

DEPARTMENT OF COMMERCE  
BUREAU OF THE CENSUS

SAM. L. ROGERS, DIRECTOR  
RESIGNED APRIL 13, 1921

W. M. STEUART, DIRECTOR  
APPOINTED APRIL 14, 1921

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FOURTEENTH CENSUS OF THE UNITED STATES  
TAKEN IN THE YEAR 1920

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VOLUME VII

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IRRIGATION AND  
DRAINAGE

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GENERAL REPORT AND ANALYTICAL TABLES  
AND REPORTS FOR STATES, WITH STATISTICS FOR COUNTIES

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PREPARED UNDER THE SUPERVISION OF WILLIAM LANE AUSTIN  
CHIEF STATISTICIAN FOR AGRICULTURE



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1922.

## REPORTS OF THE FOURTEENTH CENSUS.

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### POPULATION:

- Volume I.—NUMBER AND DISTRIBUTION OF INHABITANTS.
- Volume II.—GENERAL REPORT AND ANALYTICAL TABLES.
- Volume III.—COMPOSITION AND CHARACTERISTICS OF THE POPULATION, BY STATES.
- Volume IV.—OCCUPATIONS.

### AGRICULTURE:

- Volume V.—GENERAL REPORT AND ANALYTICAL TABLES.
- Volume VI.—REPORTS FOR STATES, WITH STATISTICS FOR COUNTIES.
  - Part 1.—THE NORTHERN STATES.
  - Part 2.—THE SOUTHERN STATES.
  - Part 3.—THE WESTERN STATES AND THE OUTLYING POSSESSIONS.
- Volume VII.—IRRIGATION AND DRAINAGE—GENERAL REPORT AND ANALYTICAL TABLES, AND REPORTS FOR STATES, WITH STATISTICS FOR COUNTIES.

### MANUFACTURES:

- Volume VIII.—GENERAL REPORT AND ANALYTICAL TABLES.
- Volume IX.—REPORTS FOR STATES, WITH STATISTICS FOR PRINCIPAL CITIES.
- Volume X.—REPORTS FOR SELECTED INDUSTRIES

### MINING:

- Volume XI.—MINES AND QUARRIES—GENERAL REPORT AND ANALYTICAL TABLES, AND REPORTS FOR STATES AND SELECTED INDUSTRIES.

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## ABSTRACT OF THE FOURTEENTH CENSUS.



## LETTER OF TRANSMITTAL.

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DEPARTMENT OF COMMERCE,  
BUREAU OF THE CENSUS,  
*Washington, D. C., September 1, 1921.*

SIR:

I transmit herewith Volume VII of the Reports of the Fourteenth Decennial Census, which contains the general report and analytical tables, and reports for states, with statistics for counties of the census of irrigation and drainage. The statistics of irrigation are also presented by drainage basins. Volume VII, together with Volumes VI and V, contains the results of the 1920 census of agriculture. Volume VI consists of three parts presenting detailed statistics, respectively, for (1) the Northern states, (2) the Southern states, and (3) the Western states and the outlying possessions. Each part contains a general summary for the United States and a brief summary for the three sections, in addition to the separate reports, with statistics by counties, for the states in the area to which it especially relates. Volume V contains the general report and analytical tables.

The census of agriculture was taken in conformity with "An act to provide for the Fourteenth and subsequent Decennial Censuses," approved March 3, 1919.

The collection and compilation of the statistics of irrigation and drainage and the preparation of the reports have been under the supervision of William Lane Austin, chief statistician for agriculture, assisted by Ray P. Teele, special agent for irrigation, and Roger D. Marsden, special agent for drainage. The chief of division for irrigation and drainage during the decennial census period was John W. Curry.

Respectfully,

W. M. STEUART,  
*Director of the Census.*

HON. HERBERT HOOVER,  
*Secretary of Commerce.*

(3)

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RAY P. TEELE

SPECIAL AGENT FOR IRRIGATION

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Irrigated areas shown in red

ENGRAVED BY U.S.G.S. Scale 1:1,000,000.

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# IRRIGATION.

## INTRODUCTION.

**Scope of the census of irrigation.**—The basic inquiries included in the census of irrigation, taken as a part of the Fourteenth Census, are the area of land under irrigation, the capital invested in irrigation enterprises, the character of irrigation enterprises, and the crops grown under irrigation. The law providing for the Thirteenth Census directed that inquiries be made regarding other phases of irrigation, notably, prices of land and water rights, amount of water used per acre, and physical condition of irrigation works, and these inquiries were continued in the Fourteenth Census, although they are of secondary importance.

**Territory covered.**—The census of irrigation is confined to the part of the United States in which irrigation is a recognized feature of agricultural practice. It covered the following states: Arizona, Arkansas, California, Colorado, Idaho, Kansas, Louisiana, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. In the remainder of the United States irrigation is practiced to a limited extent in the growing of fruit and truck crops by scattered individuals, but most crops are grown without it, and irrigation is only incidental to accepted agricultural practice; consequently this part of the country was not covered by the irrigation census, although certain questions relating to irrigation were included in the farm schedule and the replies to these have been tabulated separately. In Arkansas and Louisiana irrigation is limited to rice growing.

In the reports of the Thirteenth Census the data relating to rice growing were presented separately from the data for the arid region because rice growing was confined principally to parts of Arkansas, Louisiana, and Texas, where other crops were not irrigated. Since 1910 rice growing has assumed large proportions in California, where the area devoted to rice is not segregated from other irrigated land; consequently, the data relating to rice growing is not reported separately in the Fourteenth Census.

**Reports of the Fourteenth Census.**—The reports of the Fourteenth Census relating to irrigation are as follows: A report for each of the states covered by this inquiry, a summary for the United States, based on the state reports, and this report, which consists of the state and United States reports, a general discussion of the results, and several special tabulations not included in the United States summary and the state

reports. In addition to these separate reports, a chapter on irrigation is included in the Abstract of the Fourteenth Census.

**Previous reports.**—Inquiries relating to irrigation have been included in the Eleventh, Twelfth, and Thirteenth Censuses, and a special census of irrigation was taken in 1902. Reports for all of these inquiries have been published and the results are used in this report for purposes of comparison. No statistics of irrigation prior to 1889 are available, but in this report all data are classified by the dates of beginning of the enterprises supplying water, making it possible to show the progress of irrigation development prior to 1889 with some degree of accuracy.

**Date of the census.**—The date of the Fourteenth Census was fixed as January 1, 1920, while that of the Thirteenth Census was April 15, 1910. In each case the statistics of farms and area irrigated and of crops grown under irrigation relate to the preceding calendar year, so that the change of date does not affect comparisons in any way, the period covered being exactly 10 years. In each case the statistics of acreage to which existing enterprises are capable of supplying water relate to the year in which the enumeration is made, and here also the period covered in making comparisons is exactly 10 years. In the Fourteenth Census the capital invested in irrigation enterprises is reported as of January 1, 1920, while in the Thirteenth Census it is reported as of July 1, 1910, and the period covered in comparisons is 9½ years.

**Method of collecting information.**—The plan adopted for making the canvass for irrigation provided that the regular census enumerators should obtain from the persons controlling irrigation enterprises schedules representing small enterprises watering from one to three farms at the same time that they made the canvass for population and agriculture; and that special agents should obtain schedules for the larger enterprises and any small ones missed by the enumerators, after the canvass by the enumerators was finished. This plan was followed, and proved quite satisfactory.

**Accuracy of results.**—In general, the principal causes of inaccuracies in census reports are incompleteness in the canvass, lack of exact knowledge of facts on the part of those supplying information, carelessness on the part of enumerators in recording the information furnished them, and the errors incident to the handling of so large a mass of statistics in the short time allowed for the work.

There is no way in which the completeness of the canvass can be determined with absolute certainty, since there are no exact records against which returns can be checked. Both supervisors and enumerators, and most of the special agents, were local people who should know of the existence of all enterprises; in the sections covered by the irrigation canvass almost all enumerators and all special agents were working on a per diem salary and consequently would not be tempted to omit enterprises difficult of access; the farm schedule contained inquiries as to irrigation enterprises from which water was obtained, and all irrigation schedules were checked against the farm schedules to see that schedules were received for all enterprises shown on the farm schedules. In view of all these facts, it is believed that the canvass for irrigation was approximately complete.

As an offset to errors due to omissions, there is the possibility of duplication. Some farms receive water from more than one enterprise, and there is the possibility that they will be included in the areas served by all the enterprises from which they receive water; some enterprises extend into more than one county or state, and they may be reported more than once; and again, some enterprises are known by more than one name and may be reported more than once. Great care was exercised to eliminate duplication, and such as occurs tends to compensate for any incompleteness in the canvass that may have occurred.

The degree of probability of error on account of lack of knowledge of the facts varies considerably with the different inquiries on the irrigation schedule and the different classes of enterprises.

The inquiries which serve for classifying the data, namely,—source of water supply, character of enterprise, and character of water rights—should be correctly answered since it is probable that the owners of practically all enterprises, large and small, have exact knowledge on these points.

With regard to many of the points covered by the description of irrigation works, there will be a lack of exact knowledge. This is particularly true of capacities of the smaller ditches, length of the smaller ditches, capacities of the smaller reservoirs, and the capacities of wells, pumps, and engines. Most of the owners of pumps and engines should know the capacities at which their pumps and engines were rated by their manufacturers, but, in many instances, these ratings vary widely from that attained in actual practice. Most wells have never been tested beyond the capacities of the pumps being used in them, and it is probable that in only a small percentage of cases have the volumes pumped been measured. Therefore, the reported capacities of pumped wells represent the owners' estimates of what has been pumped from them, based on the rated capacities of the pumps used, not the volume of water that can be pumped from them, as determined by tests or measurements.

The owners of the small individual and partnership irrigation enterprises are likely to have quite accurate knowledge of the areas irrigated in 1919, since they are also the users of the water. The officials of the organized enterprises are not so likely to know the exact areas irrigated, since their records show, generally, only the areas for which the water users are entitled to receive water or do receive water, and not what is done with the water delivered. Usually in the larger enterprises farmers obtain rights to water for their entire farms, while it is seldom that a farmer actually applies water to his whole farm. For these reasons there will be a tendency for the areas reported to exceed the areas actually irrigated.

The statements as to area to which enterprises were capable of supplying water in 1920 are estimates, based on the condition of the works and the expected water supply. Here, also, there is a tendency for the area reported to exceed that for which water is actually available.

The area included in enterprises represents the estimates of promoters and, no doubt, it is greater than the area to which the enterprises reporting will be able to supply water when they are completed.

The area of irrigated land available for settlement represents the estimates made by officials of enterprises of the area to be irrigated by their enterprises that is not included in farms already settled. There is some tendency toward overestimates in this item.

For capital invested in irrigation enterprises, the amounts reported for the individual and partnership enterprises are almost all estimates. The larger parts of the works of such enterprises were built by the owners or their predecessors without any records of expenditures of money or time, and the same is true of many of the cooperative enterprises. It is probable that the estimates for many of these enterprises are too small. The amounts reported for the larger enterprises are much more likely to be based on records and, therefore, to be much more accurate. The totals ought to be approximately correct, with a slight tendency to be too small.

For many enterprises the cost of operation and maintenance was not reported and no attempts to estimate this cost were made. It is probable, therefore, that the cost that is reported is based on records and is correct. In tables showing this item the areas represented are shown in order that the reader may form his own judgment as to the value of the averages given.

The same condition exists with reference to the data relating to the quantity of water used. No estimates have been made for enterprises for which this item was not reported, and the data representing estimates and those representing measurements are shown separately. In every case the area represented is given to serve as an index to the value of the averages.



The area for which drains have been installed should be accurate, but the additional area in need of drainage is, in the nature of things, an estimate, based on the opinion of the person supplying the information.

The returns for irrigated crops were taken from the farm schedules. These schedules contained inquiries as to whether any crops were irrigated and whether any crops were grown without irrigation and called for the area irrigated, in case any crops were irrigated. Enumerators were instructed to mark the crops that were irrigated, but there were many schedules reporting irrigated land on which the enumerators had marked no crops as being irrigated. Clerks were instructed to mark as irrigated, on such schedules, the crops most likely to have been irrigated in the sections from which the schedules came. Under these conditions, the reports for irrigated crops are not satisfactory, particularly as to total areas and yields. The areas correctly reported are sufficiently large to make average yields quite reliable. The values of irrigated crops are computed from the reported yields and average values per unit supplied by the Bureau of Crop Estimates of the United States Department of Agriculture.

The magnitude of the work and the speed with which it must be done preclude any checking by the

agents of the bureau of the correctness of the information given by owners or officials of irrigation enterprises. The time and expense involved in making surveys to determine irrigated areas and in checking accounts to determine capital invested would be so great that such courses are out of the question.

The schedules were all examined in the bureau for errors made by enumerators, and in cases in which questions applicable to the enterprises represented were not answered, and in cases in which answers that appeared to be unreasonable were given, letters were written to those supplying information asking them for additional information. Answers that seemed reasonable were not questioned. While enumerators may have made mistakes in entering such answers there is no way in which these mistakes can be detected, and it is not believed that they are numerous enough to affect the general accuracy of the results.

Every care was exercised to secure accurate work in tabulation, but it is not to be expected that errors have not been made. However, there is in work of this kind a strong tendency for errors to compensate, and almost no opportunity for cumulative errors. The results, as a whole, are believed to be substantially correct, with a slight probability of exaggeration in areas.

#### DEFINITIONS AND EXPLANATION OF TERMS.

**Irrigated land.**—The following instructions, given to those who made the canvass for irrigation, show what land was to be reported as irrigated: "Land should be classed as irrigated which has water supplied to it for agricultural purposes by artificial means or by seepage from canals, reservoirs, or irrigated lands, but land which has natural ground water sufficiently near the surface to support plant life should not be classed as irrigated. Land which is flooded during high-water periods should be classed as irrigated, if water is caused to flow over the land by dams, canals, or other artificial means, but should not be classed as irrigated if the overflow is due to natural causes alone."

**Farms irrigated.**—The number of "farms irrigated" is the number on which irrigation is practiced, and for the census of irrigation a "farm" is defined as for the general census of agriculture; that is, to be classed as a farm an establishment either must be 3 acres in extent or must have produced crops to the value of \$250 in 1919, or must have required for its agricultural operations the continuous services of at least one person. "Number of farms irrigated" as used in this report and in that of 1910, is equivalent to the term "number of irrigators" used in census reports on irrigation previous to 1910. The number of farms irrigated in 1919, as given in this report, is the number of farm schedules showing irrigation.

**Irrigation enterprise.**—An "enterprise" is an independent irrigation establishment and includes the works for supplying water and the land to which water is supplied or is to be supplied, except that the cost or value of the land is not included in the "capital invested." An enterprise may represent a small ditch or pumping plant watering a single small farm, or a great system of canals and reservoirs operated under one management, supplying thousands of farms. Consequently the number of enterprises reported is not of much consequence as an indication of the extent of irrigation. It is of importance for indicating whether land is supplied with water by independent enterprises controlled by individual farmers and requiring no extensive financing or construction, or by large enterprises involving organization, financing, and large-scale construction prior to settlement. The establishment of the smaller enterprises progresses naturally without the need for public supervision or control, but the establishment of the larger enterprises has involved both Federal and state legislation covering every phase of organization and management.

**Areas irrigated, in enterprises, and available for settlement.**—The area irrigated is the acreage to which water was actually applied in the season preceding the census year—1919 for the Fourteenth Census and 1909 for the Thirteenth Census.

Acreege to which enterprises were capable of supplying water relates to the season following the time of taking the census and, consequently, is based on estimates made by those controlling the enterprises.

Acreege included in enterprises represents the extent of the plans of those controlling enterprises.

Acreege of irrigated land reported as available for settlement relates to land within existing enterprises and not to land that is susceptible of reclamation and settlement by new enterprises or extensions of existing enterprises.

**Character of enterprises.**—As stated previously, the establishment of large irrigation enterprises is controlled to a large extent by Federal and state legislation. The Federal Government is engaged directly in the construction and operation of irrigation works, and the several states have enacted laws to aid and encourage the establishment of large enterprises. The areas reported as irrigated and in enterprises will indicate the degree of need for further public aid or encouragement in the establishment of new enterprises.

The Fourteenth Census Act provides for inquiries as to the "location and character" of irrigation enterprises. The Thirteenth Census Act called for the same information, and provided further for showing in the reports the land irrigated under state and Federal laws, and whether water was obtained from national, state, or private works. In the reports of the Thirteenth Census the state and Federal laws for direct construction or for aid and encouragement to organization and construction under which enterprises operated were made the basis of the classes of "character" into which all enterprises were divided, and the same classification has been continued in the reports of the Fourteenth Census. The classes of enterprises under which all data are classified are as follows:

*United States Reclamation Service enterprises*, which operate under the Federal law of June 17, 1902, providing for the construction of irrigation works with the receipts from the sale of public lands and with other funds provided by subsequent legislation. In addition to serving land within its own projects, the United States Reclamation Service supplies stored water to land within other enterprises.

*United States Indian Service enterprises*, which operate under various acts of Congress providing for the construction by that service of works for the irrigation of land in Indian reservations.

*Carey Act enterprises*, which operate under the Federal law of August 18, 1894, granting to each of the states in the arid region 1,000,000 acres of land on condition that the state provide for its irrigation, and under amendments to that law granting additional areas to Idaho and Wyoming. The conditions contained in this law necessitate state legislation before the law becomes operative, thus Carey Act enterprises operate under both Federal and state laws.

*Irrigation districts*, which are public corporations that operate under state laws providing for their organization and management, and empowering them to issue bonds and levy and collect taxes with the object of obtaining funds for the purchase or construction

and for the operation and maintenance of irrigation works. They are controlled by the owners of the lands forming the districts through boards of directors elected by the landowners. Irrigation districts are more often organized for the purchase of irrigation works built by other agencies than for the purpose of building new works. In this report all enterprises now operating as districts, except those organized to take over and operate works built by the United States Reclamation Service, are reported as districts. In the case of United States reclamation enterprises, they are not reported as districts because the Reclamation Service still controls the projects to a large extent, and the districts are organized principally for the purpose of collecting charges due for water.

*Cooperative enterprises*, which are controlled by the water users under some organized form of cooperation. The most common form of organization is the stock company, the stock of which is owned by the water users. Some states have special laws providing for the organization of such stock companies, and in those states in which they are organized under general incorporation laws there are laws regulating their actions to some extent. The state laws governing operations under the Carey Act provide that works built under these laws shall be turned over to stock companies composed of the water users when certain payments have been made, and many commercial enterprises are organized on the same plan. In the Southwest, where irrigation was practiced before this territory became a part of the United States, much of the land is watered by "community ditches," or "public acequias," which are organized and operated in accordance with old Mexican customs providing for the election of officials by the landowners and for forced labor on repairs and cleaning. These enterprises are classed as cooperative.

The United States Reclamation Act provides that when the payments required by that act are made for the major portion of the lands in any enterprise, the management and operation of the works shall pass to the water users "under such form of organization \* \* \* as may be acceptable to the Secretary of the Interior." Originally the Secretary of the Interior favored the organization of stock companies for taking over reclamation projects, but more recently he has favored the organization of irrigation districts.

Many of the enterprises now reported as cooperative enterprises were originally in some other class and have become cooperative.

*Commercial enterprises*, which supply water for compensation to parties who may own no interest in the works. Such enterprises may be organized in any form, but their operations are subject to some degree of public control in most states. This was the earliest type of enterprise for the construction of large irrigation works. Such enterprises built irrigation works and sold rights entitling the purchasers to receive water from their works upon the payment of annual charges, but conveyed no interest in the works. Many of the states have enacted laws prohibiting the sale of such rights, and commercial enterprises organized since the passage of these laws usually sell stock representing part ownership in the works, to become effective upon the payment of specified portions of the purchase price. These enterprises eventually become cooperative. There are some commercial enterprises that sell no rights but supply water to the public for charges based, in some instances, on acreage served, and in other instances, on the quantity of water delivered. In most states rates charged by commercial enterprises are subject to public control.

*Individual and partnership enterprises*, which belong to individual farmers or to neighboring farmers, who control them without formal organization. State laws provide the procedure for compelling part owners in partnership ditches to contribute their share of the labor and expense of operation and maintenance.

**Capital invested.**—The capital invested in irrigation enterprises is that reported by the owners. For the larger works the capital invested is taken, in most

cases, from books of account and represents the actual investment. In the case of most of the private and partnership and many of the cooperative enterprises, however, the works were built by their owners without records of labor or money expended, and the capital reported represents the owners' estimates. The schedules used in 1910 called for "cost," while the schedules used in the present census call for "capital invested," but the instructions accompanying the schedules make these two terms equivalent. In both cases the investment includes cost of construction and of acquiring rights. The latter usually consists of filing fees only, but in some instances it includes the purchase price of rights. However, these cases are so rare that they are unimportant. The cost reported for 1900 is designated "cost of construction," but probably includes the cost of acquiring rights as in 1910. For the Thirteenth and Fourteenth Censuses the average cost per acre is based on the acreage which enterprises were capable of irrigating in the census year and the cost to the date of the census—January 1, 1920, for the Fourteenth Census, and July 1, 1910, for the Thirteenth Census. Capital invested in enterprises for which this is not reported is computed by multiplying the number of acres to which the enterprises not reporting capital were capable of supplying water in the census year by the average capital per acre for the other enterprises of the same class in the same county. When the acreage for which capital was reported in any county was not sufficient to justify its use as a base for an average, the average for some other county having similar conditions was used. However, the percentage of enterprises not reporting capital was very small.

**Operation and maintenance.**—Cost of operation and maintenance was not reported on all schedules, and averages are based on the acreages irrigated in 1919 by the enterprises for which cost is reported. No estimate of total cost of operation and maintenance for all irrigation enterprises has been made, but if such a total be desired, it is probable that a total obtained by applying the average cost per acre in each state to the total acreage irrigated in that state, and adding these state totals for a United States total would be approximately correct. In the case of enterprises operating pumping plants the cost of operation and maintenance includes cost of fuel and attendance. In all cases the acreages on which averages are based are given to serve as guides to the value of the averages.

**Water rights.**—A water right is a right to take and use water from some specified source and to continue such taking and using of water from year to year. Water rights are divided into two general classes, with reference to the source of supply: (1) Rights to take water from natural sources, and (2) rights to take water from artificial sources, such as irrigation canals, which receive water from natural sources. The nature and

extent of rights of the first class are governed by state laws, while those of the second class are governed by contracts, rules, and regulations of irrigation enterprises.

There are in effect in the states where irrigation is practiced two more or less conflicting systems of laws governing water rights: (1) The English common law doctrine that the right to use water from a stream or other body of water attaches to land abutting on the stream or other body of water, known as the riparian doctrine; and (2) the American doctrine that water may be taken from streams without reference to the location of the place of use, known as the doctrine of appropriation.

In all states where irrigation is practised rights by appropriation are recognized, and some of the states recognize riparian rights also. In the reports contained in this volume the irrigated land has been classified by the character of rights under which it receives water. The classes used are defined as follows. They are discussed more fully in the various reports.

*Appropriation and use.*—In most of the states irrigation began before the states assumed control over water, and those needing water took it and used it. Their rights to continue the use were recognized by the courts and later by legislation, and many rights have no other basis.

*Notice filed and posted.*—The first step in public control of the use of water was the enactment of laws requiring those wishing to acquire rights to water to post at the points where water was to be taken notices of their intentions, or to file such notices with county officials, or to both post and file notices. These were to serve as notice to those coming later of the existence of the prior rights represented by the notices. In many of the states laws required all parties who had appropriated water before the passage of the laws to file notices of their claims, with the object of making complete records of rights; and many rights, originally acquired by appropriation and use, passed into this class.

*Adjudicated by court.*—Rights acquired by appropriation and use, and those represented by notices filed and posted, while they are recognized by law, are not defined as to extent or priority, since, in the first class there is no record on these points, and in the second class the records may bear no relation to the facts. When rights come into conflict they are carried into the courts and are then defined or adjudicated, and pass from the other classes into this class. Most of the states have laws providing special procedure for water-right cases. These are discussed in the United States summary and the state reports.

*Permit from state.*—The evident disadvantages of having rights undefined until they come into conflict and are adjudicated by courts, and the advance in the completeness of public control have led in most states to the enactment of laws requiring parties wishing to acquire rights to apply to some state official or board for permits. These applications must set forth in detail what is intended, and in their approval the boards and officials fix conditions as to extent of rights and time within which works must be completed, etc. Rights are not complete until proof of compliance with the prescribed conditions has been submitted, and certificates are granted by the state, but they are defined as they are acquired rather than only after they come in conflict with other rights. Rights reported in this class are in the process of being acquired rather than vested.

*Certificate or license from the state.*—The states having laws requiring applications for permits provide for the issuing of certificates or licenses when works have been completed and water put to use in

accordance with the terms of the permits issued, and some of the states provide also for the issuing of certificates when older rights are adjudicated by courts or administrative boards. This class includes all rights represented by such certificates or licenses, and may include rights originally in any one of the other classes named.

*Riparian rights.*—Rights in this class are those based on the ownership of land abutting on the source from which water is taken, in the states which recognize such rights. The most common interpretation of riparian rights in the western states is that the owner of riparian land may make any reasonable use of the water that will not interfere with a like reasonable use by all other owners of land riparian to the same source. Under such an interpretation the right is not fixed as to extent or nature, but depends upon the number of other owners and their needs.

*Underground.*—In most states public control of the use of water has not extended to wells, and, consequently, these have been put in a class by themselves. This class includes all land watered from wells.

*Source of water supply.*—The classes of sources of water supply into which all data are divided are self-explanatory. In making this classification for the reports of the census of 1910 all acreage was credited to what seemed to be the principal source of supply, while in the reports for the census of 1920 the attempt is made to represent the facts more closely by presenting various mixed classes.

*Date of beginning.*—In the reports that follow, all data collected in the census of 1920 have been classified by the date of the beginning of the enterprises supplying water. The date of beginning of an irrigation enterprise is, in some cases, the date when construction began, and, in other cases, the date of filing a claim or of applying for a permit. If a filing or application for permit was made and work was begun and continued with reasonable diligence the date of filing is considered the date of beginning, otherwise the date of construction is taken as the date of beginning. This classification should indicate the extent to which the plans of promoters of irrigation enterprises are realized in various periods of time after their beginning, which is a very important factor in financing irrigation enterprises.

*Drainage basins.*—In all previous regular censuses of irrigation all data have been presented by states and counties, but for determining the extent to which

various stream systems have been utilized and the possibilities of further development, the drainage basin is the more logical unit of territory. In the reports that follow all data are presented by drainage basins as well as by states and counties. The results of a special census of irrigation taken in 1902 were reported in this form, and these are included in the reports of this census, for purposes of comparison. The drainage basin of a stream consists of all land drained by the stream and its tributaries.

*Units of quantity and capacity.*—Capacities of canals, reservoirs, wells, pumps, and engines, and quantities of water used are expressed in the units commonly used in engineering literature to express the same items. They are as follows:

*Capacities of canals and volumes of flowing water* are given in second-feet, a shorter equivalent for cubic feet per second.

*Capacities of wells and pumps* are given in gallons per minute. Four hundred and fifty gallons per minute equal 1 second-foot.

*Capacities of reservoirs* are given in acre-feet. An acre-foot is the quantity of water that will cover 1 acre to a depth of 1 foot. It equals 43,560 cubic feet.

*Capacities of engines and motors* are given in horsepower. One horsepower is the power required to lift 33,000 pounds through a vertical distance of 1 foot in 1 minute of time.

*Farm value of crops.*—At the census of 1920, whenever a unit value for a crop could be used, such as the value per bushel or ton, the farmer was asked to report the acreage and production of each crop, but not the value. To supplement the information obtained from the farmers, the Bureau of Crop Estimates of the United States Department of Agriculture secured by special schedule from its crop reporters average values for such crops. These special schedules were tabulated by the Bureau of the Census, and the resulting averages, approved by the Bureau of Crop Estimates as representing a fair average of the farm value per unit, were used in computing most of the crop values presented in the accompanying tables.

For some products it was not possible to find any satisfactory unit on which to base a computation of the total value. Values were therefore obtained on the 1920 census schedule for vegetables, other than potatoes and sweet potatoes, and for the farm garden.

## GENERAL DISCUSSION OF RESULTS OF IRRIGATION.

### ACREAGE IRRIGATED.

The total area reported as irrigated in the United States in 1919, exclusive of the small areas of truck and fruit that are watered in the humid region, is 19,191,716 acres, an increase of 4,758,431 acres, or 33 per cent over the area reported as irrigated in the same territory in 1909. The increase in the area irrigated during the preceding decade was 6,688,818 acres, indicating that the rate of expansion during the last decade was much less rapid than that of 1899 to 1909.

Climatic conditions in 1919 were such that some land that is irrigated in normal years was not watered in that year. In the northern part of the Great Plains, in Montana, Wyoming, North Dakota, and South Dakota, the precipitation was much below normal, and streams were so low that there was no water for much of the land ordinarily irrigated. In the southern part of the Great Plains, in Oklahoma, Texas, and New Mexico, the condition was just the opposite—the rainfall was so heavy that land ordinarily watered needed no irrigation, and was not

reported as irrigated in 1919. It is not possible to determine from the returns the extent of the area ordinarily watered which did not receive water in 1919 on account of too much or too little precipitation. A comparison of the areas irrigated in the plains section of Montana, taken as a whole, in 1919 and 1909, shows a decrease of more than 200,000 acres. County boundaries were changed so much that comparisons for smaller sections are not possible, but it is known that in some sections the area irrigated in 1919 was greater than that in 1909; consequently it seems probable that the area not watered in 1919 in eastern Montana exceeded 200,000 acres. No estimate of the area in Texas and New Mexico that is ordinarily watered, but not in 1919, is justified by the returns.

The period from 1899 to 1909 was marked by a great speculative boom in irrigation development by private agencies, and by the beginning of works under the United States Reclamation Act in 1902. At the end of the decade the boom had spent itself and the Reclamation Service had spent its accumulated funds and has been compelled to proceed less rapidly than before. Between 1909 and 1919 there was no such activity, but a more normal expansion.

Government limitations on the issuing of securities during the world war probably checked reclamation work to some extent, although this was offset by the demand for the growing of the largest possible areas of food crops and the high prices of farm products, which tended to bring into use the idle lands under works already built.

**Geographic distribution.**—The geographic distribution of the area irrigated and of the increased area of irrigated land is shown in Table 1.

TABLE 1.—GEOGRAPHIC DISTRIBUTION OF ACREAGE IRRIGATED IN 1919 AND 1909, AND OF THE INCREASE IN ACREAGE IRRIGATED, 1909 TO 1919.

STATE.	AREA IRRIGATED.				INCREASE. <sup>1</sup>	
	1919		1909		Acres.	Per cent of total. <sup>2</sup>
	Acres.	Per cent of total.	Acres.	Per cent of total.		
Total.....	19,191,716	100.0	14,433,285	100.0	4,758,431	100.0
Arizona.....	467,565	2.4	320,051	2.2	147,514	3.0
Arkansas.....	143,940	0.8	27,753	0.2	116,183	2.4
California.....	4,219,040	21.9	2,654,104	18.5	1,554,936	31.7
Colorado.....	3,348,355	17.4	2,792,032	19.3	556,323	11.4
Idaho.....	2,488,800	13.0	1,430,848	9.9	1,057,952	21.6
Kansas.....	47,312	0.2	37,479	0.3	9,833	0.2
Louisiana.....	454,832	2.4	350,200	2.6	74,632	1.5
Montana.....	1,681,729	8.8	1,679,084	11.6	2,645	0.1
Nebraska.....	442,690	2.3	255,950	1.8	186,740	3.8
Nevada.....	561,447	2.9	701,833	4.9	-140,386	...
New Mexico.....	838,377	3.8	461,718	3.2	76,659	1.6
North Dakota.....	12,072	0.1	10,248	0.1	1,824	(?)
Oklahoma.....	2,969	(?)	4,338	(?)	-1,419	(?)
Oregon.....	986,162	5.1	686,129	4.8	300,033	6.1
South Dakota.....	100,632	0.5	63,248	0.4	37,384	0.8
Texas.....	586,130	3.1	451,130	3.1	134,990	2.8
Utah.....	1,371,651	7.1	999,410	6.9	372,241	7.6
Washington.....	529,899	2.8	334,378	2.3	195,521	4.0
Wyoming.....	1,307,982	6.8	1,133,302	7.9	74,680	1.5

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Based on the sum of the increases, 4,900,236, not on the net increase.  
<sup>3</sup> Less than one-tenth of 1 per cent.

California reports the largest area irrigated, while Colorado ranks second, Idaho third, and Montana fourth. These four states reported the largest areas in 1909 also, but in that year Colorado ranked first, California second, Montana third, and Idaho fourth.

In increase in acreage irrigated California leads, Idaho ranks second, Colorado third, and Utah fourth. In all of these states the increases are fairly well distributed. Montana shows very little increase, but there was a large increase in the western part of the state, which was offset by the decrease due to drought in the eastern part. Nevada shows a considerable decrease. This decrease occurred almost entirely in the Humboldt Valley. Most of the irrigation in this valley consists in forcing the water over river-bottom lands during the spring floods. In Nevada 1919 was one of the driest seasons on record, while the snows melted early, leaving a very limited supply of water for use during the crop-growing season. Oklahoma also shows a decrease, which, as previously stated, is due to abnormally heavy precipitation rather than to drought.

The results of the Fourteenth Census have been tabulated by drainage basins, as well as by states and counties. The only other census for which results have been presented in this way is a special census of irrigation taken in 1902. The distribution of the acreage irrigated in this way in 1919 and 1902 is shown in detail in the table beginning on page 48. The distribution by the principal drainage basins is shown in Table 2.

TABLE 2.—DISTRIBUTION OF ACREAGE IRRIGATED, BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			
	1919	1902	Increase. <sup>1</sup>	
			Amount.	Per cent.
Total.....	19,191,716	8,374,408	10,317,308	116.3
Missouri River and tributaries.....	4,147,278	2,533,237	1,614,041	68.7
Mississippi River and tributaries other than Missouri River.....	958,493	393,687	564,806	143.5
Gulf streams other than Mississippi River and Rio Grande.....	698,077	21,833	676,244	.....
Rio Grande and tributaries.....	1,283,863	496,587	787,276	160.6
Independent streams in Rio Grande drainage basin.....	13,992	8,353	10,637	127.3
Colorado River and tributaries.....	2,312,047	927,183	1,384,864	149.4
Whitewater Draw.....	5,871	384	5,487	.....
Great Basin.....	2,313,163	1,639,473	673,690	41.1
Columbia River and tributaries.....	3,873,245	1,297,437	2,575,808	198.5
Pacific Ocean streams other than Columbia and Colorado Rivers.....	3,570,687	1,556,232	2,014,455	129.4

<sup>1</sup> Per cent not shown when more than 1,000.

Missouri River shows the largest area, with Columbia River second, and other Pacific Ocean streams third. The largest increase since 1902 occurred in the Columbia River Basin, the principal part of this occurring in the Snake River Basin in Idaho.

**Distribution by type of enterprise.**—The distribution of the acreage irrigated in 1919 and 1909, and of

the increase in acreage irrigated, 1909 to 1919, is given in Table 3, showing the relative importance of the various agencies in supplying water for irrigation, and in the increase in the area supplied during the last decade.

TABLE 3.—DISTRIBUTION OF ACREAGE IRRIGATED IN 1919 AND 1909, AND OF INCREASE IN ACREAGE IRRIGATED 1909-1919, BY TYPE OF ENTERPRISE.

TYPE OF ENTERPRISE.	AREA IRRIGATED.				INCREASE.	
	1919		1909		Acres.	Per cent of total.
	Acres.	Per cent of total.	Acres.	Per cent of total.		
Total.....	19,191,716	100.0	14,433,285	100.0	4,758,431	100.0
Individual and partnership.....	8,848,807	35.7	6,594,614	45.7	254,193	5.3
Cooperative.....	6,581,400	34.3	4,843,539	32.2	1,937,861	40.7
Irrigation district.....	1,822,887	9.5	528,642	3.7	1,294,245	27.2
Carey Act.....	523,929	2.7	288,553	2.0	235,376	4.9
Commercial.....	1,822,001	9.5	1,809,379	12.5	12,622	0.3
U. S. Reclamation Service.....	1,254,669	6.5	385,646	2.7	858,923	18.1
U. S. Indian Service.....	294,551	1.5	172,912	1.2	111,639	2.3
State.....	5,620	(1)	(2)		5,620	0.1
City.....	40,148	0.2	(2)		40,148	0.8
Other.....	7,236	(1)	(2)		7,236	0.2
Not reported.....	570	(1)	(2)		570	(1)

<sup>1</sup> Less than one-tenth of 1 per cent.  
<sup>2</sup> Not included in classification in 1910.

Individual and partnership enterprises occupy, as in 1909, the first place, in extent of area supplied with water. These enterprises represent principally the earlier, easier, and cheaper types of construction. However, this class is particularly well adapted to irrigation from wells, and it is probable that both the number of enterprises and the area of land irrigated will continue to increase. On the other hand, there is, in some sections, a tendency to consolidate small enterprises by the organization of stock companies or irrigation districts. This tendency is indicated by the relatively large increases in the areas irrigated by enterprises of these types.

Cooperative enterprises supply water to about the same area as individual and partnership enterprises, the area served by them being also more than one-third of the total area irrigated—the two combined serve just 70 per cent of the total. Enterprises of this class showed the largest increase in area irrigated from 1909 to 1919, having more than 40 per cent of the total increase. This type of enterprise is not utilized for the development of new lands but rather for taking over enterprises of other types, particularly Carey Act and commercial enterprises after works have been built and lands have been settled. The increase in the area served by cooperative enterprises represents, therefore, transfers to this type and more complete use of old enterprises rather than new ones.

Irrigation districts rank third in area irrigated, and second in the extent of increase in the area irrigated from 1909 to 1919. Like cooperative enter-

prises, districts are not well adapted to the development of new lands and, speaking generally, the increase in area reported under districts represents reorganizations rather than new enterprises. The figures given in the table do not show the full extent of this movement, since the districts organized within United States Reclamation enterprises are not reported, because the Reclamation Service still controls these enterprises to a large extent, the districts serving merely as collecting agencies for the Reclamation Service.

Commercial enterprises supplied water to about the same area in 1919 as did irrigation districts. The figures do not represent correctly the importance of this type of enterprise in reclaiming land, since enterprises of this type are constantly being reorganized into cooperative enterprises or districts, and a considerable part of the area reported by enterprises of these classes was, in fact, originally supplied with water by commercial enterprises, and probably a considerable part of the increase reported for cooperative enterprises and districts represents reorganized commercial enterprises.

The United States Reclamation Service ranks fifth among the types of enterprises, in the extent of the area irrigated in 1919, having 6.5 per cent of the total. This does not represent the full extent of the work of the Reclamation Service since it supplies stored water to lands receiving their principal supply from other sources. The area thus furnished with a partial supply of water in 1919 was slightly less than one million acres. On the other hand, some of the land reported by the Reclamation Service was supplied with water by enterprises of other types that have been incorporated into the reclamation enterprises. In extent of increase in area irrigated from 1909 to 1919 the Reclamation Service ranks third, with 18.1 per cent of the total. This increase represents a real extension in the area irrigated, and not transfers from other enterprises, as is the case with cooperative enterprises and irrigation districts.

Carey Act enterprises show the smallest areas irrigated in 1919 of any of the types of enterprise engaged primarily in supplying water for irrigation, and they show also only a small part of the total increase in area irrigated during the last decade. Here, again, the figures do not present the whole truth, since under state laws Carey Act enterprises pass to cooperative enterprises as soon as they become well developed. However, there has been an almost complete cessation of activity under this law since 1910, except for the settlement of lands under enterprises begun previously.

The United States Indian Service supplies water to land in Indian reservations only.

Distribution by source of water supply.—The character and extent of the water supply for irrigation in the United States is discussed on pages 43 to 45, and in more detail in the section of this report



giving the results for the various states, in which area irrigated and capital invested have been classified on this basis.

The areas irrigated in 1919 and 1909, the area enterprises were capable of irrigating in 1920, and the area included in enterprises in 1920, classified by the source from which water is received are given in Table 4, on page 46. In the table which follows, the distribution of the areas irrigated in 1919 and 1909, and of the increases from 1909 to 1919, is shown.

TABLE 4.—DISTRIBUTION OF AREA IRRIGATED 1919 AND 1909, AND OF INCREASE IN AREA IRRIGATED 1909 TO 1919, BY SOURCE OF WATER SUPPLY.

SOURCE.	1919		1909		INCREASE. <sup>1</sup>	
	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total. <sup>2</sup>
Total.....	19,191,716	100.0	14,433,285	100.0	4,758,431	100.0
Streams, gravity.....	14,527,060	75.7	12,767,351	88.5	1,759,709	36.3
Streams, pumped.....	1,226,510	6.4	608,659	4.2	617,851	12.8
Streams, pumped and gravity.....	199,595	1.0	( <sup>3</sup> )	.....	199,595	4.1
Wells, pumped.....	1,263,098	6.6	489,341	3.4	773,757	16.0
Wells, flowing.....	65,856	0.3	144,420	1.0	-78,564	.....
Wells, flowing and pumped.....	35,685	0.2	( <sup>4</sup> )	.....	35,685	0.7
Lakes, pumped.....	35,730	0.2	17,826	0.1	17,904	0.4
Lakes, gravity.....	100,646	0.5	59,631	0.4	41,015	0.8
Springs.....	198,008	1.0	196,186	1.4	1,822	( <sup>5</sup> )
Stored storm water.....	98,873	0.5	105,792	0.7	-6,919	.....
City water.....	930	( <sup>6</sup> )	( <sup>6</sup> )	.....	930	( <sup>6</sup> )
Sewage.....	2,578	( <sup>6</sup> )	( <sup>6</sup> )	.....	2,578	0.1
Streams, gravity, and pumped wells.....	344,713	1.8	( <sup>6</sup> )	.....	344,713	7.1
Streams, gravity, and flowing wells.....	83,665	0.4	( <sup>6</sup> )	.....	83,665	1.7
Other mixed.....	996,621	5.2	44,079	0.3	952,542	19.7
Other, and not reported.....	13,148	0.1	( <sup>6</sup> )	.....	13,148	0.3

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Based on sum of all increases, 4,843,914, not on the net increase.  
<sup>3</sup> Not included in classification in 1909.  
<sup>4</sup> Less than one-tenth of 1 per cent.

In studying Table 4 it should be kept in mind that the classes used in 1919 are not exactly the same as those used in 1909. In 1909 land was credited to what seemed to be the principal source of supply, while in 1919 various mixed classes are used. However, all of the mixed classes combined include less than 9 per cent of the total area irrigated in 1919, so that the comparisons are substantially correct, except, possibly, for "streams, gravity." But if all of the mixed classes into which "streams, gravity" enters, including "other mixed," were added to "streams, gravity," there would still be a considerable decrease in the percentage of the total area irrigated represented by this class.

As shown by the table, more than three-fourths of the area irrigated in 1919 was supplied by streams by gravity diversion; more than 83 per cent of the area received its total supply from streams, by either gravity or pumping, while much of the balance represented by the mixed classes, received part of its supply from this source.

Wells furnished the full supply to slightly more than 7 per cent of the total area, most of this being supplied by pumped wells.

Springs supplied 1 per cent of the total area, but none of the other single sources supplied so much as 1 per cent of the total.

Of the various mixed classes "streams, gravity, and pumped wells" shows the largest area. In many places water is pumped from wells to supplement the supply by gravity diversions from streams, the extent to which the wells are used in any season depending on the sufficiency of the supply from the streams, a conspicuous example of this being found in the San Joaquin Valley, California. Another condition in which wells are used to supplement a stream supply is found in the Salt River Valley, Arizona. Here the rise of the ground water has injured considerable land, and wells have been put in for the double purpose of lowering the ground water and furnishing an added supply of water for irrigation.

Of the simple classes "streams, gravity," shows the largest absolute increase from 1909 to 1919, "pumped wells" ranks next and "streams, pumped," ranks third. In per cent of increase "pumped wells" stands first, "pumped streams" second, and "pumped lakes" third. Each of these pumping classes shows an increase of more than 100 per cent in the area irrigated; while no other class shows so high a percentage.

"Flowing wells" shows a decrease of more than 50 per cent. This is due to the increased draft on the artesian supplies, which has caused many wells to cease to flow. In most cases such wells are pumped when they do not flow.

"Stored storm water" also shows a decrease. Storm-water reservoirs are found principally on the Great Plains, and the abnormal season in that section in 1919 is responsible for this decrease.

Notwithstanding the fact that "streams, gravity" shows a decrease in the percentage of the total area served and a comparatively small percentage of increase from 1909 to 1919, it shows the largest actual increase from 1909 to 1919 in area irrigated. Pumped wells rank second, and pumped streams third.

The most conspicuous fact brought out by this classification of the area irrigated is the rapid development of pumping during the last decade. As noted previously, each of the pumping classes included in the table shows an increase of more than 100 per cent in the area served, while the average for all classes is only 33 per cent, and the increase for "streams, gravity," the largest class, is only about 14 per cent. In addition to the above, there is the large area receiving a partial supply from pumped wells. In all of the older irrigated sections there are large opportunities for watering new lands and for supplementing the supply from streams, by pumping from wells. Irrigation has brought the ground water near the surface, so that the pumping lift is small. The supply is re-

plenished by the continued irrigation of surrounding lands, assuring a future supply. This source is particularly valuable where stored water is not available, since it makes possible the growing of long-season crops where this would not be possible if water were available only when the streams are in flood.

Distribution of area receiving water from different sources, by states.—The distribution by states of the areas receiving water from the principal sources is shown in Tables 5, 6, and 7. All of the sources that report more than 1 per cent of the total area irrigated are included in the tables.

TABLE 5.—DISTRIBUTION OF AREA RECEIVING ITS ENTIRE WATER SUPPLY FROM STREAMS IN 1919, BY STATES.

STATE.	Total (acres).	Gravity (acres).	Pumped (acres).	Gravity and pumped (acres).
Total.....	15,953,165	14,527,060	1,226,510	199,595
Arizona.....	196,453	189,782	6,671	.....
Arkansas.....	6,129	120	6,009	.....
California.....	2,920,396	2,564,445	295,673	60,278
Colorado.....	3,050,964	3,028,787	12,747	9,430
Idaho.....	2,384,010	2,274,959	107,181	1,870
Kansas.....	32,137	30,807	730	600
Louisiana.....	271,152	10,226	248,306	12,620
Montana.....	1,550,827	1,515,212	15,743	19,872
Nebraska.....	437,532	435,567	1,115	850
Nevada.....	470,179	466,812	2,647	730
New Mexico.....	434,368	432,478	1,890	.....
North Dakota.....	11,499	9,030	2,469	.....
Oklahoma.....	2,710	2,522	188	.....
Oregon.....	851,183	786,354	64,576	253
South Dakota.....	93,360	92,491	869	.....
Texas.....	495,870	73,982	421,538	350
Utah.....	1,116,130	1,105,691	10,389	50
Washington.....	471,145	352,199	26,244	92,702
Wyoming.....	1,157,121	1,155,598	1,525	.....

Of the area receiving its entire supply from streams, water diverted by gravity supplied more than 91 per cent, that pumped supplied nearly 8 per cent, while the area supplied in part by gravity and in part by pumping was slightly more than 1 per cent of the total. The only states in which the area supplied by pumping exceeded the area supplied by gravity were Arkansas, Louisiana, and Texas. These areas represent the rice-growing districts in the states named and the area irrigated from the Rio Grande near its mouth in Texas, where most of the water is pumped. These three states report considerably more than one-half of the total area served by water pumped from streams, while California reports nearly one-fourth. Idaho and Oregon are the only other states reporting large areas.

California reports nearly two-thirds of the area receiving its entire water supply from wells. The rice-growing states of Louisiana and Arkansas rank next, the two combined reporting slightly more than one-fifth of the area. New Mexico, Texas, and Arizona follow in the order named. Only one state, North Dakota, reports no land irrigated from wells,

but the areas supplied from this source in Idaho, Montana, Nebraska, Nevada, Oklahoma, South Dakota, and Wyoming are negligible.

TABLE 6.—DISTRIBUTION OF AREA RECEIVING ITS ENTIRE WATER SUPPLY FROM WELLS IN 1919, BY STATES.

STATE.	Total (acres).	Pumped (acres).	Flowing (acres).	Flowing and pumped (acres).
Total.....	1,364,639	1,263,098	65,856	35,685
Arizona.....	41,810	39,694	1,558	558
Arkansas.....	135,260	135,260	.....	.....
California.....	868,060	826,546	17,653	23,861
Colorado.....	14,390	10,114	4,191	85
Idaho.....	1,545	414	1,131	.....
Kansas.....	13,285	13,235	.....	50
Louisiana.....	155,575	154,304	196	1,075
Montana.....	351	139	212	.....
Nebraska.....	546	546	.....	.....
Nevada.....	1,171	295	811	65
New Mexico.....	52,295	18,709	30,030	6,556
North Dakota.....	.....	.....	.....	.....
Oklahoma.....	125	107	18	.....
Oregon.....	2,405	1,998	72	340
South Dakota.....	130	.....	130	.....
Texas.....	44,466	39,483	3,256	1,727
Utah.....	12,394	7,308	4,908	178
Washington.....	20,065	17,504	1,671	1,490
Wyoming.....	166	147	19	.....

Of the area receiving its total supply of water from wells, pumped wells supplied 92.6 per cent, flowing wells 4.8 per cent, and mixed 2.6 per cent.

Since pumped wells supply so large a percentage of the total area supplied from wells, the area supplied by pumped wells is distributed in approximately the same way as the total. A notable exception to this is in New Mexico, where the area irrigated from flowing wells is approximately double the area irrigated from pumped wells. Neither North Dakota nor South Dakota reports any land watered from pumped wells.

Arkansas, Kansas, Nebraska, and North Dakota report no land watered from flowing wells. New Mexico reports nearly one-half of the total area irrigated from flowing wells, and California slightly more than one-fourth of the total, while Utah, Texas, and Colorado report considerable areas.

California reports nearly two-thirds of the area receiving water from both flowing and pumped wells. Many wells in southern California that originally flowed are now pumped, while others flow at times and are pumped at times. Most of the area reported in this class lies in that section of the state. In the Pecos Valley, New Mexico, much the same condition exists. These two states report about 85 per cent of the total area in this class.

As stated elsewhere, pumping from wells represents a later and more expensive stage of development than diverting water from streams. In all states there is opportunity for much expansion in this field whenever the returns will justify the expense.



TABLE 7.—DISTRIBUTION OF AREA RECEIVING ITS WATER SUPPLY FROM MIXED SOURCES, IN 1919, BY STATES.

STATE	Streams, gravity, and pumped wells (acres).	Streams, gravity, and flowing wells (acres).	Other mixed (acres).
Total.....	344,713	82,665	996,621
Arizona.....	217,799	525	7,690
Arkansas.....	250	.....	1,817
California.....	87,897	4,255	223,424
Colorado.....	16,253	67,880	165,525
Idaho.....	357	1,927	54,501
Kansas.....	1,540	.....	350
Louisiana.....	10,945	.....	7,535
Montana.....	155	6,068	89,070
Nebraska.....	115	.....	1,120
Nevada.....	4,957	82	45,176
New Mexico.....	1,341	685	29,787
North Dakota.....	.....	.....	65
Oklahoma.....	.....	.....	125
Oregon.....	105	200	111,137
South Dakota.....	500	20	3,864
Texas.....	454	45	24,170
Utah.....	125	537	173,495
Washington.....	2,415	441	19,027
Wyoming.....	400	.....	33,043

The area reported in Table 7 for "streams, gravity, and pumped wells" represents land that receives its principal supply from streams, but gets a supplemental supply from wells. More than 60 per cent of the total area is reported for Arizona, and most of this area lies in the Salt River project of the United States Reclamation Service. By far the larger part of the water supply is diverted from Salt River by gravity, but wells have been sunk in places within the irrigated areas where the ground water has come near the surface. Water is pumped from these wells into the ditches carrying water from the river, and supplements the supply from the river. About 70 per cent of the remaining area reported in this class lies in California, mostly in the San Joaquin Valley. Here individual farmers have put down their own wells to supplement the water of large ditches from which they receive their principal supply.

More than 80 per cent of the land receiving water from both streams and flowing wells is reported for Colorado. Most of this land is located in the San Luis Valley on the headwaters of the Rio Grande, where there are many flowing wells.

Montana reports the next largest area, and this land is located principally in Beaverhead County. The remainder of the land is scattered through the states.

"Other mixed" includes so many different combinations that an analysis of the returns is not justified.

**AREA ENTERPRISES WERE CAPABLE OF IRRIGATING AND ACREAGE INCLUDED IN ENTERPRISES.**

The area enterprises were capable of irrigating and the acreage in enterprises are classified in the same way that all other data are classified in the tables contained in this report. These areas have been tabulated in the Thirteenth and Fourteenth Censuses as an indication

of the degree to which irrigation works are utilized and of the need for the construction of new works. The geographic distribution of the area enterprises were capable of irrigating in 1920 and 1910 and the excess of these items over the acreages irrigated in 1919 and 1909 are shown in Table 8.

TABLE 8.—AREAS ENTERPRISES WERE CAPABLE OF IRRIGATING IN 1920 AND 1910, AND EXCESSES IN THESE AREAS OVER AREAS IRRIGATED IN 1919 AND 1909, BY STATES.

STATE	1920		1910		INCREASE, <sup>1</sup> 1910-1920.	
	Acres.	Excess over area irrigated in 1919 (acres).	Acres.	Excess over area irrigated in 1909 (acres).	Acres.	Excess over area irrigated (acres).
Total.....	26,020,477	6,828,761	20,285,403	5,852,118	5,735,074	976,643
Arizona.....	627,303	159,738	387,655	67,604	239,648	92,134
Arkansas.....	179,013	35,067	47,136	19,383	131,877	15,684
California.....	5,894,466	1,675,426	3,619,378	955,274	2,275,088	720,152
Colorado.....	3,855,348	508,963	3,990,166	1,198,134	-134,818	-691,171
Idaho.....	3,092,810	604,004	2,388,959	958,111	703,851	-354,107
Kansas.....	67,853	30,541	139,995	102,516	-72,142	-81,975
Louisiana.....	728,742	273,860	553,220	173,020	175,522	100,840
Montana.....	2,753,498	1,071,769	2,205,155	526,071	548,343	545,698
Nebraska.....	562,468	119,778	425,225	173,275	133,243	-53,497
Nevada.....	704,708	143,261	840,962	139,126	-136,254	4,132
New Mexico.....	696,119	157,742	644,970	133,252	51,149	-25,510
North Dakota.....	34,225	22,163	21,917	11,669	12,318	10,494
Oklahoma.....	9,672	6,703	6,397	2,009	3,275	4,694
Oregon.....	1,344,046	367,884	830,526	144,397	513,520	215,487
South Dakota.....	150,914	50,232	128,481	65,233	22,433	-15,001
Texas.....	1,150,542	564,422	690,991	239,861	459,551	324,561
Utah.....	1,700,550	328,899	1,250,246	250,856	450,304	78,063
Washington.....	637,151	107,252	470,514	136,136	166,637	-28,884
Wyoming.....	1,831,039	628,057	1,639,510	506,208	191,529	116,849

<sup>1</sup> A minus sign (-) denotes decrease.

As shown in the table, existing irrigation enterprises were capable of supplying in 1920 nearly 7,000,000 acres in addition to the area irrigated in 1919. In other words, the area irrigated can be increased about 36 per cent, and considerably more than it has been increased in the last 10 years, without the construction of any new works or the extension of existing works. The corresponding figure for 1910 is about 6,000,000 acres, showing that the margin between actual use and possible use had increased about 1,000,000 acres since 1910. In the discussion of acreage irrigated in 1919 attention has been called to the fact that much land ordinarily irrigated was not irrigated in 1919 because of drought in some sections and because of excessive rainfall in others. It seems probable that this area will about offset the increase in the area for which water is available but not used. Even in that case, the latter area is more than the increase in the area irrigated between 1909 and 1919.

The last column of the table shows in what states the water supply ready for use has increased more rapidly than has the area irrigated, and in what states use has extended more rapidly, Colorado, Idaho, Kansas, Nebraska, New Mexico, South Dakota, and Washington being in the latter class, while in all the other states use has lagged behind.

This excess area consists in part of land in existing farms that is not yet watered and in part of land that

is not yet settled but is available for settlement. The extent to which the area consists of each of these classes is not shown by the returns. However, the schedules called for the area available for settlement, and the total area reported as available by enterprises reporting this item was 2,257,981 acres. (See pp. 94 to 99.) This is about one-third of the total excess over the area irrigated. Some further light is thrown on this question by Table 9, in which the excess is distributed by type of enterprise.

TABLE 9.—AREAS ENTERPRISES WERE CAPABLE OF IRRIGATING IN 1920 AND 1910, AND EXCESSES IN THESE AREAS OVER AREAS IRRIGATED IN 1919 AND 1909, BY TYPE OF ENTERPRISE.

TYPE OF ENTERPRISE.	1920		1910		INCREASE, <sup>1</sup> 1910-1920.	
	Acres.	Excess over area irrigated in 1919 (acres).	Acres.	Excess over area irrigated in 1909 (acres).	Acres.	Excess over area irrigated (acres).
Total.....	26,020,477	6,828,761	20,285,403	5,852,118	5,735,074	976,643
Individual and partnership.....	9,255,756	2,406,949	8,086,760	1,492,152	1,168,990	914,797
Cooperative.....	8,403,298	1,821,898	6,191,577	1,548,038	2,211,721	273,860
Irrigation district.....	2,531,425	708,538	800,451	271,809	1,730,974	436,729
Carey Act.....	804,298	280,369	1,089,677	801,124	-285,379	-520,755
Commercial.....	2,799,563	977,562	2,954,166	1,144,787	-154,603	-107,225
U. S. Reclamation Service.....	1,630,643	426,074	786,190	390,544	894,453	35,530
U. S. Indian Service.....	484,486	199,935	376,576	203,664	107,910	-3,729
State.....	7,379	1,759	( <sup>2</sup> )	( <sup>2</sup> )	7,379	1,759
City.....	44,458	4,312	( <sup>2</sup> )	( <sup>2</sup> )	44,458	4,312
Other.....	8,546	1,310	( <sup>2</sup> )	( <sup>2</sup> )	8,546	1,310
Not reported.....	625	55	( <sup>2</sup> )	( <sup>2</sup> )	625	55

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

Slightly more than one-third of the excess area is reported by individual and partnership enterprises, and this does not, generally, represent land available for settlement, but land on individual farms that was not watered in 1919 for one reason or another. The areas not watered in 1919 on account of drouth on the northern Great Plains and in Nevada, and those not watered in 1919 on account of excessive rainfall in the southern Great Plains fall largely in this class.

Slightly more than one-fourth of the excess area is reported by cooperative enterprises. This is more likely to represent land in farms that is not watered than land available for settlement, although more of it will fall in the latter class than is the case with individual and partnership enterprises.

Irrigation districts, Carey Act enterprises, commercial enterprises, and United States Reclamation enterprises, the classes of enterprises that are engaged in reclaiming new land, taken together reported slightly more than one-third of the total excess. Not all of this represents land not yet taken up, but a considerable part of it does. From this tabulation and that of land reported as available for settlement it appears that between one-third and one-half of the total excess of area represents land outside of existing farms, and available for settlement—between 2,250,000 and 3,500,000 acres.

A fact shown conspicuously by this table is the decrease in land not watered in Carey Act enterprises. This is due to an almost complete cessation in the undertaking of new enterprises and the transfer of some old enterprises to enterprises of other forms.

The data given above indicate that irrigation works, taken as a whole, were utilized to about 74 per cent of their available capacity. Table 10 shows the extent to which works belonging to the various classes of enterprises were utilized, as represented by the ratio between the areas they were capable of irrigating in 1920 and the areas irrigated in 1919.

TABLE 10.—PERCENTAGE WHICH AREA IRRIGATED IS OF AREA ENTERPRISES WERE CAPABLE OF IRRIGATING IN 1920.

TYPE OF ENTERPRISE.	Per cent.
Total.....	73.8
Individual and partnership.....	74.0
Cooperative.....	78.3
Irrigation district.....	72.0
Carey Act.....	65.1
Commercial.....	65.1
U. S. Reclamation Service.....	74.6
U. S. Indian Service.....	58.7

The areas included in enterprises in 1920 and 1910, with the excesses in these areas over the areas irrigated in 1919 and 1909 are given in Table 11.

TABLE 11.—AREAS INCLUDED IN ENTERPRISES IN 1920 AND 1910, AND THE EXCESSES IN THESE AREAS OVER THE AREAS IRRIGATED IN 1919 AND 1909, BY STATES.

STATE.	1920		1910		INCREASE, <sup>1</sup> 1910-1920.	
	Acres.	Excess over area irrigated in 1919 (acres).	Acres.	Excess over area irrigated in 1909 (acres).	Acres.	Excess over area irrigated (acres).
Total.....	36,890,821	16,699,105	32,245,464	17,812,179	3,645,357	-1,113,074
Arizona.....	813,153	345,588	944,090	624,039	-130,937	-278,451
Arkansas.....	246,480	102,534	52,883	25,130	193,597	77,404
California.....	7,805,207	3,585,167	5,490,360	2,826,256	2,314,847	759,911
Colorado.....	5,220,589	1,872,203	5,917,457	3,125,425	-696,869	-1,253,222
Idaho.....	3,780,048	1,291,242	3,549,573	2,118,725	230,475	-827,483
Kansas.....	102,862	55,259	161,300	123,821	-58,738	-68,571
Louisiana.....	851,211	396,329	581,965	201,765	269,246	194,564
Montana.....	4,329,148	2,647,419	3,515,602	1,838,518	813,546	810,901
Nebraska.....	766,768	324,078	680,133	424,183	86,635	-100,105
Nevada.....	1,382,036	801,589	1,232,142	530,309	149,894	271,280
New Mexico.....	961,879	423,502	1,102,297	640,579	-140,418	-217,077
North Dakota.....	57,476	45,404	38,173	27,925	19,303	17,479
Oklahoma.....	11,742	8,773	8,528	4,140	3,214	4,633
Oregon.....	1,925,987	939,825	2,527,208	1,841,078	-601,221	-901,254
South Dakota.....	188,382	87,700	201,625	138,377	-13,243	-50,677
Texas.....	1,687,447	1,101,327	1,253,173	802,043	434,274	299,284
Utah.....	3,359,244	658,683	1,947,625	948,215	411,619	-289,522
Washington.....	836,795	306,896	817,032	482,654	19,763	-175,758
Wyoming.....	2,564,668	1,356,686	2,224,298	1,090,996	340,370	265,690

<sup>1</sup> A minus sign (-) denotes decrease.

The excess of the area in enterprises over the area irrigated in 1919 was 16,699,105 acres, which is a little less than one-half of the area included in enterprises; that is, all enterprises taken together are watering a little more than one-half of the land included in their plans. The excess area is 87 per cent as great as the area irrigated in 1919, hence the completion and full utilization of all existing enterprises would permit of almost doubling the area now irrigated.

The area included in enterprises increased between 1910 and 1920 less than did the area irrigated or the

area enterprises were capable of irrigating, indicating that it was a period of building up under existing enterprises rather than of undertaking new enterprises. This is shown conspicuously by the last column of Table 11, which shows a decrease from 1910 to 1920 in the excess of area in enterprises over area irrigated for the irrigated region as a whole and for many of the states.

The distribution of the area in enterprises and the excesses over the areas irrigated, by type of enterprise, are shown in Table 12.

TABLE 12.—AREA INCLUDED IN ENTERPRISES IN 1920 AND 1910, AND THE EXCESSES IN THESE AREAS OVER AREAS IRRIGATED IN 1919 AND 1909, BY TYPE OF ENTERPRISE.

TYPE OF ENTERPRISE.	1920		1910		INCREASE, <sup>1</sup> 1910-1920.	
	Acres.	Excess over area irrigated in 1919 (acres).	Acres.	Excess over area irrigated in 1909 (acres).	Acres.	Excess over area irrigated (acres).
Total.....	85,800,821	16,699,105	32,245,464	17,812,179	3,645,357	-1,118,074
Individual and partnership.....	13,008,415	6,159,608	10,621,067	4,026,463	2,387,348	2,133,155
Cooperative.....	10,628,548	4,047,143	8,830,197	4,156,658	1,798,346	-139,515
Irrigation district.....	3,432,109	1,609,222	1,581,465	1,052,823	1,850,644	556,899
Carey Act.....	1,188,937	665,008	2,573,874	2,285,321	-1,384,937	-1,620,313
Commercial.....	3,999,581	2,177,580	5,786,777	3,977,398	-1,787,196	-1,799,818
U. S. Reclamation Service.....	2,627,176	1,372,607	1,978,016	1,577,370	654,160	-204,763
U. S. Indian Service.....	932,985	648,434	879,068	706,156	53,917	-57,722
State.....	9,581	3,961	(*)	(*)	9,581	3,961
City.....	49,650	9,504	(*)	(*)	49,650	9,504
Other.....	13,144	5,903	(*)	(*)	13,144	5,903
Not reported.....	700	130	(*)	(*)	700	130

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.

TABLE 13.—PER CENT DISTRIBUTION OF AREA IRRIGATED IN 1919, AREA ENTERPRISES WERE CAPABLE OF IRRIGATING IN 1920, AREA INCLUDED IN ENTERPRISES IN 1920, AND EXCESSES IN THESE ITEMS OVER AREA IRRIGATED IN 1919, BY SOURCE OF WATER SUPPLY.

SOURCE.	PER CENT OF TOTAL.				
	Area irrigated in 1919.	Area enterprises were capable of irrigating in 1920.	Area included in enterprises, 1920.	Excess of area enterprises were capable of irrigating in 1920 over area irrigated in 1919.	Excess of area included in enterprises over area irrigated in 1919.
Total.....	100.0	100.0	100.0	100.0	100.0
Streams, gravity.....	75.7	74.1	72.6	69.4	68.9
Streams, pumped.....	6.4	8.1	8.0	13.1	9.9
Streams, gravity and pumped.....	1.0	0.9	0.8	0.6	0.5
Wells, pumped.....	6.6	6.4	6.6	6.0	6.5
Wells, flowing.....	0.3	0.3	0.4	0.2	0.4
Wells, flowing and pumped.....	0.2	0.2	0.2	0.1	0.3
Lakes, gravity.....	0.5	0.5	0.9	0.7	1.3
Lakes, pumped.....	0.2	0.2	0.2	0.4	0.3
Springs.....	1.0	1.0	1.1	0.8	1.3
Stored storm water.....	0.5	0.9	0.9	1.8	1.8
City water.....	(*)	(*)	(*)	(*)	(*)
Sewage.....	(*)	(*)	(*)	(*)	(*)
Streams, gravity, and pumped wells.....	1.8	1.5	1.3	0.7	0.7
Streams, gravity, and flowing wells.....	0.4	0.4	0.6	0.3	0.7
Other mixed.....	5.2	5.4	5.4	5.9	7.3
Other, and not reported.....	0.1	0.1	(*)	(*)	(*)

<sup>1</sup> Less than one-tenth of 1 per cent.

Several of the states show actual decreases in the area included in enterprises, indicating the abandonment of extravagant schemes conceived during the boom period in irrigation development between 1900 and 1910, as well as a cessation in the undertaking of new enterprises.

The distribution of the area to which enterprises were capable of supplying water in 1920 and the area included in enterprises in 1920, and of the excesses in these items over the area irrigated in 1919 are shown in percentages, by source of water supply, in the preceding table. The distribution of the area irrigated in 1919 is repeated for the purpose of making comparisons.

CAPITAL INVESTED IN IRRIGATION ENTERPRISES.

The capital invested in irrigation works is presented in the United States summary and in the state reports, classified in the same way that acreage and other items are classified. The total investment and the average investment per acre in 1920 and 1910 are given by states in Table 14.

TABLE 14.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES BY STATES: 1920 AND 1910.

STATE.	1920		1910		INCREASE, 1910-1920.	
	Amount.	Average per acre.	Amount.	Average per acre.	Amount.	Average per acre.
Total.....	\$697,657,328	\$26.81	\$321,454,008	\$15.85	\$376,203,320	\$10.96
Arizona.....	33,498,094	53.40	17,677,965	45.00	15,820,128	7.80
Arkansas.....	7,183,322	40.13	587,834	12.47	6,595,488	27.66
California.....	194,886,388	33.06	72,580,030	20.05	122,306,358	13.01
Colorado.....	38,302,442	22.90	56,635,443	14.19	31,665,999	8.71
Idaho.....	91,501,009	29.59	40,977,668	17.15	50,523,341	12.44
Kansas.....	2,067,381	30.47	1,366,563	9.75	701,818	20.72
Louisiana.....	14,063,181	19.30	6,859,166	12.40	7,204,015	6.90
Montana.....	52,143,363	18.94	22,970,958	16.42	29,172,405	8.59
Nebraska.....	13,909,185	24.73	7,788,310	18.17	6,110,875	6.56
Nevada.....	14,754,280	20.94	6,721,924	7.99	8,032,356	12.95
New Mexico.....	18,210,412	26.16	9,154,897	14.19	9,055,515	11.97
North Dakota.....	1,867,118	54.25	836,482	38.17	1,020,636	16.08
Oklahoma.....	151,325	15.65	47,200	7.38	104,125	8.27
Oregon.....	28,929,151	21.52	12,780,214	15.36	16,168,937	6.16
South Dakota.....	5,465,248	36.21	3,043,140	23.69	2,422,108	12.52
Texas.....	35,072,739	30.48	13,487,347	19.52	21,585,392	10.96
Utah.....	32,037,351	18.84	14,028,717	11.22	18,008,634	7.62
Washington.....	29,299,011	45.98	16,219,149	34.47	13,079,862	11.51
Wyoming.....	34,326,328	18.76	17,700,980	10.80	16,625,348	7.95

The capital invested in irrigation enterprises was more than doubled in the last decade. This is due principally to two causes: (1) Prices have been higher during this period than in any other period since irrigation construction on a large scale began, and this not only increased the cost of construction actually done during this period, but had a tendency to make owners of works built previously give higher estimates of capital invested than they would have done had prices been lower. (2) The bringing of water to land becomes constantly more difficult, and the easier projects are, naturally, carried out first, leaving the more difficult projects to be developed as the demand for agricultural products becomes greater.

The absolute increase in the average investment per acre was greater than in any previous period. This increase is due to the causes already enumerated, and to the fact that a considerable part of the capital invested during the last decade was for pumping equipment for supplementing the supply of water from canals and ditches for lands already under irrigation. Such investment and that for reservoirs to supply water in the late summer when streams are low are not accompanied by corresponding increases in the areas irrigated, and consequently raise the average investment per acre. At the same time, however, they increase and insure the returns from irrigated land to an extent that more than justifies the added investment per acre. Dependence upon the natural flow of streams, without storage or a supplemental water supply from wells, limits the crops grown to those with short growing periods, which, generally, are the less valuable crops.

In the discussion of water supply (pages 43 to 45) it is stated that future extension of the irrigated area will depend largely upon the storage of flood water and pumping from underground sources. This will be a more costly type of development, and consequently the average investment per acre is likely to continue to increase. In fact, the determining factor in fixing the limit of irrigation development is likely to be the amount that can be expended profitably in providing a water supply.

The data presented in the preceding pages show very large areas for which water is available that were not watered in 1919. The average investment per acre is computed on the basis of the areas to which enterprises were ready to supply water in 1920, consequently the average investment per acre actually watered and bringing a return was much higher than the figure reported. This fact is at the foundation of the financial difficulties of irrigation enterprises. The land actually producing must furnish whatever income there is. If the whole burden is thrown on this land, it is too heavy, and the farmer fails; and if the producing land bears only its proper share of the burden the investor must carry the rest, and the enterprise fails.

The capital invested in irrigation enterprises and the average investment per acre, based on the area enterprises were capable of irrigating in 1920, classified by the sources from which water is received, are given on page 52. The area that enterprises were capable of irrigating in 1920, classified in the same way, is given on page 46. The distribution of the areas enterprises were capable of irrigating and the capital invested, by the sources from which water is received, are shown, in percentages, in Table 15, which follows, with the average investment per acre, and comparison of the average for each class with the general average.

TABLE 15.—PER CENT DISTRIBUTION OF AREAS ENTERPRISES WERE CAPABLE OF IRRIGATING AND CAPITAL INVESTED, BY SOURCES FROM WHICH WATER IS RECEIVED.

SOURCE.	PER CENT OF TOTAL.		AVERAGE PER ACRE.	
	Area enterprises were capable of irrigating in 1920.	Capital invested to January 1, 1920.	Amount.	Per cent of general average.
Total.....	100.0	100.0	\$26.81	100.0
Streams, gravity.....	74.1	63.0	22.81	85.1
Streams, pumped.....	8.1	8.5	28.01	104.5
Streams, gravity and pumped.....	0.9	1.4	40.02	149.3
Wells, pumped.....	6.4	11.0	45.85	171.1
Wells, flowing.....	0.3	0.4	36.92	137.7
Wells, flowing and pumped.....	0.2	0.4	58.51	218.2
Lakes, pumped.....	0.2	0.3	38.06	142.0
Lakes, gravity.....	0.6	0.4	19.46	72.6
Springs.....	1.0	0.8	23.01	85.8
Stored storm water.....	0.9	2.2	67.47	251.7
City water.....	( <sup>1</sup> )	( <sup>1</sup> )	156.88	585.2
Sewage.....	( <sup>1</sup> )	( <sup>1</sup> )	52.85	197.1
Streams, gravity, and pumped wells.....	1.5	4.1	72.69	271.1
Streams, gravity, and flowing wells.....	0.4	0.4	27.38	102.1
Other mixed.....	5.4	6.9	34.67	129.3
Other, and not reported.....	0.1	0.1	54.86	204.6

<sup>1</sup> Less than one-tenth of 1 per cent.

As is the case with area irrigated, "streams, gravity," is by far the most important class in area enterprises were capable of irrigating in 1920, and in capital invested, while "streams, pumped," and "wells, pumped," are the other classes showing any considerable part of the area and capital. "Streams, gravity," is less important in capital invested than in area because of the fact that the average investment per acre for this class is less than the average for all classes.

In average investment per acre only one class—"lakes, gravity," which includes only about one-half of 1 per cent of the total area and capital—falls below "streams, gravity," and these two classes, and "springs"—which includes only 1 per cent of the total area—are the only classes for which the average investment is less than the general average. Streams, taken as a whole, show an average investment per acre of \$23.51, about 88 per cent of the general average; wells, taken as a whole, show an average of \$45.75 per acre, approximately double the average for streams; and the average investment for all pumped sources—streams, wells, and lakes—is \$35.92 per acre, 134 per cent of the general average.

While averages are shown for city water and sewage, the areas included are so small that the averages are not of much value. Eight other classes report less than 1 per cent of the total area, but the areas included are large enough to give the averages some value. All ten of these classes combined do not affect the general average greatly.

The outstanding fact shown by this table is that the cost of a water supply from wells is approximately double that of a supply from streams.

**COST OF OPERATION AND MAINTENANCE.**

The cost of operation and maintenance and the average cost per acre, classified by the sources from which water is received are given on page 52. The average cost per acre and a comparison of the cost for each source with the general average cost are given in Table 16.

**TABLE 16.—PER CENT DISTRIBUTION OF COST OF OPERATION AND MAINTENANCE, 1919, BY SOURCE FROM WHICH WATER IS RECEIVED.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

SOURCE.	Per cent of total area for which cost is reported.	AVERAGE PER ACRE.	
		Amount.	Per cent of general average.
Total.....	100.0	\$2.48	100.0
Streams, gravity.....	75.0	1.25	51.4
Streams, pumped.....	7.1	0.50	207.5
Streams, gravity and pumped.....	1.2	2.38	95.9
Wells, pumped.....	8.5	10.07	414.4
Wells, flowing.....	0.2	2.77	114.0
Wells, flowing and pumped.....	0.2	8.04	330.9
Lakes, pumped.....	0.3	5.20	214.0
Lakes, gravity.....	0.5	1.80	53.5
Springs.....	0.9	1.63	67.1
Stored storm water.....	0.5	2.39	98.4
City water.....	( <sup>1</sup> )	20.73	853.1
Sewage.....	( <sup>1</sup> )	9.05	372.4
Streams, gravity and pumped wells.....	1.9	5.97	245.7
Streams, gravity and flowing wells.....	0.5	1.36	56.0
Other mixed.....	5.2	2.71	111.5
Other, and not reported.....	0.1	10.75	442.4

<sup>1</sup> Less than one-tenth of 1 per cent.

Disregarding city water and sewage, on account of the small areas covered, and "other mixed" and "other, and not reported," because they do not represent definite classes, the average cost per acre for every class that does not include pumping, except for flowing wells, is below the general average cost; while the average cost for every class that does include pumping, except for "streams, gravity and pumped," is more than double the general average cost.

Table 15, page 22, shows that the average first cost of a water supply from pumped wells is about double that of a gravity supply from streams, while Table 16, above, shows that the average cost of operation and maintenance for "wells, pumped," is about eight times as great as that for "streams, gravity," and that the cost of operation and maintenance for "streams, pumped," is more than five times as great as that for "streams, gravity."

The very low cost of a gravity supply from streams, as compared with a pumped supply, is accounted for in very large part by the fact that "streams, gravity," includes practically all of the early inexpensive ditches that water river-bottom lands, where both capital invested and cost of operation and maintenance are very low. Comparisons with large, modern enterprises taking water from streams by gravity, would be much less unfavorable to pumping enterprises.

**DRAINAGE OF IRRIGATED LAND.**

The irrigation of land has, in many cases, brought about the necessity for draining a part of the land. Where there is not good natural drainage it has brought the ground water near the surface, and in many places this has caused an accumulation of mineral salts, which are grouped under the term "alkali." In these cases artificial drainage will remove the surplus water and make it possible to wash out the alkali and restore the land to productivity.

The extent of the land damaged and the extent of the land for which drains have been installed are shown by states in State Table I, on pages 100 to 102.

About 5 per cent of all irrigation enterprises reported either land drained or land in need of drainage, or both. The area for which drains have been installed is about 8 per cent of the total area irrigated in 1919, and nearly as much more land is reported as in need of drainage. The area that has been injured by irrigation water is, therefore, slightly less than 16 per cent of the total area irrigated, and slightly more than 8 per cent of the total area included in enterprises.

The appearance of swampy places within irrigation projects has led to suggestions that drains should be put in when the irrigation works are built. The data given do not seem to justify such a plan. With only 5 per cent of the enterprises reporting any injured land, and only 8 per cent of the area in enterprises reported as injured, it is apparent that installing drains for all the land in irrigation enterprises as a part of the original construction would involve a very large expense for drains that are not needed, and this at a time when expense should be kept as low as possible. It seems much more logical to install drains as the necessity develops.

**QUANTITY OF WATER USED.**

The schedules used in both the Fourteenth and the Thirteenth Censuses called for the average volume of water entering canals, in second-feet; the total quantity of water entering canals, in acre-feet; and the total quantity of water delivered from canals, in acre-feet. In both censuses this inquiry was answered on only part of the schedules, and no attempts were made to supply missing information; nor were attempts made to convert measurements reported in one form into another form. Those reported in each form were tabulated together.

In the Fourteenth Census, the schedules showed whether water was measured, and the reports representing measurements and those not representing measurements were tabulated separately, and then combined. The results are shown on page 56, and in the state reports, and are summarized in the following table:

TABLE 17.—QUANTITY OF WATER USED IN 1919 AND 1909.

ITEM.	1919			1909
	Total.	Meas-ured.	Not meas-ured.	
Average number of acres irrigated per second-foot of water entering canals.....	41	60	25	62
Average quantity of water entering canals per acre.....acre-feet.....	5.5	4.7	7.5	4.8
Average quantity of water delivered per acre.....acre-feet.....	2.5	2.2	3.2	.....

The reports for 1919 cover a very much larger area than those for 1909. The results for 1909 correspond very closely with the results representing measurements for 1919, but differ quite widely from the averages of all reported.

The results from measurements in 1919 should be considered to be of the most value. They show an average of 4.7 acre-feet entering canals per acre irrigated, and 2.2 acre-feet delivered per acre irrigated, the quantity delivered being about 47 per cent of the quantity entering canals. These measurements do not represent the same canals, and the comparison is justified only on the assumption that each average is representative of all canals. The first average represents measurements of water diverted for nearly 8,000,000 acres, or over 40 per cent of the total area irrigated, and should be fairly representative. The average of quantity of water delivered represents about 4,000,000 acres, and is not so valuable as the other, but still is based on a sufficient area to justify its use. Assuming, then, that these averages are representative, 53 per cent of the water entering canals is either lost or wasted between the point of diversion and the point of delivery. In this connection "wasted" is not used in its usual sense, but as meaning turned out of the canal without being used for irrigation. Most of this water is not wasted, in the usual sense, but is available for use elsewhere.

It is worthy of note that the average number of acres irrigated per second-foot of average volume entering canals (41) is exactly the same as the average number of acres enterprises were capable of irrigating per second-foot of ditch capacity reported.

#### TYPES OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

Classification of enterprises.—All the data relating to irrigation collected in connection with the Fourteenth Census have been classified by the types of enterprises supplying water for irrigation, and the results in detail are presented in the United States summary and in the state reports at the end of this volume. The types used are defined on page 12. In this section the field of usefulness of each type of enterprise as a

means of bringing land under irrigation is discussed in the light of the returns of the census. They are taken up in the order of their importance, as indicated by the area to which they supplied water in 1919. This order is shown, in percentages, in Table 18.

TABLE 18.—PER CENT DISTRIBUTION OF AREA IRRIGATED IN 1919 AND 1909, AND OF THE INCREASE IN AREA IRRIGATED 1909 TO 1919, BY TYPE OF ENTERPRISE.

TYPE OF ENTERPRISE.	PER CENT OF TOTAL AREA IRRIGATED SERVED BY EACH TYPE.		Per cent of total increase, 1909 to 1919.
	1919	1909	
Total.....	100.0	100.0	100.0
Individual and partnership.....	35.7	45.7	5.3
Cooperative.....	34.3	32.2	40.7
Irrigation district.....	9.5	3.7	37.2
Commercial.....	9.5	12.5	0.3
U. S. Reclamation Service.....	6.5	2.7	18.1
Carey Act.....	2.7	2.0	4.9
U. S. Indian Service.....	1.5	1.2	2.3
City.....	0.2	( <sup>1</sup> )	0.8
Other.....	( <sup>2</sup> )	( <sup>1</sup> )	0.2
State.....	( <sup>2</sup> )	( <sup>1</sup> )	0.1
Not reported.....	( <sup>2</sup> )	( <sup>1</sup> )	( <sup>2</sup> )

<sup>1</sup>Not included in classification in 1909. <sup>2</sup>Less than one-tenth of 1 per cent.

Individual and partnership enterprises.—Individual and partnership enterprises occupy, as in 1909, the first place, in extent of area supplied with water, although the relative importance of such enterprises is decreasing. These enterprises supply water to more than one-third of the area irrigated and represent principally the earlier, easier, and cheaper types of construction. Since opportunities for such development are constantly diminishing, enterprises of this class must become relatively less important. However this class is particularly well adapted to irrigation from wells, and it is probable that both the number of enterprises and the area of land irrigated will continue to increase. The increase in the area irrigated by individual and partnership enterprises from 1909 to 1919 was less than 4 per cent, and this represented only a little more than 5 per cent of the total increase in area irrigated from 1909 to 1919. This poor showing for 1919 is due in part, at least, to the drouth in the northern part of the Great Plains region and the excessive rainfall in the southern part, since this semi-arid region is the section where such enterprises find their greatest usefulness. On the other hand, there is, in some sections, a tendency to consolidate small enterprises by the organization of stock companies or irrigation districts. This tendency is indicated by the relatively large increases in the areas irrigated by enterprises of these types and the increase shown for individual and partnership enterprises is, in fact, the net increase after deducting areas transferred to other classes.

The effect of the peculiar climatic conditions in 1919 is indicated by the large excesses in the areas that enterprises were capable of irrigating in 1920 and that were included in enterprises over the areas irrigated in 1919. The areas irrigated in 1919 were but 53 per cent of the total areas included in these enterprises, and but 74 per cent of the areas they were capable of supplying with water in 1920.

No doubt the area reported included in enterprises is greater than these enterprises can actually irrigate even when used to their fullest extent, but there is no way in which the extent of exaggeration can be measured. The area which all individual and partnership enterprises combined were capable of irrigating in 1920 was 71 per cent of the total area reported as included in such enterprises. At any time there will be some enterprises in the course of development, so that some of the excess represents land that will be irrigated when the enterprises are completed.

While individual and partnership enterprises represented 35.7 per cent of the area irrigated in 1919, and about the same percentage of the area enterprises were capable of irrigating in 1920, and the area included in enterprises, they represented only 22.2 per cent of the capital invested—that is, the average capital invested per acre for this class is below the general average investment per acre. The average investment per acre for all classes was \$26.81, and that for individual and partnership enterprises was \$16.71 or 62 per cent of the general average.

Irrigation works, classified by type of enterprise, are reported on page 57, and in the state reports at the end of this volume. The proportion of the total of each item belonging to individual and partnership enterprises is shown in the form of percentages in Table 19.

TABLE 19.—PERCENTAGE OF ALL IRRIGATION WORKS BELONGING TO INDIVIDUAL AND PARTNERSHIP ENTERPRISES.

ITEM.	Per cent of total.
Diverting dams.....number..	85.2
Storage dams.....number..	72.1
Main ditches:	
Number.....	89.9
Length.....miles..	63.0
Capacity.....second-feet..	42.2
Lateral ditches:	
Number.....	59.0
Length.....miles..	26.8
Reservoirs:	
Number.....	83.0
Capacity.....acre-feet..	11.1
Pipe lines, length.....miles..	54.0
Flowing wells:	
Number.....	86.1
Capacity.....gallons per minute..	88.4
Pumped wells:	
Number.....	94.8
Capacity.....gallons per minute..	91.2
Pumping plants:	
Number.....	96.2
Engine capacity.....horsepower..	71.7
Pumps:	
Number.....	83.4
Capacity.....gallons per minute..	62.2

As is to be expected, the irrigation works belonging to individual and partnership enterprises are the smaller ones. This is particularly noticeable in the case of ditches, reservoirs, and pumping plants. Enterprises of this type own about 90 per cent of the main ditches, but these report only a little more than 40 per cent of the total capacity; they report 83 per cent of the reservoirs, but these have less than 12 per cent of the total capacity; they report 96 per cent of the pumping plants, but only 62 per cent of the pump capacity.

In regard to wells the situation is different. Irrigation from wells is naturally an individual matter, and enterprises of this class report 86 per cent of the flowing wells and 95 per cent of the pumped wells, and about the same proportion of the total capacities of wells.

Table 20 shows the historical development of enterprises of this type.

TABLE 20.—NUMBER OF INDIVIDUAL AND PARTNERSHIP ENTERPRISES, WITH AREA IRRIGATED IN 1919, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of enterprises.	AREA IRRIGATED IN 1919.	
		Acres.	Per cent of total.
Total.....	58,640	6,923,798	100.0
Before 1860.....	424	63,603	0.9
1860-1869.....	1,770	379,602	5.5
1870-1879.....	3,252	775,054	11.2
1880-1889.....	7,064	1,575,408	22.8
1890-1899.....	5,551	904,773	13.1
1900-1904.....	4,407	588,965	8.5
1905-1909.....	5,066	436,709	6.3
1910-1914.....	11,104	749,813	10.8
1915-1919.....	12,149	734,983	10.6
Not reported.....	7,853	716,888	10.4

The figures given in the table show that this type of enterprise reached its greatest importance, measured by the area irrigated, in the eighties, before the advent of large enterprises. As measured by the number of enterprises there has been great activity since 1910, but this represents principally pumping enterprises, supplying comparatively small areas.

Cooperative enterprises.—Cooperative enterprises supply water to about the same area as individual and partnership enterprises, the area served by them being also more than one-third of the total area irrigated—the two combined serve just 70 per cent of the total. Enterprises of this class showed the largest increase in area irrigated from 1909 to 1919, having more than 40 per cent of the total increase. This type of enterprise is not utilized for the development of new lands but rather for taking over enterprises of other types, particularly Carey Act and commercial enterprises, after works have been built and lands have been settled. The increase in the area served by cooperative enterprises represents in considerable part, therefore, trans-



fers to this type and more complete use of old enterprises rather than new enterprises.

The most common form of organization for cooperative enterprises is the stock company organized under the general incorporation laws of the state, with most of the stock owned by the water users. Water is apportioned on the basis of stock ownership, and the cost of the operation and maintenance is raised by assessments on the stock. There is not, in most cases, any necessary relation between amount of stock owned and area of land owned or irrigated, although there is a tendency for the two to be proportional. In fact, stock may be owned independent of land ownership, and it may be, and is at times, rented, the lessee receiving the water apportioned to the stock rented. This renders the stock good collateral for loans, and it is sometimes used in that way.

As stated previously, this type of organization is not well adapted for the construction of new enterprises of large size. In an arid region irrigation works must be built in advance of settlement, and consequently those who are to use the water are not there to organize the enterprises or build the works, except in the case of colonies backed by some powerful organization.

This type of organization for controlling irrigation works in the United States was originated in Utah, where the Mormon Church furnished the money necessary to support the settlers during the construction period, paid the settlers for work on construction in stock in the companies which were to control the enterprises, and, in return for its advances, took stock which was disposed of to later settlers. The famous Union Colony at Greeley, Colorado, was organized in much the same way, the settlers receiving stock in payment for work.

Commercial enterprises which have gone into land reclamation for profit have very generally adopted the plan of selling land and water, or water rights only, under contracts that provide for the irrigation works and water rights becoming the property of the purchasers of water rights, organized into stock companies, when the rights have been paid for. These enterprises then become cooperative. Carey Act enterprises almost universally operate on the same plan; and originally the United States Reclamation Service adopted this plan, but more recently it has changed and its enterprises are being organized into irrigation districts.

The cooperative enterprise has been found well adapted to the operation and management of irrigation enterprises, even those of large size. While in many cases it is possible for stock to get into the hands of persons who are not water users, this has not developed into a serious abuse, and the danger of abuse is more than offset by the advantages of being able to use the stock as collateral for loans. In some cases the stock is at-

tached to the land, and can not be owned apart from the land to which it is attached. In such cases the stock is proportioned to the acreage, and representation in the management is directly proportional to extent of land ownership.

The area irrigated in 1919 by cooperative enterprises was 78.3 per cent of the area these enterprises were capable of irrigating in 1920; that is, about 78 per cent of their effective capacity was utilized. This is higher than the average for all classes, 73.8 per cent. The area irrigated in 1919 was 61.9 per cent of the total area in enterprises of this class. This is considerably above the average for all classes. This is to be expected, since this class consists so largely of completed enterprises transferred to it.

Cooperative enterprises report 26.2 per cent of the total capital invested, with an average of \$21.78 per acre, based on the acreage enterprises were capable of irrigating in 1920. This average investment per acre is about 19 per cent less than the general average for all classes.

Table 21 shows, in percentages, what part of all irrigation works is controlled by cooperative enterprises.

TABLE 21.—PERCENTAGE OF ALL IRRIGATION WORKS BELONGING TO COOPERATIVE ENTERPRISES.

ITEM.	Per cent of total.
Diverting dams.....number.....	12.2
Storage dams.....number.....	20.0
Main ditches:	
Number.....	7.6
Length.....miles.....	21.9
Capacity.....second-feet.....	31.5
Lateral ditches:	
Number.....	20.7
Length.....miles.....	20.8
Reservoirs:	
Number.....	11.3
Capacity.....acre-feet.....	17.1
Pipe lines, length.....miles.....	23.6
Flowing wells:	
Number.....	5.5
Capacity.....gallons per minute.....	6.6
Pumped wells:	
Number.....	3.4
Capacity.....gallons per minute.....	6.2
Pumping plants:	
Number.....	2.6
Engine capacity.....horsepower.....	11.1
Pumps—	
Number.....	3.7
Capacity.....gallons per minute.....	9.7

The figures in the table show that the works belonging to cooperative enterprises are larger than the average, since they control larger percentages of the capacity than of the number.

Table 22 shows the history of enterprises of this class.

Like individual and partnership enterprises, cooperative enterprises showed their greatest activity, measured by area irrigated, in the eighties. The succeeding decade shows the next largest area, and the two preceding decades rank next. Since 1904 new enterprises of this type have not been so important.



TABLE 22.—NUMBER OF COOPERATIVE ENTERPRISES, WITH AREA IRRIGATED IN 1919, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of enterprises.	AREA IRRIGATED IN 1919.	
		Acres.	Per cent of total.
Total.....	3,477	6,465,090	100.0
Before 1860.....	198	176,618	2.7
1860-1869.....	373	793,432	12.3
1870-1879.....	348	842,649	13.0
1880-1889.....	696	1,745,743	27.0
1890-1899.....	492	762,540	11.8
1900-1904.....	282	753,909	12.1
1905-1909.....	301	625,782	9.7
1910-1914.....	238	380,223	5.9
1915-1919.....	282	169,222	2.6
Not reported.....	237	181,912	2.8

Irrigation districts.—Irrigation districts rank third in area irrigated, and second in the extent of increase in the area irrigated from 1909 to 1919. Like cooperative enterprises, districts are not well adapted to the development of new lands and, speaking generally, the increase in area reported under districts represents reorganizations rather than new enterprises. The figures given in Table 18 do not show the full extent of this movement, since the districts organized within United States Reclamation enterprises are not reported, because the Reclamation Service still controls these enterprises to a great extent, the districts serving merely as collecting agencies for the Reclamation Service. The large extent to which such reorganizations have taken place in the last decade is due very generally to the enactment of the Federal Farm Loan Act and the interpretation of that law. Under the Federal Farm Loan Act loans can be made only on first liens, while under the Reclamation Act as it was previously administered, under the Carey Act, and under most commercial enterprises, deferred payments on water rights were first liens on the lands to be irrigated, and, consequently farmers could get no loans from the Federal Farm Loan banks until their water rights were paid for—a period of 20 years under the Reclamation Act. Under irrigation district laws the cost of construction is covered by the issuance of bonds, with the principal and interest to be raised by taxation of the lands to be irrigated, rather than by mortgages to be enforced by foreclosure. It has been held that district bonds are not a bar to loans under the Federal Farm Loan Act.

A part of the increase in area irrigated by irrigation districts, however, represents new enterprises. This is particularly true in parts of California, where conditions are peculiar. It has been stated that the irrigation district is not adapted to the reclamation of new land, but this does not apply where districts are organized to supply water to land that has been farmed without irrigation. Unsettled desert land is not considered sufficient security for the capital necessary to

build works to bring water to the land, and consequently, districts composed of such lands can not sell bonds; but land already settled and under cultivation has, in some cases, sufficient value to serve as a basis for a bond issue, and bonds can be sold. That is the condition that prevails where districts have provided water for land already farmed but not previously irrigated.

The fundamental purpose of the organization of irrigation districts is the obtaining of funds for the construction or purchase of irrigation works, except for such reorganizations as have just been discussed. The inclusion of land within a district renders the land subject to taxation for interest and principal of bond issues, and also for the expense of operation and maintenance, and under state laws district taxes are to be collected in the same manner as state and county taxes, under the same penalties. This throws the burden of enforcing the bond lien, which is equivalent to a mortgage to secure deferred payments, upon the county officials, which is quite an advantage, from the standpoint of the holder of the lien.

An added advantage from the standpoint of the bond holder is that the whole bond issue is an obligation of the whole district. If any part of the land does not meet its share of the obligation, this deficit is added to the burden of the balance of the land.

Because of defaults in the payment of interest and principal on district bond issues, the markets for such securities have not been good, and the states have made many attempts to make irrigation district bonds more attractive to investors. The steps in this direction, taken by the several states, are shown in the following paragraphs, in which the state laws are analyzed from this viewpoint:

*Arizona.*—The original irrigation district law in Arizona was enacted in 1912. This law provided for the organization of districts under the supervision of county supervisors and for testing the validity of organizations and of bond issues in the courts, and irrigation district bonds were made legal investments for "all trust funds and for the funds of insurance companies, banks, banking institutions, and trust companies, and for the state and school funds, and whenever any money or fund may by law be invested in bonds of cities, counties, school districts, or municipalities in the state, such money or funds may be invested in said bonds of irrigation districts." (See sec. 5425, R. S., 1913.)

In 1921 there was created a state certification board, which is to investigate districts and certify their bonds.

No irrigation districts are reported in Arizona.

*Arkansas.*—Arkansas has no irrigation district law.

*California.*—Petitions for the organization of districts are submitted to the county supervisors and to the state engineer. If the supervisors find that a petition submitted to them conforms to the law, the state engineer is so notified. He then makes an investigation as to the feasibility of the project and reports to the supervisors. If the engineer reports that the water supply is not sufficient for the proposed district, the commissioner may still approve a district, but only after receiving a petition signed by an increased proportion of the landowners.

A law enacted in 1913 created an irrigation district bond commission and provided for the certification of bonds by the state comptroller, under certain conditions. Any district proposing the issuing of bonds may apply to have its bonds certified. Upon the receipt of such an application the commissioner examines: (1) The water supply, (2) the soil and its probable water requirements, (3) the feasibility of the plans for supplying water, (4) the reasonable market value of the water, water rights, and irrigation works of the district, (5) the reasonable market value of the land in the district, (6) whether the proposed bond issue, together with others that have been issued or proposed, exceeds 60 per cent of the value of the water, water rights, works, and land, and (7) the character and number of bonds proposed to be issued.

The commission reports to the state comptroller, and if it reports that the water supply is sufficient, that the plans are feasible, and that the proposed bond issue does not exceed 60 per cent of the value of the water, water rights, works, and land, the bonds are certified by the comptroller.

Bonds certified by the comptroller are legal investments for "all trust funds, and for the funds of all insurance companies, banks, both commercial and savings, and trust companies, and for the state school funds, and whenever any money or funds may, by law now or hereafter enacted, be invested in bonds of cities, cities and counties, counties, school districts, or municipalities in the state of California, such money or funds may be invested in said bonds of irrigation districts."

*Colorado.*—In Colorado all irrigation districts are organized under the supervision of the county commissioners. In 1921 Colorado provided for investigation of proposed districts by the state engineer and by a commission, and bonds certified by this commission were made legal investments for public and trust funds.

*Idaho.*—In Idaho irrigation districts are organized under the supervision of the county commissioners. When a petition for the organization of a district is filed it is submitted to the state engineer, who makes a report on it to the county commissioners. If the state engineer reports adversely the petition for organization is denied, unless a new petition signed by three-fourths of the landowners of the district is received. The board of directors of each district is required to report to the state engineer at least once a year, and to publish a financial statement on or before the first Tuesday in February of each year. In addition, the county commissioners have access to the books at all times.

In 1921 Idaho created a "Reclamation District Bond Commission," similar to the irrigation district bond commission of California, described above. The Idaho commission handles drainage district bonds as well as irrigation district bonds. The provisions of the Idaho law are similar to those of California except that the commission is to determine the reasonable "cost" of the water, water rights, and works belonging to the district rather than their "value"; is to determine the value of the land in the district "when supplied with the water that will be made available," and is to determine whether the aggregate amount of bonds proposed exceeds 50 per cent of the reasonable value of the "lands within the district, with the water right that will be made available." The essential differences seem to be that California takes into account the value of the water, water rights, and irrigation works, while Idaho does not; but, on the other hand, Idaho takes into consideration the prospective increased value of the land on account of irrigation, while California takes the value of the land as it stands. Idaho requires a margin of value above bond issues of 50 per cent, while California requires only 40 per cent. Bonds are certified by the state treasurer and are then legal investments for the same classes of funds as in California.

*Kansas.*—Kansas has an irrigation district law, but no districts are reported.

*Louisiana.*—Louisiana has no irrigation district law.

*Montana.*—In Montana irrigation districts are organized under the supervision of the county commissioners, the proceedings for

issuing bonds are reviewed by the courts, and the books of districts are open to state examiners. In 1919 there was created a public service commission under which districts may be organized.

A law enacted in 1921 provides for an irrigation bond commission, similar to the California commission, and makes bonds that have been certified legal investment for the same classes of funds as in California. After bonds have been certified no expenditures from funds raised may be made without approval of the commission.

*Nebraska.*—The Nebraska irrigation district law provides for the organization of districts under the supervision of the county commissioners. A copy of the petition for organization is filed with the state board of irrigation, and the secretary of the board (the state engineer) makes a report to the commissioners. After organization the board employs an engineer to make plans, and his plans are submitted to the state engineer. After the receipt of the report of the state engineer the directors of the district decide upon the amount of the bond issue needed, and call an election to decide whether the bonds shall be issued. The law provides a special court procedure for passing on the validity of the bond issue. There is no further provision for public supervision.

*Nevada.*—In Nevada irrigation districts are organized under the supervision of the county commissioners, and there is provision for submitting and testing the validity of organization and bond issues in the courts. A law of 1911 provided for submitting plans to the state engineer, but this was repealed in 1915. In 1921 Nevada created a bond commission similar to that of California.

*New Mexico.*—The New Mexico irrigation district law provides for the organization of districts under the supervision of the county commissioners. Each district is to employ an engineer, and his report is to be submitted to the state engineer, who is to determine the sufficiency of the water supply. If he finds that there is not enough water, he is to disapprove the report, and in such a case, no bonds can be issued. The validity of bond issues is to be tested in the courts.

*North Dakota.*—The provisions of the North Dakota irrigation district law regarding public supervision of the organization of districts and of bond issues are exactly like those of Nebraska. No districts are reported.

*Oklahoma.*—Oklahoma has an irrigation district law, but no districts are reported.

*Oregon.*—In Oregon districts are organized under the supervision of the county courts. Plans are submitted to the state engineer for his approval or disapproval. A commission similar to the California irrigation district bond commission was created in 1917. The law is similar to the California law except that the aggregate bond issues may not exceed 50 per cent of the value of the land, water, water rights, and irrigation works. Bonds are certified by the secretary of state, and, when certified, are legal investments for the same classes of funds as in California. In 1919 Oregon provided for state guarantee of bond interest, for not to exceed five years.

*South Dakota.*—South Dakota has an irrigation district law, but no districts are reported.

*Texas.*—Water improvement districts in Texas are organized under the supervision of the county commissioners. The proceedings for issuing bonds are reviewed by the court. When an action for this purpose is brought, notice is served on the state attorney general, who examines the proceedings and files an answer with the court. If the case is decided in favor of the district, the clerk of the court certifies this fact to the state controller of accounts, and on presentation of this certificate and the bonds of the district he registers the bonds, and attaches to each bond a certificate of the fact that the proceedings have been validated by the court.

*Utah.*—In Utah irrigation districts are organized under the supervision of the county commissioners, and organization and bond issues are validated by the court. In 1919, Utah enacted a law similar to the California law creating an irrigation bond commission. The provisions of this law are the same as those of the California law, and certified bonds are legal investments for the same funds.

When bonds have been certified in accordance with this law the district can make no expenditures without the consent of the bond commission.

*Washington.*—In Washington irrigation districts are organized under the supervision of the county commissioner. When a petition for the organization of a district is received by the county commissioners the state hydraulic engineer is notified and sits with the commissioner in an advisory capacity when a hearing is held on the petition. Proceedings for organization and bond issues are validated by the courts. There is no further state supervision.

*Wyoming.*—Wyoming enacted a new irrigation district law in 1920, which is entirely different from any previously existing irrigation district law. Under this law petition is filed with the district court of the county containing the largest part of the area of the proposed district, and all proceedings regarding organization and bond issues are handled by the court. There is no provision for participation by any public official.

The preceding analysis of the irrigation district laws shows the successive steps in attempting to give irrigation district bonds a standing to have been as follows: First, the organization of districts under public supervision, usually by the county commissioners; second, the validation of proceedings for organization and bond issues by the courts; third, examination and report upon plans by the state engineers but without authority to take any action; fourth, the making of irrigation district bonds legal investments for trust funds and public funds; fifth, the certification of bonds by public commissions after examination of the enterprises; sixth, giving the bond commissions supervision over expenditures from funds obtained by the sale of certified bonds. Oregon has gone one step further and guarantees interest on district bonds for the first five years. No other state has gone so far as to guarantee bonds in any way.

Still further attempts to utilize district bonds for financing the construction of irrigation works have been made by enacting legislation in the states providing for issuing bonds to the United States in payment for the construction of irrigation works by the Federal Government and by attempting to get Federal legislation authorizing the acceptance of such bonds by the Federal Government, and the issuance of its own bonds, to secure funds, which, in turn, would be repaid with the payments on the district bonds. No such law has been enacted, but many bills providing for such laws have been introduced and urged. This would amount to the guaranteeing of district bonds by the Federal Government, since the Government could not afford to default in its payments, even if the districts defaulted in the payments on the bonds on which the Government bonds were based. Except in California and Oregon the laws providing for the certification of bonds are of so recent date that the census returns do not show their results, if there are any. The returns for California show 19 districts begun in the period from 1915 to 1919, including

238,000 acres. This is much greater activity than has been shown at any previous time, and may be due, in part, at least, to this law. Oregon reports in the same period 11 districts, including about 145,000 acres, which is nearly one-half of all the districts organized in the state, and about one-third of the area included in districts.

No other state shows any marked activity in the organization of districts, and consequently it seems that the results in California and Oregon may be attributed to their laws.

In 1919 irrigation districts supplied 9.5 per cent of the total area irrigated, which is less than one-third of the area served by either individual and partnership enterprises or cooperative enterprises. In 1909, however, districts served only 3.7 per cent of the total area, showing a large increase in relative importance. In fact, districts showed 27.2 per cent of the total increase in area irrigated from 1909 to 1919. This increase has been discussed (p. 16).

The area irrigated by districts in 1919 was 72 per cent of the area they were reported capable of supplying in 1920, and 53 per cent of the area included in district enterprises. These figures indicate that districts were in about the same condition as the average for all enterprises, considered as a whole. Irrigation districts reported 9.5 per cent of the total area irrigated in 1919, and about the same percentage of the area enterprises were capable of irrigating in 1920 and the area in enterprises. On the other hand, they represented 12.7 per cent of the capital invested to January 1, 1920, indicating an average investment per acre higher than the general average. The average investment per acre, based on the area districts were capable of irrigating in 1920, was \$34.98, while the general average for all enterprises was \$26.81.

The percentages of all irrigation works of all classes belonging to irrigation districts are given in Table 23.

TABLE 23.—PERCENTAGE OF ALL IRRIGATION WORKS BELONGING TO IRRIGATION DISTRICTS.

ITEM.	Per cent of total.
Diverting dams.....number.....	1.1
Storage dams.....number.....	2.0
Main ditches:	
Number.....	0.9
Length.....miles.....	4.8
Capacity.....second-feet.....	3.2
Lateral ditches:	
Number.....	4.3
Length.....miles.....	10.8
Reservoirs:	
Number.....	1.1
Capacity.....acre-feet.....	7.9
Pipe lines, length.....miles.....	9.2
Flowing wells:	
Number.....	6.6
Capacity.....gallons per minute.....	1.3
Pumped wells:	
Number.....	0.3
Capacity.....gallons per minute.....	0.6
Pumping plants:	
Number.....	0.3
Engine capacity.....horsepower.....	5.5
Pumps—	
Number.....	0.9
Capacity.....gallons per minute.....	5.1

The table shows that the works belonging to irrigation districts are larger than the average, since the percentages of capacities are larger than the percentages of the total numbers of works of various kinds.

Table 24 shows the history of irrigation district enterprises.

TABLE 24.—NUMBER OF IRRIGATION DISTRICT ENTERPRISES, WITH AREA IRRIGATED IN 1919 CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of enterprises.	AREA IRRIGATED IN 1919.	
		Acres.	Per cent of total.
Total.....	255	1,840,874	100.0
Before 1860.....	1	2,000	0.1
1860-1869.....	9	93,672	5.1
1870-1879.....	12	235,327	12.8
1880-1889.....	41	395,562	21.5
1890-1899.....	44	397,588	21.6
1900-1904.....	16	62,270	3.4
1905-1909.....	44	254,108	13.8
1910-1914.....	29	166,569	9.0
1915-1919.....	49	204,884	11.1
Not reported.....	11	28,914	1.6

It is evident that in some instances districts have given as the date of beginning the date on which the enterprises that have been reorganized into districts were begun, rather than dates when the districts were organized. The eighties and nineties were the periods of greatest activity in the beginning of enterprises that are now controlled by districts. This period was followed by a slump from 1900 to 1905, due to defaults of existing districts, a revival between 1905 and 1909, with another slump from 1910 to 1914. Within the last five years there has been some revival, due to increased public supervision, reorganizations to permit of loans under the Federal Farm Loan Act, and other causes previously discussed.

**Commercial enterprises.**—Commercial enterprises report the same percentage of the total area irrigated in 1919 as that reported for irrigation districts, 9.5 per cent. They show, however, a decrease in relative importance since 1909, when they reported 12.5 per cent of the total area irrigated. While cooperative enterprises and districts are continually gaining in relative importance by the reorganization of other enterprises into these forms, commercial enterprises are losing in relative importance by the same process. Notwithstanding this loss commercial enterprises rank among the leading types, measured by the area irrigated in 1919, and much higher in the area actually reclaimed by such enterprises, now reorganized into other forms.

Commercial enterprises reported practically no increase in area irrigated from 1909 to 1919, and an actual decrease during the same period in area enterprises were capable of irrigating and the area in enterprises. Table 26, page 31, shows considerable areas in enterprises begun between 1910 and 1915, but almost a complete cessation in the organization of such enterprises since 1915.

The original plan of operation of commercial enterprises was to build irrigation works and sell water rights that carried with them no interest in the works, but merely entitled the purchasers to obtain water upon the payment of annual charges. This was the plan on which most of the large irrigation enterprises promoted between 1870 and 1895 operated. There were so many abuses in selling rights to more water than could be delivered, in unfair contracts, and in excessive annual charges, that from time to time the states passed laws prohibiting the sale of rights beyond the capacities of canals, providing for the regulation of rates by some public authority, and, in some states, prohibiting the sale of water rights of this type. In most states rates are regulated by the county commissioners, but in California and Nebraska they are regulated by the state railway commissions.

The restrictive legislation referred to and the general financial failure of such enterprises have led to the abandonment of this plan of operation, and in recent years commercial enterprises sell rights which carry an interest in the works and water supply under contracts that provide that the works and rights shall become the property of the water users. Under this plan organization as a commercial enterprise is only a stage in the development of a cooperative enterprise.

The area irrigated in 1919 by commercial enterprises was 65 per cent of the area these enterprises were capable of irrigating in 1920, indicating that these enterprises are not so fully utilized as those of the types previously discussed. The area irrigated in 1919 was but 46 per cent of the land in the enterprises. The excess in area in enterprises over area irrigated is by far greater in the more recent enterprises, indicating that it represents enterprises in the process of development.

The part of all irrigation works that belongs to commercial enterprises is shown in Table 25.

TABLE 25.—PERCENTAGE OF ALL IRRIGATION WORKS BELONGING TO COMMERCIAL ENTERPRISES.

ITEM.	Per cent of total.
Diverting dams.....number..	0.8
Storage dams.....number..	3.0
Main ditches:	
Number.....	0.8
Length.....miles..	6.1
Capacity.....second-feet..	8.6
Lateral ditches:	
Number.....	7.7
Length.....miles..	13.2
Reservoirs:	
Number.....	2.7
Capacity.....acre-feet..	11.1
Pipe lines, length.....miles..	9.5
Flowing wells:	
Number.....	1.8
Capacity.....gallons per minute..	2.8
Pumped wells:	
Number.....	0.9
Capacity.....gallons per minute..	1.4
Pumping plants:	
Number.....	0.6
Engine capacity.....horsepower..	8.9
Pumps—	
Number.....	1.4
Capacity.....gallons per minute..	18.8

Commercial enterprises report 12.3 per cent of the capital invested in all enterprises, with an investment per acre to which they were capable of supplying water in 1920 of \$30.62, as compared with \$26.81 for all classes.

The table shows that for every item the percentage of the total capacity exceeds the percentage of the total number, indicating that the works belonging to commercial enterprises exceed the average size.

In recent years many commercial enterprises have secured control of tracts of land, and sell the land with the works and rights. This form of organization is particularly well adapted to this type of development, operating on a comparatively small scale.

The historical development of commercial enterprises is shown by Table 26.

TABLE 26.—NUMBER OF COMMERCIAL IRRIGATION ENTERPRISES, WITH AREA IRRIGATED IN 1919, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of enterprises.	AREA IRRIGATED IN 1919.	
		Acres.	Per cent of total.
Total.....	309	1,802,599	100.0
Before 1860.....	18	13,877	0.8
1860-1869.....	8	9,535	0.5
1870-1879.....	36	726,505	40.3
1880-1889.....	24	273,089	15.1
1890-1899.....	53	279,817	15.5
1900-1904.....	38	178,311	9.9
1905-1909.....	27	168,481	9.3
1910-1914.....	52	113,050	6.3
1915-1919.....	26	18,313	1.0
Not reported.....	17	21,621	1.2

The largest development of commercial enterprises was coincident with the beginning of large-scale irrigation enterprises in 1870, and commercial enterprises continued to be of importance, although on a decreasing scale, until 1914. Since 1914 commercial enterprises have ceased to be important, because of the difficulty in financing such enterprises.

United States Reclamation Service enterprises.—The United States Reclamation Service ranks fifth among the types of enterprises in the extent of the area irrigated in 1919, having 6.5 per cent of the total.

This does not represent the full extent of the work of the Reclamation Service, since it supplies stored water to lands receiving their principal supply from other sources. The area thus furnished a partial supply of water in 1919 was slightly less than one million acres. On the other hand, some of the land reported by the Reclamation Service was supplied with water by enterprises of other types that have been incorporated into the reclamation enterprises. In extent of increase in area irrigated from 1909 to 1919 the Reclamation Service ranks third, with 18.1 per cent of the total. This increase represents a real extension in the area irrigated, and not transfers from other enterprises, as is the case with cooperative enterprises and irrigation districts.

The Reclamation Service reports about the same percentages of the total area all enterprises were capable of irrigating in 1920 and of the total area included in all enterprises that it does of the area irrigated in 1919, 6.5 per cent and 7.3 per cent, respectively.

The area irrigated in 1919 was 74.6 per cent of the area enterprises were capable of irrigating in 1920, showing that the effective capacity of the United States Reclamation Service enterprises was more fully utilized than that of most other types of enterprise. The area irrigated in 1919 was but 47.8 per cent of the area included in enterprises. This low percentage is due to the fact that the Reclamation Service is actively engaged in construction work and very few of its enterprises are completed.

The United States reclamation law was enacted in 1902. The original law provided for the construction of irrigation works with the proceeds from the sale of public lands, after deducting certain amounts, and for the repayment of the cost by the water users in 10 annual installments. These repayments were to go into the reclamation fund, to be used in building additional works, thus creating a revolving fund continually augmented by the proceeds from the sale of lands. To this fund was added in 1914 a loan from the Treasury of \$20,000,000, which is to be repaid, and consequently does not form a part of the revolving fund. Table 27, taken from the Nineteenth Annual Report of the Reclamation Service (p. 57), shows the amounts which have gone into the reclamation fund from 1901 to June 30, 1920.

TABLE 27.—ACCRETIONS TO THE RECLAMATION FUND FROM ALL SOURCES TO JUNE 30, 1920.

FISCAL YEAR.	Total.	Sale of public lands.	Sale of town lots.	Bond loan.	Miscellaneous collections and repayments.
Total.....	\$153,657,583.43	\$100,300,195.79	\$493,329.63	\$20,000,000	\$32,864,058.01
1901.....	3,144,821.91	3,144,821.91			
1902.....	4,585,520.53	4,585,520.53			
1903.....	3,714,238.97	3,713,996.60			242.37
1904.....	6,826,964.43	6,826,253.59			710.84
1905.....	4,806,854.24	4,805,515.39			1,338.85
1906.....	5,169,261.13	5,166,336.50			22,924.63
1907.....	8,072,116.16	7,914,131.71	61,535.00		96,449.45
1908.....	9,961,540.18	9,430,573.98	12,864.06		518,102.14
1909.....	8,519,885.24	7,755,466.81	10,017.85		754,400.58
1910.....	8,810,876.80	7,028,185.78	60,112.86		1,722,578.27
1911.....	8,239,355.55	6,135,547.76	69,468.80		2,034,338.99
1912.....	8,127,546.68	5,657,498.88	15,224.10		2,454,823.70
1913.....	6,115,808.91	3,737,910.55	17,784.74		2,360,113.62
1914.....	9,717,890.35	3,460,451.63	15,280.25	\$ 500,000	2,742,158.47
1915.....	14,177,564.75	3,268,057.78	18,438.28	\$ 500,000	2,391,070.74
1916.....	8,518,265.80	2,648,057.74	21,189.28	\$ 500,000	2,349,018.78
1917.....	7,578,859.57	2,865,338.34	31,250.15	1,500,000	3,182,233.08
1918.....	9,073,087.21	2,552,650.65	60,990.66	\$ 3,000,000	3,459,446.00
1919.....	5,877,034.04	1,959,496.88	65,362.49		3,862,224.67
1920.....	7,600,030.92	2,644,334.88	43,818.21		4,911,882.83

<sup>1</sup> Of this total, \$9,286,469.16 is reported as repayments on construction charges; \$6,462,637.23 as operation and maintenance charges; and \$17,115,031.62 as miscellaneous collections. These items are not reported separately by years.

The same report gives the gross construction cost as \$126,140,986.18 and the operation and maintenance cost as \$18,588,049.85. The gross construction cost reported here is slightly less than the capital invested

as reported by the census. The report states that this difference is due "to a combination of items included in disbursements but not in cost and items included in cost but not in disbursements." The reported repayments on construction charges are 7.4 per cent of the gross construction cost. From this it appears that the "revolving fund" feature of the reclamation fund is as yet not realized.

Since the date of the census, and therefore not affecting the reclamation fund as reported above, Congress has provided that 52.5 per cent of the receipts under the oil-leasing act and 50 per cent of the receipts under the Federal power act shall be paid into the reclamation fund.

For the purpose of permitting of more construction of irrigation works than the reclamation fund provides for, many bills have been introduced in Congress providing that the Federal Government may accept the bonds of irrigation districts in payment for construction work, or in advance of construction, and issue its own bonds, to be repaid from the payments on the district bonds, for the purpose of obtaining funds for construction. (See page 29.) No such law has been enacted, however.

As stated previously, the reclamation law originally provided that the cost of construction should be repaid in not more than 10 annual installments. In 1914 Congress enacted the so-called "extension act," which provided for extending payments over a period of 20 years instead of 10. In both cases the Secretary of the Interior was authorized to fix the time when the payments shall begin, and in neither case is interest charged on deferred payments. The extension of the time during which payments may be made and the fact that for several projects the Secretary of the Interior has not yet fixed the time when payments shall begin account for the smallness of the amount received from the repayments of construction charges.

Projects for which the payments have not begun are operated on temporary rental agreements. The report referred to above gives (p. 52) the receipts from water rentals to June 30, 1920, as \$6,149,617.27.

The census schedules returned by the Reclamation Service show the total capital invested to January 1, 1920, to be \$129,509,819, which is 18.6 per cent of the total capital invested in enterprises of all classes. On the basis of the area capable of being irrigated in 1920, this is an average investment per acre of \$77.06. However, the Reclamation Service supplied stored water to nearly 1,000,000 acres receiving their principal supply of water from other sources. A part of its expenditures should be charged to these lands, but the census returns do not show how much. Including the total area supplied with stored water in the area used in computing the average investment per acre would give an average of \$48.31 per acre. The correct average lies between these two sums, above rather than

below the mean of the two. Probably \$65 per acre approximates the correct amount. The average for all enterprises is \$26.81, and the average for the Reclamation Service is about two and one-half times the general average.

The average cost per acre of operation and maintenance for Reclamation Service enterprises was \$2.20, which is but 91 per cent of the average cost of all enterprises.

With reference to the ultimate control of Reclamation Service enterprises the law contains the following provision (sec. 6):

*Provided*, That when the payments required by this act are made for the major portion of the lands irrigated from the waters of any of the works herein provided for, then the management and operation of such irrigation works shall pass to the owners of the lands irrigated thereby, to be maintained at their expense under such form of organization and under such rules and regulations as may be acceptable to the Secretary of the Interior: *Provided*, That the title to and the management and operation of the reservoirs and the works necessary for their protection and operation shall remain in the Government until otherwise provided by Congress.

In the earlier years of the operation of the Reclamation Act the Secretary of the Interior required the organization of water-users' associations with which he dealt in matters relating to the various enterprises, but in more recent years he has preferred the organization of irrigation districts. Some of the enterprises are organized in one form and some in the other, but none has yet reached the stage described in the law. In either case the local organizations act as collecting agents for the Reclamation Service. As pointed out in the discussion of districts, this form of organization has the advantage that the deferred payments represented by district obligations do not bar settlers from obtaining loans under the Federal Farm Loan Act.

While the United States Reclamation Act nominally relates to public lands, it provides for the inclusion of private lands in reclamation enterprises, and therefore is available for supplying water to lands of either class.

The Reclamation Act originally provided in general for expenditures in the various states in proportion to the funds arising from the sales of public lands within the states. This restriction was later removed, leaving the allotment of funds to the discretion of the Secretary of the Interior. The act extending the period of repayment to 20 years provided that after July 1, 1915, expenditures from the reclamation fund should not be made except out of appropriations made annually by Congress, and since that date Congress has made annually appropriations for specific projects.

The percentage of the total of all irrigation works that belongs to the Reclamation Service is shown in Table 28.

For only one item does the number credited to the Reclamation Service equal 1 per cent of the total, but



in capacity its works rank much higher. This is particularly noticeable in the case of reservoirs, where the number is less than 1 per cent of the total, while the capacity is only a little less than 50 per cent of the total.

TABLE 28.—PERCENTAGE OF ALL IRRIGATION WORKS BELONGING TO UNITED STATES RECLAMATION ENTERPRISES.

ITEM.	Per cent of total.
Diverting dams.....number.....	0.2
Storage dams.....number.....	1.0
Main ditches:	
Number.....	0.2
Length.....miles.....	1.9
Capacity.....second-feet.....	5.2
Lateral ditches:	
Number.....	5.6
Length.....miles.....	10.2
Reservoirs:	
Number.....	0.6
Capacity.....acre-feet.....	46.7
Pipe lines, length.....miles.....	2.0
Pumped wells:	
Number.....	0.2
Capacity.....gallons per minute.....	0.3
Pumping plants:	
Number.....	0.1
Engine capacity.....horsepower.....	1.9
Pumps—	
Number.....	0.2
Capacity.....gallons per minute.....	2.7

The activity of the Reclamation Service, measured by the area irrigated in 1919 in enterprises begun at various dates, is shown by Table 29.

TABLE 29.—NUMBER OF UNITED STATES RECLAMATION SERVICE ENTERPRISES, WITH AREA IRRIGATED IN 1919, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of enterprises.	AREA IRRIGATED IN 1919.	
		Acres.	Per cent of total.
• Total.....	74	1,241,016	100.0
1900-1904.....	16	368,946	29.7
1905-1909.....	37	761,361	61.3
1910-1914.....	10	102,390	8.2
1915-1919.....	6	7,644	0.6
Not reported.....	6	705	0.1

The reclamation law was enacted in 1902, and more than 90 per cent of the land irrigated in 1919 is in enterprises begun between 1902 and 1910. For many years it has been the policy of the service, as well as of Congress, to complete existing projects rather than begin new ones. Table 12 on page 21, shows that the area included in these enterprises but not irrigated in 1919 exceeds the area irrigated in 1919. In other words, the area irrigated by Reclamation Service enterprises can be doubled without the undertaking of any new enterprises.

Carey Act enterprises.—Carey Act enterprises show the smallest area irrigated in 1919 of any of the types of enterprise engaged primarily in supplying water for irrigation—only 2.7 per cent of the total; and they show also only about 5 per cent of the total increase in area irrigated during the last decade. Here again,

the figures do not present the whole truth, since under state laws, Carey Act enterprises pass to cooperative enterprises as soon as they become well developed.

The area irrigated in 1919 was 65 per cent of the area enterprises were capable of irrigating in 1920, and 44 per cent of the area included in enterprises, as compared with general averages of 74 per cent, and 53 per cent for enterprises of all types. The poor showing of Carey Act enterprises as to utilization of their full capacity, as compared with enterprises of other classes, is due in part, at least, to the fact that they, like commercial enterprises, represent only one stage in the development of cooperative enterprises. As soon as an enterprise is fairly well developed it is reorganized into a cooperative enterprise and would not be reported as a Carey Act enterprise.

Carey Act enterprises report 4.7 per cent of the total capital invested in irrigation enterprises, with an average of \$40.63 per acre, while the average per acre for all enterprises is \$26.81.

The Federal Carey Act is very general in its terms, the plan of operation being left largely to the several states. The states are authorized to make all contracts necessary for the reclamation of the lands, but are prohibited from leasing any land, from disposing of it in any way except to secure its reclamation, cultivation and settlement, and from disposing of more than 160 acres to any one person.

The state laws governing operations under the Carey Act differ much in detail but are alike in general plan. All operations are placed under the supervision of state boards. Any person or corporation desiring to reclaim land under this law applies to the proper board, specifying the lands which it is desired to have segregated, and describing the proposed plan of reclamation. If the application is approved by the state board, it is submitted to the General Land Office, and if it is approved there the land is segregated and set aside to be disposed of in accordance with a contract entered into by the state and the applicant. This contract provides for the construction of works and fixes the terms on which water rights may be sold to settlers, one of the conditions being that the rights sold shall carry an interest in the works, so that when rights are paid for the works and rights become the property of the purchasers of rights. On its part the state agrees to sell lands only to parties who have entered into contract with the applicant for the purchase of water rights. The plan adopted for passing title from the applicant to the purchaser of water rights and land is to issue with the rights stock in a new company which becomes effective upon the completion of specified payments. The Federal Government patents the land to the state, and the state issues title to the purchaser, when his payments are made.

The Federal law authorizes the states to create liens on the lands "for the actual cost and necessary expense of reclamation and reasonable interest thereon from the date of reclamation until disposed of to actual settlers," and for this purpose the Government may pass title to the states as soon as an adequate water supply is made permanently available. This, however, is not the usual plan. Water rights are sold on deferred payments, and bonds are sold, secured by the notes for these deferred payments and the settlers' interest in the land. Settlers agree to give mortgages on the land as soon as they get title, but until that time the bonds are secured only by the settlers' interest in the land. The usual practice has been for the states to apply for patent only when the settlers have fulfilled the conditions entitling them to patent; consequently, up to that time the title to the land is in the Federal Government and it is not liable for the bonds.

Table 30, compiled from the annual reports of the General Land Office, shows the areas applied for, segregated and patented under the Carey Act from 1911 to 1920. As the amounts are cumulative, they show in fact what has been done under this act from the date of its passage in 1894.

TABLE 30.—AREAS APPLIED FOR, SEGREGATED, AND PATENTED UNDER THE CAREY ACT (ACRES).

YEAR.	APPLIED FOR.		SEGREGATED.		PATENTED.	
	To date.	During year.	To date.	During year.	To date.	During year.
1911.....	7, 116, 339	978, 529	3, 193, 314	323, 795	388, 404	60, 540
1912.....	7, 301, 037	184, 697	3, 291, 231	97, 917	474, 000	85, 596
1913.....	7, 773, 359	356, 657	3, 685, 992	394, 761	430, 048	35, 171
1914.....	7, 682, 445	21, 766	3, 692, 230	6, 238	460, 054	30, 006
1915.....	7, 781, 110	98, 665	3, 705, 445	13, 215	601, 573	141, 519
1916.....	7, 735, 846	34, 338	3, 708, 367	2, 922	761, 455	159, 962
1917.....	7, 741, 963	6, 116	3, 711, 615	3, 247	803, 519	42, 064
1918.....	7, 797, 631	55, 668	3, 755, 429	43, 814	815, 163	11, 644
1919.....	7, 797, 631	.....	3, 758, 965	3, 536	883, 264	68, 102
1920.....	8, 373, 973	576, 343	3, 781, 649	22, 685	888, 793	5, 527

Except for the application for something over 500,000 acres in 1920—the application coming from Idaho—there have been few applications and fewer segregations since 1913. The issuing of patents represents progress on older enterprises, rather than the undertaking of new ones.

The Carey Act applies only to public lands, and as large bodies of public land susceptible of irrigation become more scarce there is less and less opportunity for development under this act. It has been stated that desert lands in irrigation districts are not considered sufficient security for bonds to cover the cost of construction of irrigation works, where these bonds are a tax lien on the lands, and Carey Act bonds have even less security, since they do not become a lien on the lands until the settlers on the lands secure title to their holdings. Many Carey Act enterprises have

failed, and this has given Carey Act bonds a poor standing in the market. Because of this and the fact that the areas of public land fitted to be reclaimed under the Carey Act are diminishing, it appears that the Carey Act will not be made use of to so large an extent as it has in the past.

Table 31 shows what part of the irrigation works of the country are controlled by Carey Act enterprises. The table shows that Carey Act enterprises control an insignificant part of the irrigation works.

TABLE 31.—PERCENTAGE OF ALL IRRIGATION WORKS BELONGING TO CAREY ACT ENTERPRISES.

ITEM.	Per cent of total.
Diverting dams.....number..	0.2
Storage dams.....number..	0.7
Main ditches:	
Number.....	0.1
Length.....miles..	1.4
Capacity.....second-feet..	3.0
Lateral ditches:	
Number.....	1.0
Length.....miles..	4.5
Reservoirs:	
Number.....	0.4
Capacity.....acre-feet..	4.2
Pipe lines, length.....miles..	0.7
Flowing wells:	
Number.....	0.2
Capacity.....gallons per minute..	0.6
Pumping plants:	
Number.....	( <sup>1</sup> )
Engine capacity.....horsepower..	0.1
Pumps—	
Number.....	0.1
Capacity.....gallons per minute..	( <sup>1</sup> )

<sup>1</sup> Less than one-tenth of 1 per cent.

Table 32 shows the acreage irrigated by Carey Act enterprises in 1919, distributed by date of beginning.

TABLE 32.—NUMBER OF CAREY ACT ENTERPRISES, WITH AREA IRRIGATED IN 1919, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of enterprises.	AREA IRRIGATED IN 1919.	
		Acres.	Per cent of total.
Total.....	42	521, 829	100.0
1890-1899.....	7	50, 855	9.7
1900-1904.....	7	243, 565	46.7
1905-1909.....	19	221, 256	42.4
1910-1914.....	7	6, 103	1.2
1915-1919.....	2	60	( <sup>1</sup> )

<sup>1</sup> Less than one-tenth of 1 per cent.

This table shows, as did that compiled from the reports of the General Land Office, that there has been little activity under the Carey Act since 1910.

Other types of enterprises.—The other types of enterprises included in the classification are not engaged primarily in supplying water for irrigation.

The United States Indian Service supplies water to land in Indian reservations, and the land to which it supplied water in 1919 was 1.5 per cent of the total.

State enterprises have some significance because they include a state land-settlement project in California, the first of its kind in the United States. In



this case the state has prepared so-called "ready-made farms," equipped with buildings, fences, and other improvements, as well as irrigation and drainage facilities. The lands are sold on long-time, amortized payments, and there has been a high degree of state supervision and leadership in the affairs of the colony. A second colony has been established in California, but was not sufficiently advanced to be reported in the census. This plan of land settlement, backed by both state and Federal governments is being urged, but has not been adopted, except in California.

#### WATER RIGHTS.

In the arid sections of the United States the right to use water is the most important factor entering into the value of land. Yet the development of the West was begun without an adequate appreciation of the value of titles to water rights, and without adequate legislation for perfecting titles, and according to the returns of the Fourteenth Census only a little more than one-half of the land irrigated is served by enterprises whose titles to water are defined and recognized by any legally constituted authority. Nearly \$700,000,000 has been invested in irrigation enterprises, and land values of many times that amount are dependent on rights to water, only about one-half of which are properly defined. The laws of the several states relating to this subject are summarized on pages 47 to 48, and are stated more in detail in the state reports at the end of this report.

There are in the Western states two general theories as to water rights, one known as the doctrine of appropriation—that water may be taken from streams for use on land without reference to its bordering on the streams—and the other known as the riparian doctrine—that water from a stream may be used only on land bordering that stream. The doctrine of appropriation is recognized in all of the states where irrigation is generally practised, while the riparian doctrine is recognized to a limited extent in several of the states. However, less than 2 per cent of the land irrigated in 1919 is reported to be served by riparian rights. Consequently, it may be stated that practically all of the rights to water for irrigation rest on the doctrine of appropriation.

The fundamental elements of the doctrine of appropriation are as follows:

1. Water may be taken from streams for beneficial uses on lands not bordering the streams from which it is taken.
2. The appropriation (the taking of the water) must be for some useful or beneficial purpose.
3. Among appropriators the first in time is the first in right. That is, when there is not water enough for all, the appropriators are to be supplied in the order of the dates of their first use of water, up to the limit of their rights.

#### 4. When the use ceases the right ceases.

The states have assumed the right under their police powers to control the acquirement and enforcement of water rights, and the United States Supreme Court has recognized this right on the part of the states. (*Kansas v. Colorado*, 206 U. S., 46.)

Notwithstanding that all Western states have provided for some public control over the acquirement of water rights, they have all recognized rights acquired without conforming to the legal requirements or prior to the establishment of such requirements; that is, by "appropriation and use." The reports show that 13.1 per cent of the land irrigated in 1919 was served by rights of this class that have not been defined or otherwise made of record.

The first step in public control was the enactment of laws requiring the posting of notices at the points of intended diversion stating what was claimed, and the filing of copies of these notices in county records. In several states the laws required also the filing of claims for rights acquired prior to the enactment of the laws. The dates of the enactment of laws requiring posting and filing of notices or the filing of claims are shown on page 47. Since "beneficial use" is essential to the acquirement of a right and to its maintenance, it is obvious that the filing of a claim does not give title and the filing is merely evidence of an intent to acquire a right and not evidence of the right itself. Consequently, rights acquired in this way are not defined as they are acquired. The area irrigated in 1919 under rights initiated in this way and not otherwise defined is 14.4 per cent of the total area irrigated.

All of the states covered by the census of irrigation, except Arkansas, Colorado, Kansas, Louisiana, and Montana, have provided for a more orderly and efficient system of the acquirement of rights. The dates of the enactment of their laws making this provision are shown on page 48. These laws require a party wishing to acquire a right to apply to some state board or official for a permit to take a specified quantity of water from some source, stating the nature and the place of use. The approved application becomes a permit. Proof of the completion of irrigation works and of the use of water is to be submitted, and if the work has been done in accordance with the permit a certificate or license is issued that states the nature and extent of the rights acquired. The land irrigated in 1919 under rights of this character is 16.9 per cent of the total area irrigated.

Since so large a part of the rights have been acquired in a manner in which they are not defined as acquired, the states have made provision for defining rights. The nature of the procedure adopted and the date of its adoption in the several states are shown on page 48. In all of the states except Nebraska and Wyoming, rights are defined in the courts, and 37.3 per cent of all the land irrigated in 1919 was supplied with water

under rights that have been defined by courts. As shown on page 48, in Arkansas, Colorado, Idaho, Kansas, Louisiana, Montana, and South Dakota, rights are defined by the courts on the testimony of interested parties without the aid of state officials or boards; while Arizona, California, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Utah, and Washington provide for the making of surveys, the collection of information, and the formulation of decrees by state boards or officials, with provision for review and the issuing of decrees defining rights by the courts. The returns do not show what part of the rights that have been defined by the courts have been defined by each of these procedures.

Table 33, which follows, shows the percentages of the areas irrigated in each of the states, in 1919, that are served by rights of the various classes.

TABLE 33.—PERCENTAGE OF ACREAGE IRRIGATED IN 1919, SERVED BY WATER RIGHTS OF VARIOUS CLASSES.

STATE.	Ap-propriation and use.	No-tice filed and posted.	Ad-judicated by court.	Per-mit from state.	Certi-ficate or license from state.	Ri-parian rights.	Under-ground.	Other, mixed, and not reported.
Total.....	13.1	14.4	37.3	10.2	6.7	1.9	5.6	10.7
Arizona.....	48.5	20.8	18.2	( <sup>1</sup> )			8.9	3.6
Arkansas.....								100.0
California.....	11.4	16.7	23.3	1.9	6.6	5.7	20.5	20.0
Colorado.....	3.4	6.2	87.2				0.4	2.8
Idaho.....	5.3	9.6	44.4	19.6	13.6	0.6	( <sup>1</sup> )	6.9
Kansas.....	55.9	8.9	0.9			0.1	28.5	5.7
Louisiana.....								100.0
Montana.....	13.7	39.6	41.7			0.3	( <sup>1</sup> )	4.6
Nebraska.....	9.5	3.7	2.1	53.0	25.6	0.1	0.1	4.7
Nevada.....	35.7	9.3	28.7	19.0	1.2		0.2	5.9
New Mexico.....	28.4	10.1	17.1	19.2	3.7	0.1	9.7	11.7
North Dakota.....	52.6	19.3		24.3				3.8
Oklahoma.....	1.2	7.2	74.1	10.4		2.7	4.0	0.3
Oregon.....	15.1	15.3	29.8	13.3	22.0	1.5	0.3	2.7
South Dakota.....	1.8	61.6	7.6	17.4	8.6	1.6	0.1	1.4
Texas.....	11.8	17.9	0.5	39.2	2.0	12.4	7.6	8.6
Utah.....	34.3	12.5	42.4	4.1	4.9			1.2
Washington.....	37.1	32.0	10.6	7.5	3.3	3.2	3.9	2.3
Wyoming.....	2.1	6.0	13.4	38.6	37.8		( <sup>1</sup> )	3.0

<sup>1</sup> Less than one-tenth of 1 per cent.

In Table 34, the percentages of the areas irrigated in 1919 and 1909 that are served by rights that have

been defined or are being acquired under permits, so that they will be defined as they are acquired, are shown by states.

TABLE 34.—PERCENTAGE OF ACREAGE IRRIGATED IN 1919 AND 1909, THAT IS SUPPLIED BY WATER UNDER DEFINED RIGHTS.

STATE.	1919	1909
Total.....	54.2	47.7
Arizona.....	18.2	8.6
California.....	25.8	28.0
Colorado.....	87.2	84.4
Idaho.....	77.6	55.8
Kansas.....	0.9	( <sup>1</sup> )
Montana.....	41.7	38.0
Nebraska.....	81.7	81.1
Nevada.....	48.9	7.6
New Mexico.....	40.0	13.7
North Dakota.....	24.3	4.3
Oklahoma.....	84.5	17.1
Oregon.....	65.1	9.2
South Dakota.....	33.6	39.7
Texas.....	41.7	( <sup>1</sup> )
Utah.....	51.4	42.2
Washington.....	21.4	7.6
Wyoming.....	59.9	90.6

<sup>1</sup> Less than one-tenth of 1 per cent.

The degree to which rights have been defined in the several states seems to depend more largely upon the time when they adopted plans for defining rights than upon the character of the system adopted. Colorado was the first state to adopt a special procedure in the courts for this purpose and reports that more than 87 per cent of the land irrigated in the state is served by defined rights. Wyoming was the first state to provide for the defining of rights by an administrative board and shows about 90 per cent of the land served by defined rights—the highest percentage shown by any state, while Nebraska, the only other state having this system, ranks high.

The table shows a slight advance in the area served by defined rights in the states taken as a whole, with very marked increases in Nevada, New Mexico, Oklahoma, Oregon, and Texas, and slight decreases in several of the states. In most cases the decreases are due to the new enterprises, the rights for which have not been defined.

PUMPING FOR IRRIGATION.

The summary for the United States and the reports for the several states contain data on the areas irrigated with pumped water and on pumping equipment. This chapter contains additional information regarding pumping equipment, and brings together that found in the other reports, in order to make a complete presentation of the data relating to pumping for irrigation collected in the Fourteenth Census, with such comparisons with the results of the Thirteenth Census as can be made.

Table 35 shows the areas receiving either a total or a partial water supply from pumps in 1919, by states. In classifying the areas irrigated in 1909 by the source of supply all areas were credited to what seemed to

be the principal source of supply, so that comparisons of the areas receiving pumped water in 1919 and in 1909 are not justified.

Other tables follow, without discussion. The accuracy of the data is discussed on pages 9 to 11.

The average investment per acre in 1910 for pumping enterprises furnishing the entire water supply to the land irrigated was \$21.96 per acre, while that reported for 1920 was \$35.92, an increase of 63.6 per cent. The per cent of increase from 1910 to 1920 in average investment per acre for all classes of enterprises was 69.1 per cent, showing that the pumping enterprises increased in about the same proportion as did all others.

IRRIGATION.

TABLE 35.—DISTRIBUTION OF AREA IRRIGATED WITH PUMPED WATER IN 1919, BY STATES.

STATE.	TOTAL SUPPLY PUMPED.								PARTIAL SUPPLY PUMPED.							
	Total.		Streams.		Wells.		Lakes.		Total.		Streams, gravity, and pumped.		Streams, gravity, and pumped wells.		Wells, flowing and pumped.	
	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total.	Acres.	Per cent of total.
Total.....	2,525,338	100.0	1,226,510	100.0	1,263,098	100.0	35,730	100.0	579,993	100.0	199,595	100.0	344,719	100.0	35,685	100.0
Arizona.....	46,370	1.8	6,671	0.5	39,694	3.1	5	( <sup>1</sup> )	218,357	37.6	.....	.....	217,799	63.2	558	1.6
Arkansas.....	141,719	5.6	6,009	0.5	135,260	10.7	450	1.3	250	( <sup>1</sup> )	.....	.....	250	0.1	.....	.....
California.....	1,126,687	44.6	295,673	24.1	826,846	65.5	4,168	11.7	171,736	29.6	60,278	30.2	87,897	25.5	23,561	66.0
Colorado.....	23,732	0.9	12,747	1.0	10,114	0.8	871	2.4	25,773	4.4	9,430	4.7	16,258	4.7	85	0.2
Idaho.....	112,607	4.5	107,181	8.7	414	( <sup>1</sup> )	4,912	13.7	2,227	0.4	1,870	0.9	357	0.1	.....	.....
Kansas.....	13,965	0.6	730	0.1	13,235	1.0	.....	.....	2,190	0.4	600	0.3	1,540	0.4	50	0.1
Louisiana.....	409,576	16.2	248,306	20.2	154,304	12.2	6,966	19.5	23,740	4.1	12,620	6.3	10,045	2.9	1,075	3.0
Montana.....	15,961	0.6	15,743	1.3	139	( <sup>1</sup> )	79	0.2	20,027	3.5	19,872	10.0	155	( <sup>1</sup> )	.....	.....
Nebraska.....	1,661	0.1	1,115	0.1	546	( <sup>1</sup> )	.....	.....	965	0.2	850	0.4	115	( <sup>1</sup> )	.....	.....
Nevada.....	2,942	0.1	2,647	0.2	295	( <sup>1</sup> )	.....	.....	5,742	1.0	720	0.4	4,957	1.4	65	0.2
New Mexico.....	17,599	0.7	1,800	0.2	15,799	1.2	.....	.....	7,897	1.4	.....	.....	1,341	0.4	6,556	18.4
North Dakota.....	2,469	0.1	2,469	0.2	.....	( <sup>1</sup> )	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oklahoma.....	295	( <sup>1</sup> )	188	( <sup>1</sup> )	107	( <sup>1</sup> )	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oregon.....	68,189	2.7	64,570	5.3	1,993	0.2	1,620	4.5	658	0.1	253	0.1	105	( <sup>1</sup> )	340	0.1
South Dakota.....	809	( <sup>1</sup> )	809	0.1	.....	.....	.....	.....	500	0.1	.....	.....	500	0.1	.....	.....
Texas.....	461,618	18.3	421,538	34.4	39,483	3.1	597	1.7	2,531	0.4	350	0.2	454	0.1	1,727	4.8
Utah.....	29,097	1.2	10,389	0.8	7,308	0.6	11,409	31.9	353	0.1	50	( <sup>1</sup> )	125	( <sup>1</sup> )	1,178	0.8
Washington.....	48,410	1.9	26,244	2.1	17,504	1.4	4,662	13.0	96,607	16.7	92,702	46.4	2,415	0.7	1,490	4.2
Wyoming.....	1,672	0.1	1,525	0.1	147	( <sup>1</sup> )	.....	.....	400	0.1	.....	.....	400	0.1	.....	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 36.—DISTRIBUTION OF PUMPING EQUIPMENT, 1920 AND 1910, BY STATES.

STATE.	PUMPING PLANTS.						PUMPS.			Average lift, 1920 (feet). <sup>2</sup>	
	Number.			Engine capacity (horsepower).			Number, 1920. <sup>3</sup>	Capacity (gallons per minute).			
	1920	1910	Per cent of increase. <sup>1</sup>	1920	1910	Per cent of increase. <sup>1</sup>		1920	1910		Per cent of increase. <sup>1</sup>
Total.....	29,458	15,803	86.4	748,971	361,480	107.2	33,804	36,275,005	19,355,864	87.4	41
Arizona.....	744	429	73.4	22,014	37,258	-40.9	1,001	1,048,030	851,873	23.0	44
Arkansas.....	1,041	315	230.5	58,332	12,440	368.9	1,121	1,654,097	436,402	279.0	50
California.....	21,561	9,297	131.9	386,200	128,143	201.4	24,134	16,773,692	5,276,298	217.9	41
Colorado.....	406	206	97.1	8,635	7,969	8.4	435	299,726	296,937	0.9	23
Idaho.....	143	58	146.6	28,364	7,065	301.5	232	1,397,681	278,569	401.7	29
Kansas.....	198	698	-71.6	6,946	1,517	357.9	283	297,975	128,276	132.3	30
Louisiana.....	1,250	1,007	24.1	85,628	57,426	49.1	1,941	4,968,680	5,064,173	-1.9	32
Montana.....	253	125	102.4	10,341	3,511	184.5	299	453,231	281,199	61.3	20
Nebraska.....	51	75	-32.0	959	140	585.0	54	73,686	5,366	.....	24
Nevada.....	64	18	255.6	409	693	-41.0	72	35,266	24,295	45.2	22
New Mexico.....	472	413	14.3	8,488	14,226	-40.3	491	304,789	216,355	40.9	40
North Dakota.....	4	4	.....	2,068	2,039	1.5	10	51,250	182,115	-71.9	38
Oklahoma.....	22	68	-67.6	184	107	72.0	26	7,668	4,541	68.9	59
Oregon.....	573	229	150.2	18,769	3,095	344.9	614	600,045	118,514	406.3	28
South Dakota.....	25	8	212.5	498	63	690.5	25	23,320	5,280	340.9	21
Texas.....	1,369	2,359	-42.0	90,511	69,094	16.5	1,641	6,825,998	5,362,665	27.3	45
Utah.....	250	69	262.3	11,392	2,143	431.6	291	783,888	315,057	148.7	25
Washington.....	975	391	149.4	22,929	13,847	65.6	1,059	630,552	385,411	74.2	60
Wyoming.....	87	34	67.6	1,304	705	85.0	70	39,725	142,529	-72.1	31

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Not reported in 1910.

TABLE 37.—DISTRIBUTION OF CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, FOR ENTERPRISES USING PUMPED WATER, BY SOURCE OF WATER SUPPLY.

SOURCE.	CAPITAL INVESTED, 1920.				COST OF OPERATION AND MAINTENANCE, 1919.			
	Amount.	Per cent of total.	Average per acre.		Area for which cost is reported (acres).	Amount.	Per cent of general average.	
			Amount.	Per cent of general average.				
Total supply pumped.....	\$138,405,160	100.0	\$35.92	134.0	2,261,209	\$9.15	335.4	
Streams.....	59,343,298	42.9	28.01	104.5	1,151,319	6.50	267.6	
Wells.....	76,787,251	55.5	45.85	171.1	1,064,338	10.07	414.4	
Lakes.....	2,274,611	1.6	38.06	142.0	45,558	5.20	214.0	
Partial supply pumped.....	40,359,414	100.0	60.21	223.8	543,896	4.75	195.5	
Streams, gravity and pumped.....	9,512,907	23.6	40.02	149.3	198,656	2.33	95.9	
Wells, flowing and pumped.....	2,498,672	6.2	53.51	218.2	29,000	8.04	330.9	
Streams, gravity, and pumped wells.....	28,347,835	70.2	72.69	271.1	315,640	5.97	245.7	

TABLE 38.—DISTRIBUTION OF PUMPED WELLS, BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number.	Per cent of total.	CAPACITY (GALLONS PER MINUTE).	
			Amount.	Per cent of total.
Total.....	32,094	100.0	16,396,549	100.0
Before 1860.....	37	0.1	19,028	0.1
1860-1869.....	79	0.2	38,909	0.2
1870-1879.....	82	0.3	46,174	0.3
1880-1889.....	327	1.0	144,329	0.9
1890-1899.....	846	2.6	400,373	2.4
1900-1904.....	1,591	5.0	745,045	4.5
1905-1909.....	3,304	10.3	1,741,309	10.6
1910-1914.....	10,467	32.6	5,436,719	33.2
1915-1919.....	10,971	34.2	5,861,661	35.7
Not reported.....	4,390	13.7	1,962,502	12.0

TABLE 39.—DISTRIBUTION OF PUMPING EQUIPMENT, BY DATE OF BEGINNING.

DATE OF BEGINNING.	PUMPING PLANTS.		ENGINE CAPACITY (HORSEPOWER).		PUMPS.			
	Number.	Per cent of total.	Number.	Per cent of total.	Number.		Capacity (gallons per minute).	
					Amount.	Per cent of total.	Amount.	Per cent of total.
Total.....	29,458	100.0	748,971	100.0	33,804	100.0	36,275,005	100.0
Before 1860.....	46	0.2	684	0.1	55	0.2	28,073	0.1
1860-1869.....	43	0.1	574	0.1	44	0.1	43,439	0.1
1870-1879.....	83	0.3	3,697	0.5	108	0.3	86,287	0.2
1880-1889.....	290	1.0	14,938	2.0	407	1.2	1,476,530	4.1
1890-1899.....	668	2.3	37,387	5.0	862	2.5	4,378,623	12.1
1900-1904.....	1,455	4.9	59,286	7.9	1,741	5.2	3,706,532	10.2
1905-1909.....	2,898	9.8	98,729	13.2	3,492	10.3	4,379,501	12.1
1910-1914.....	9,468	32.1	226,748	30.3	10,867	32.1	8,316,741	22.9
1915-1919.....	10,469	35.5	242,629	32.4	11,713	34.6	10,663,654	29.4
Not reported.....	4,038	13.7	64,299	8.6	4,515	13.4	3,196,625	8.8

TABLE 40.—DISTRIBUTION OF PUMPED WELLS, BY TYPE OF ENTERPRISE.

CLASS.	NUMBER.		CAPACITY (GALLONS PER MINUTE).	
	Amount.	Per cent of total.	Amount.	Per cent of total.
Total.....	32,094	100.0	16,396,549	100.0
Individual and partnership.....	30,415	94.8	14,953,276	91.2
Cooperative.....	1,082	3.4	1,014,138	6.2
Irrigation district.....	100	0.3	93,770	0.6
Commercial.....	298	0.9	235,272	1.4
U. S. Reclamation Service.....	49	0.2	46,000	0.3
U. S. Indian Service.....	72	0.2	7,268	( <sup>1</sup> )
State.....	34	0.1	9,636	0.1
City.....	32	0.1	27,619	0.2
Other.....	12	( <sup>1</sup> )	9,570	0.1

<sup>1</sup> Less than one-tenth of 1 per cent.

Efficiency of pumping plants.—The census returns on pumping are not sufficiently accurate to justify the computation of the efficiency of pumping plants. In many instances the schedules contained only a part of the information required, and it was not possible to supply what was lacking. However, a special tabulation was made from the schedules that contained engine capacity, pump capacity and average lift, and the results are given in Tables 45 and 46, with the ratio between engine capacity and the work done, computed on the pump capacity and the average lift.

TABLE 41.—DISTRIBUTION OF PUMPING EQUIPMENT, BY TYPE OF ENTERPRISE.

CLASS.	PUMPING PLANTS.		ENGINE CAPACITY (HORSEPOWER).		PUMPS.			
	Number.	Per cent of total.	Number.	Per cent of total.	Number.		Capacity (gallons per minute).	
					Amount.	Per cent of total.	Amount.	Per cent of total.
Total.....	29,458	100.0	748,971	100.0	33,804	100.0	36,275,005	100.0
Individual and partnership.....	28,336	96.2	537,381	71.6	31,564	93.4	22,563,649	62.2
Cooperative.....	752	2.6	82,963	11.1	1,252	3.7	3,515,742	9.7
Irrigation district.....	103	0.3	43,394	5.8	312	0.9	1,837,264	5.1
Carey Act.....	1	( <sup>1</sup> )	746	0.1	25	0.1	.....	.....
Commercial.....	188	0.6	66,409	8.9	464	1.4	6,814,220	18.8
U. S. Reclamation Service.....	15	0.1	14,423	1.9	84	0.2	973,170	2.7
U. S. Indian Service.....	14	( <sup>1</sup> )	733	0.1	25	0.1	87,243	0.2
State.....	16	0.1	416	0.1	21	0.1	60,810	0.2
City.....	18	0.1	2,225	0.3	40	0.1	411,722	1.1
Other.....	15	0.1	281	( <sup>1</sup> )	17	0.1	11,185	( <sup>1</sup> )

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 42.—DISTRIBUTION OF PUMPING EQUIPMENT, BY KIND OF PUMP.

KIND OF PUMP.	CAPACITY OF ENGINES (HORSEPOWER).		NUMBER OF PUMPS.		CAPACITY OF PUMPS (GALLONS PER MINUTE).		Average lift (feet).
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	
Centrifugal.....	581,274	77.6	26,019	77.0	29,250,062	80.6	33
Rotary.....	36,716	4.9	1,305	3.9	2,089,211	5.8	42
Reciprocating.....	32,344	4.3	2,723	8.1	735,362	2.0	94
Turbine.....	24,390	3.3	677	2.0	525,728	1.4	84
Air lift.....	10,072	1.3	319	0.9	304,105	0.8	58
Other, mixed, and not reported.....	64,175	8.6	2,755	8.1	3,370,537	9.3	57

TABLE 43.—DISTRIBUTION OF PUMPING EQUIPMENT, BY KIND OF POWER.

KIND OF POWER.	CAPACITY OF ENGINES (HORSEPOWER).		NUMBER OF PUMPS.		CAPACITY OF PUMPS (GALLONS PER MINUTE).		Average lift (feet).
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	
Wind.....	10,768	1.4	287	0.8	247,445	0.7	44
Water.....	8,093	1.1	166	0.5	212,346	0.6	40
Steam.....	106,568	14.2	1,862	5.5	7,526,435	20.7	36
Electricity.....	289,018	38.6	12,743	37.7	13,311,435	36.7	50
Gas.....	259,618	34.7	15,691	46.4	10,461,857	28.8	35
Other, mixed, and not reported.....	74,911	10.0	3,055	9.0	4,515,487	12.4	46

TABLE 44.—COMPARISON OF CAPACITY OF ENGINES AND CAPACITY OF PUMPS, 1920 AND 1910, BY KIND OF POWER.

KIND OF POWER.	CAPACITY OF ENGINES (HORSEPOWER).			CAPACITY OF PUMPS (GALLONS PER MINUTE).		
	1920	1910	Per cent of increase. <sup>1</sup>	1920	1910	Per cent of increase. <sup>1</sup>
Total.....	671,694	361,480	85.8	32,333,097	19,355,864	67.0
Wind.....	10,683	1,525	600.5	226,029	71,403	216.6
Water.....	4,990	17,623	-71.7	154,432	603,606	-74.4
Steam.....	91,124	140,177	-35.0	6,387,040	11,068,597	-42.3
Electricity.....	257,268	51,559	399.0	11,603,079	1,898,373	511.2
Gas.....	287,316	123,209	92.6	9,632,395	4,762,890	102.2
Other, mixed, and not reported.....	70,313	27,387	156.7	4,330,122	950,996	355.3

<sup>1</sup> A minus sign (-) denotes decrease.

TABLE 45.—RATIO OF ENGINE CAPACITY TO WORK DONE, BY KIND OF PUMP.

[Work done computed on pump capacity and average lift.]

KIND OF PUMP.	Capacity of engines (horse-power).	Capacity of pumps (gallons per minute).	Average lift (feet).	Ratio of engine capacity to work done.
Total.....	671,694	32,333,097	40	48.6
Centrifugal.....	519,535	26,257,469	33	42.1
Rotary.....	31,869	1,528,093	45	54.5
Reciprocating.....	29,745	620,995	97	51.1
Turbine.....	22,756	478,996	81	43.0
Air lift.....	9,736	297,798	60	46.4
Other, mixed, and not reported.....	58,301	3,150,064	49	6.7

TABLE 46.—RATIO OF ENGINE CAPACITY TO WORK DONE BY KIND OF POWER.

[Work done computed on pump capacity and average lift.]

KIND OF POWER.	Capacity of engines (horse-power).	Capacity of pumps (gallons per minute).	Average lift (feet).	Ratio of engine capacity to work done.
Total.....	671,694	32,333,097	40	48.6
Wind.....	10,683	226,029	40	21.4
Water.....	4,990	154,432	43	33.6
Steam.....	91,124	6,387,040	38	67.2
Electricity.....	257,268	11,603,079	49	55.8
Gas.....	237,310	9,632,396	34	34.8
Other, mixed, and not reported.....	70,313	4,330,122	46	71.6

## LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT.

An important factor in determining the need for the construction of additional irrigation works is the area of land available for settlement under existing enterprises. The reports of areas irrigated in 1919 and areas enterprises were capable of irrigating in 1920 indicate a very large area already supplied with water that is not in use (see p. 19). While this land is not in use and is available for expansion of the irrigated area, it is not, necessarily, available for settlement. As a check on these figures, and for the purpose of determining how much land in existing irrigation enterprises was actually available for settlement, its location, and the terms on which it can be obtained, inquiries covering these points were placed on the irrigation schedules.

The instructions to enumerators showing what should be reported under these inquiries were as follows:

*Land available for settlement covered by this enterprise.*—This item should be limited to land for which water is available or is to be made available, and which is not yet settled. Land already settled should not be included even if it is for sale, unless the holdings are to be subdivided, when only the parts of such holdings that are to be sold for new farms should be reported as available for settlement. If the management of an enterprise is itself farming land pending its settlement, the land should be reported as available for settlement.

*Price of unimproved lands suitable for agriculture covered by this enterprise.*—This item relates strictly to land covered by the enterprise reported, and not to other land in the vicinity. If no unimproved land is included in the enterprise this inquiry should

not be answered. If land and water rights are sold together for a specified price and it is not possible to segregate the part representing land from that representing water rights, this fact should be stated and the part representing land should be estimated. If land is not for sale at a uniform price, the average price prevailing at the time of the canvass should be given.

*Average cost of preparing land for irrigation.*—Under this heading should be given the best estimate obtainable from the officials of the enterprise reported or from farmers operating under the enterprise. Frequently this amount will vary so much from farm to farm that a strictly accurate reply to this inquiry can not be obtained; yet for any enterprise it should be possible to make a fairly representative estimate.

In State Table II, on page 94, the land reported as available for settlement is given by counties, with such information as the schedules contained, as to the types of enterprises supplying water, sources of water supply, prices of land and water rights, terms on which land and water rights are sold, and the cost of preparing land for irrigation. Prices and cost vary so much that no attempt has been made to average them.

## IRRIGATED CROPS.

The areas, production, and values of the principal crops grown on irrigated land are given in the State Reports and in the United States Summary, which are contained in this volume. In none of these reports however, is shown the distribution of the crops by counties. There has been considerable call for this information, and it is presented in State Table I, beginning on page 71.

As stated in the discussion of the accuracy of the results of the census of irrigation, the returns for crops grown under irrigation are not considered complete. Enumerators were instructed to mark on the farm schedules the crops that were irrigated, and in many instances it was evident that this instruction was not followed. Where this was the case, the crops were marked as irrigated, but there were many cases where there was doubt as to whether crops were irrigated, and in such cases they were not marked. Consequently, the figures given should be considered as below the correct figures. For a few counties, however, the total area of crops reported as irrigated exceeds the total area of land reported as irrigated. The two items are taken from different schedules and each has been tabulated as reported. This course seemed better than to adjust the figures arbitrarily.

Owing to the fact that the reports of the census of agriculture give complete crop returns by counties, only the areas harvested are reported here.

The totals for the areas harvested, production, and value for each crop, by states, are included in the table. Average yields per acre are given in the state reports and can be computed from the figures reported here.

The values are computed in the manner stated on page 14. Averages per acre can be computed from the figures given here.

# SUMMARY FOR THE UNITED STATES.

## INTRODUCTION.

This summary presents the statistics of irrigation collected at the census of 1920 for the 17 arid and semiarid states of the United States, comprising the states of Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming and for the states of Arkansas and Louisiana, in which, together with the eastern part of Texas, irrigation is confined largely to rice growing. In the eastern states there are small areas irrigated for the growing of fruit and truck crops, but statistics for these states are not included in the general tables presented. Statistics of acreage irri-

gated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout this summary figures for the census of 1910 are given for purposes of comparison; and, for the purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	1,916,391	1,776,046	140,345	7.9
Approximate land area of states included..... acres..	1,223,989,120	1,224,063,360	<sup>2</sup> -74,240	( <sup>3</sup> )
All land in farms in states included..... acres..	505,440,954	416,462,547	88,978,407	21.4
Improved land in farms in states included..... acres..	214,689,819	186,786,227	27,903,592	14.9
Number of farms irrigated.....	231,541	162,723	68,818	42.3
Area irrigated..... acres..	19,191,716	14,433,285	4,758,431	33.0
Area enterprises were capable of irrigating..... acres..	26,020,477	20,285,403	5,735,074	28.3
Area included in enterprises..... acres..	35,890,821	32,245,464	3,645,357	11.3
Per cent irrigated:				
Number of all farms.....	12.1	9.2	2.9	.....
Approximate land area.....	1.6	1.2	0.4	.....
Land in farms.....	3.8	3.5	0.3	.....
Improved land in farms.....	8.9	7.7	1.2	.....
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	6,828,761	5,852,118	976,643	16.7
Excess of area included in enterprises over area irrigated..... acres..	16,699,105	17,812,179	-1,113,074	-6.2
Area of irrigated land reported as available for settlement..... acres..	2,257,981	( <sup>4</sup> )	2,257,981	.....
Capital invested.....	\$697,657,328	\$321,454,008	\$376,203,320	117.0
Average per acre enterprises were capable of irrigating.....	\$26.81	\$15.85	\$10.96	69.1
Estimated final cost of existing enterprises.....	\$819,778,005	\$437,948,825	\$381,829,180	87.2
Average per acre included in enterprises.....	\$22.84	\$13.58	\$9.26	68.2
Average cost of operation and maintenance per acre.....	\$2.43	*\$1.07	\$1.36	127.1
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	63,298	56,858	6,440	11.3
Number of main ditches.....	51,621	46,677	4,944	10.6
Length of main ditches..... miles..	103,177	88,927	14,250	16.0
Capacity of main ditches..... second-feet..	681,079	618,097	12,982	2.1
Number of lateral ditches.....	57,553	36,513	21,040	57.6
Length of lateral ditches..... miles..	56,687	30,003	26,684	88.9
Number of reservoirs.....	7,538	6,956	582	8.4
Capacity of reservoirs..... acre-feet..	21,246,436	12,602,924	8,643,512	68.6
Number of flowing wells.....	4,606	5,071	-465	-9.2
Capacity of flowing wells..... gallons per minute..	935,057	1,345,676	-410,619	-30.5
Number of pumped wells.....	32,094	15,971	16,123	101.0
Capacity of pumped wells..... gallons per minute..	16,396,549	7,248,699	9,147,850	126.2
Number of pumping plants.....	29,458	15,803	13,655	86.4
Engine capacity..... horsepower..	748,971	361,480	387,491	107.2
Pump capacity..... gallons per minute..	36,275,005	19,355,864	16,919,141	87.4
Average lift..... feet..	41	.....	.....	.....

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Decrease due to the building of several reservoirs in connection with irrigation projects.

<sup>3</sup> Less than one-tenth of 1 per cent decrease.

<sup>4</sup> Not reported in 1910.

\* Does not include cost of operation and maintenance for rice growing districts in Gulf states; consequently figures for 1919 and 1909 are not comparable.

## CLIMATIC CONDITIONS.

The climatic conditions having the largest influence in determining the necessity for irrigation are the amount and seasonable distribution of precipitation, particularly rainfall, while wind movement and relative humidity also have an influence.

In that part of the United States lying east of the arid and semiarid states named in the introduction to this summary the normal annual precipitation exceeds 25 inches and is so distributed throughout the year as to provide sufficient moisture for the growing of general farm crops. In this section short periods of drought occur sufficiently often to make irrigation desirable for such crops as truck and small fruits, which may be damaged to a large extent by lack of moisture for even short periods, although the irrigation of these crops is not general. Seasons with too little rainfall for the proper growth of general crops occur, but not sufficiently often to justify making provision for irrigation.

Arkansas, Louisiana, and eastern Texas have a normal annual precipitation of from 40 to 50 inches, which is ample for all crops except rice. It is necessary to keep water standing on rice fields during most of the growing period of this crop, and for this the rainfall is not sufficient. Irrigation in this section is practically confined to the rice fields.

The states of North and South Dakota, Nebraska, Kansas, Oklahoma, and western Texas lie in the so-called semiarid region, and have a normal annual precipitation varying from about 15 inches at their western boundaries to about 25 or more inches at their eastern boundaries. In this section success in growing crops without irrigation varies from year to year according to the amount and distribution of the rainfall, and the practice of irrigation advances eastward and recedes to the west with periods of deficient or excessive rainfall.

The same condition exists on the plains in the eastern parts of Montana, Wyoming, Colorado, and New Mexico. Here crops are grown on the high plains without irrigation, with varying success, while irrigation is generally practiced in the stream valleys.

The main ranges of the Rocky Mountains extend through Montana, Wyoming, Colorado, and New Mexico. On the high mountains the precipitation, particularly snowfall, is heavy, while in the valleys between the ranges the precipitation is light and irrigation is necessary for the growing of most crops.

West of the Rocky Mountains and between them and the Sierra Nevada and Cascade Mountains and extending from the Mexican boundary to central Idaho is the real arid region of the United States. Here the normal annual precipitation varies from about 2 inches

in southwestern Arizona and southeastern California to about 8 inches in southern Idaho. In this section, comprising the larger parts of Arizona, Nevada, and Utah, and considerable parts of California, Oregon, Washington and Idaho, almost no crops can be grown in the valleys without irrigation. On the higher lands in Arizona, Utah, Idaho, Oregon, and Washington the precipitation is greater and grain and forage crops are grown without irrigation. Northern Idaho, northwestern Montana, and northeastern Washington receive sufficient precipitation for growing crops without irrigation.

West of the Sierra Nevada and Cascade Mountains there is a great variation in rainfall. The western coast of Washington and Oregon receives the heaviest precipitation of any part of the United States, but there is a dry period in the late summer, during which irrigation is desirable for crops which make their growth during this period. Irrigation is practiced to a limited extent for pastures, vegetables, and fruits.

Throughout California there is a well-defined wet season in the winter months, and an equally well-defined dry season in summer. Most of the northern part of the state receives sufficient rainfall to mature crops if it were distributed throughout the year, but the growing of crops in late summer requires irrigation. On the other hand, most of the southern part of the state receives less moisture than is usually considered necessary for crop growing, but the concentration of the year's precipitation in the winter and spring makes it possible to mature crops where it would not be possible were the rainfall more widely distributed throughout the year.

Climatic conditions during the year 1919 were abnormal in many places. In eastern Montana and Wyoming and western North Dakota and South Dakota, 1919 was the third year in succession in which the precipitation was below normal. The condition not only damaged crops grown without irrigation but greatly decreased the supply of water available for irrigation, and much land was not irrigated in 1919 that would have been if water had been available. On the other hand, at the southern end of the semiarid region, in Oklahoma, Texas, and New Mexico, the precipitation in 1919 was far above normal and much land that is irrigated ordinarily was not watered in 1919 because of the heavy rainfall.

In the inter-mountain region, in Arizona, Nevada, Utah, Idaho, Oregon, and Washington, the precipitation in 1919 was far below normal, and the same condition existed in the central valleys of California. It is probable that in all of the states named in this paragraph the acreage irrigated in 1919 was smaller than it would have been had water been more plentiful.



**WATER SUPPLY FOR IRRIGATION.**

Streams supply the water used on by far the greater part of the land irrigated in the United States, 83 per cent of the acreage receiving its entire supply from this source in 1919, and 2 per cent additional receiving part of its supply from streams. The streams in the western states have one common characteristic—they are subject to heavy floods in the spring and early summer and become very low in late summer. This condition makes it necessary to store a part of the flood flow for use in the late summer if the largest use of the water supply is to be made.

Both flowing and pumped wells supply water to considerable areas. The use of water from these sources in most sections comes only after the supply from streams is exhausted, or nearly so, and represents a later and usually more expensive stage of development than the use of stream water. Wells furnished the entire water supply for 7 per cent of the acreage irrigated in 1919, and a part of the supply to 2 per cent of this acreage. Streams and wells combined supplied 92 per cent of the total acreage irrigated in 1919. The other sources are, therefore, almost negligible.

The water supply in the several states is discussed in detail in the state bulletins.

The northern half of the Great Plains, extending from the Rocky Mountains toward Mississippi River, is drained by Missouri River and its tributaries. In most of this area some crops can be grown without irrigation, and the irrigated land is confined almost exclusively to the stream valleys. The Missouri itself is not very largely utilized, and many of its tributaries are in the same condition. Storage has been provided for only a small part of the flood flow of the main stream and its tributaries north of the Platte, and there is in these streams a large supply of water available for future development in Wyoming, Montana, and the Dakotas.

The North Platte supplies large areas in Colorado, Wyoming, and Nebraska. Its low-water flow is largely utilized and storage has been provided in the Pathfinder Reservoir in central Wyoming for a large part of the flood water of this stream, but there is a considerable supply for additional storage, which would make it possible to extend the area irrigated considerably.

The South Platte waters a large area of land in Colorado and a small area in Nebraska. Its low-water flow is fully utilized. On this stream the flood water and winter flow is stored in many small reservoirs rather than in one large reservoir. While most of the flood water is stored there is some water available for further development of the same kind on the lower part of the stream.

Water stored on the North Platte can be used on the main Platte in Nebraska and there is water from floods, winter flow, and return seepage that could be stored on the main stream if the demand for water justified the expense. Uncertainty as to the need for irrigation and as to the water supply have retarded development in this section.

The central part of the Great Plains is drained by Arkansas River and its tributaries. The Arkansas waters a large area in Colorado and a small area in Kansas. The low-water flow of the Arkansas is all used, and a large part of the flood water is stored in small reservoirs, but there is still some water available for storage on the main stream and its tributaries.

Practically all of the land used for rice-growing in Arkansas and a considerable part of that in Louisiana and Texas is watered from wells. There is nothing to indicate that the water supply is not sufficient for a large expansion of the rice-growing area, if other conditions justify it.

The rice grown along the Gulf coast in Louisiana and Texas is supplied principally by pumping from streams entering the Gulf, which are so nearly at the Gulf level that heavy pumping at times causes the salt water of the Gulf to enter the streams. The supply of fresh water is limited unless storage is provided. This has not been done. In Texas water for rice is taken from streams at higher levels, and here the supply is insufficient in some seasons. There is ample water for storage.

Streams flowing to the Gulf of Mexico supply scattered areas throughout central Texas with water, and in northern Texas wells supply a considerable area. The water supply is sufficient for a large extension of irrigation from both sources, if other conditions justify it.

The Rio Grande and its tributaries drain south central Colorado, most of central and eastern New Mexico, and the southwestern part of Texas. Large areas are irrigated in Colorado, considerable areas in New Mexico, and a large area in Texas. The Rio Grande is subject to heavy floods and at times is dry or nearly so, and storage is necessary for permanently successful irrigation. The Elephant Butte Reservoir in south central New Mexico has sufficient capacity to store the flood water and to regulate the flow of the stream below. Water from this reservoir supplies land along the stream in New Mexico, in Texas, and in Mexico. There is little opportunity to use water from the Rio Grande below the El Paso Valley in Texas, except near the mouth of the river, where a large area is irrigated. The lower part of the river receives much of its water from tributaries in Mexico below El Paso and is not dependent on storage in Elephant Butte Reservoir. Most of the water used



for irrigation in this section is pumped from the river. At times the supply is low, but there is a good supply for storage, although reservoirs have not been built. The question of providing storage on this part of the Rio Grande is complicated by the fact that the river forms the boundary between the United States and Mexico, and until some agreement is reached between the two republics for the equitable division of the water supply, the extent of safe irrigation development on either side of the river can not be determined.

The Pecos, a tributary of the Rio Grande, drains a large part of southeastern New Mexico. It is subject to heavy floods and periods of very low discharge. Storage has been provided for a part of the flood flow, but there is opportunity for additional storage. There are many flowing wells in the valley of the Pecos in New Mexico.

The Colorado River system drains all the land west of the Rio Grande drainage area to the California boundary, and extends northward to northern Wyoming. It supplies water to land in Wyoming, Colorado, Utah, New Mexico, Nevada, Arizona, and California. In the upper states the areas of tillable land in the valleys of the tributaries of the Colorado are limited and much of the low-water flow of these streams is not yet utilized, while there is very little storage. Near the mouth of the stream very large areas are irrigated in Arizona, California, and Mexico. The low-water flow reaching this portion of the river is just about sufficient for the land now irrigated. Any considerable extension of the area watered will necessitate storage. A very large volume of flood water is available for storage, and Federal and local agencies are studying the possibilities of storing these flood waters. A compact between the states interested for the control of the river has been provided for by state and Federal legislation. Gila River, which is a tributary of Colorado River, and its tributaries drain a considerable part of western New Mexico and most of southern Arizona. All of these streams are subject to heavy floods and to periods with practically no discharge; consequently storage is necessary to make them reliable sources of water for irrigation. Little storage has been provided except on Salt River, where the Roosevelt Reservoir has sufficient capacity to store the entire flow of the stream above the reservoir. Tributaries reaching the stream below the reservoir are subject to violent floods, but no storage has been provided for these floods. In the irrigated section of the Salt River Valley ground water has come near the surface, making drainage necessary. Both wells and open ditches have been installed for the purpose of lowering the ground water and supplying additional water for irrigation. There is opportunity for more work of this kind.

North and west of the Colorado River basin lies the Great Basin, which has no outlet to the sea. This

basin includes small parts of Wyoming, Idaho, California, and Oregon, and most of Utah and Nevada. It really consists of several independent drainage basins, one with the Great Salt Lake as its low point, another centering in the "sinks" in western Nevada, and a third consisting of the Sevier River drainage in southwestern Utah. There are also small basins in northern California and southern Oregon.

The Great Salt Lake receives almost its entire inflow from the mountains lying to the east of its basin. Jordan River, carrying the discharge of Utah Lake, enters at the south end, Bear River enters at the north end, and between these there are several short streams entering the lake. These are typical mountain streams with large flow when the snow melts in the spring and a small flow during the summer. Water is stored in Utah Lake for use in the Jordan Valley and in Bear Lake for use in the Bear River Valley. Water stored in Strawberry Reservoir, in the Colorado River drainage basin, is brought into this basin through a tunnel discharging into Spanish Fork River, a tributary of Utah Lake. The low-water flow of all the streams in this drainage basin is used, but there is opportunity for much additional storage.

The sinks in western Nevada receive water from both east and west. Humboldt River and its tributaries drain most of the eastern slope of this basin. The Humboldt has a flood period in spring and most of the irrigation along this stream consists in damming the stream so that it will overflow natural meadows on its bottom lands during its flood. A much larger use of the stream could be made if a part of the flood water were stored for use in the late summer.

Walker, Carson, and Truckee Rivers flow into the sinks from the west. These streams rise in California in the Sierra Nevada Mountains. Carson and Walker Rivers water considerable areas in both states. Truckee River is the outlet of Lake Tahoe, which lies on the border between California and Nevada. Plans for using Lake Tahoe for a storage reservoir have been made, but litigation has prevented this use to any large extent. Water from both Truckee and Carson Rivers is stored in Lahontan Reservoir in Nevada. There is opportunity for additional storage on all these streams.

Throughout the Great Basin there are large valleys which have no surface water supply. In some of these a good supply of ground water has been found. It is probable that large areas can be supplied from wells, when this becomes economically feasible.

North of the Great Basin and extending from western Montana and Wyoming to the Pacific Ocean is the Columbia River drainage basin. The Columbia and its tributaries water large areas in Montana, Idaho, Oregon, and Washington.

Clark Fork of the Columbia and its tributaries, the Bitterroot and Flathead, water lands in western Mon-

tana. Water is stored in Flathead Lake for lands near the lake. There is opportunity for storage on the other tributaries.

Snake River rises near the headwaters of the Missouri and Colorado in northwestern Wyoming and waters land in Idaho, Oregon, and Washington. Its low-water flow is all used, and storage has been provided for much of the flood water in Jackson Lake in Wyoming and in reservoirs in Idaho. There is still a large volume of flood water available for storage and plans are being made to provide reservoirs to store this water.

The Columbia itself is not extensively used for irrigation. Throughout its course it is so far below the level of the adjoining lands that extensive gravity diversions have not been made but some water is pumped from the river. It carries large volumes of water that could be used if its use were feasible.

The tributaries of the Columbia coming from the Cascade Mountains in Washington supply water to most of the land irrigated in that state. Their low-water flow is used, and storage has been provided for a part of the flood water. There is opportunity for additional storage.

The tributaries of the Columbia in Oregon supply a large part of the irrigated land in that state. Irrigation development in this part of Oregon has not reached the stage where flood water is stored. The water supply is sufficient for the irrigation of a much larger area than is now watered.

West of the Cascade Mountains in Washington and Oregon there is an abundant supply of water and very little irrigation because of the heavy rainfall. However, there is a dry period in the late summer when some land is irrigated. The water supply is sufficient for a very large extension of the irrigated area.

In northern California the dry season in summer is more pronounced than it is in Oregon and Washington, and at that time there is little water in the streams. There is a large supply available for storage, but little storage has been provided. Sacramento River waters a large area, and the summer flow is fully utilized. The stream is subject to very heavy floods, and almost no storage has been pro-

vided. Both Federal and state agencies are working on plans for storing the flood water of the Sacramento and its tributaries.

The San Joaquin and its tributaries supply water to the larger part of the irrigated land in California. The low-water discharge of these streams is all used, but very little provision for storing flood water has been made. State and private agencies are working on plans for large storage projects, which will provide water for a large additional area. In the San Joaquin Valley irrigation has brought the ground water near the surface and a great many wells and pumps have been put in, in some instances to furnish a supplemental supply of water when the streams are low, and in others to provide the entire water supply.

The coast streams south of San Francisco Bay are torrential in character. On some of these streams reservoirs have been built to store flood waters, but on many reservoir sites do not exist and large quantities of flood water waste to the ocean. In the valleys of these streams there are many wells, both flowing and pumped, and the heavy draft on the ground water has lowered its level. In the absence of reservoir sites, the flood waters are spread over the gravelly soil where the streams emerge from the mountains in order that they may enter the soil and replenish the ground-water supply. There is a large supply of flood water in southern California for which there is a large demand. If some practicable way of conserving these flood waters can be found the irrigated area can be extended greatly.

Taking the western part of the United States as a whole, with few exceptions, the low-water flow of the streams is exhausted, but there is a very large supply of flood water available for storage. There is no lack of tillable land on which this water can be used. Future extension of irrigation depends on whether economic conditions are such that the value of the crops which can be produced will justify the expense of storing the flood waters. The same may be said of the use of ground water. The extent of the supply of ground water is not so well known as the amount of flood water, but there are many places where water can be obtained from wells when the expense of pumping is justified.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	231,541	42.3	12.1	19,191,716	33.0	1.6	3.8	8.9
1910.....	162,723	43.0	9.2	14,433,285	85.4	1.2	3.5	7.7
1900.....	113,829	110.3	8.2	7,744,407	108.4	0.7	2.2	6.2
1890.....	54,136	.....	5.8	3,716,758	.....	0.3	2.1	3.8

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	63,298	35,890,821	19,191,716	53.5	26,020,477
Before 1860.....	696	469,006	299,784	63.9	356,573
1860-1869.....	2,170	1,916,572	1,282,705	66.9	1,432,801
1870-1879.....	3,663	4,246,246	2,588,414	61.0	3,378,758
1880-1889.....	7,854	6,256,086	4,043,391	64.6	4,880,859
1890-1899.....	6,186	4,564,393	2,538,913	55.6	3,560,098
1900-1904.....	4,808	3,840,247	2,211,749	57.6	2,963,840
1905-1909.....	5,588	5,863,374	2,549,927	43.5	3,815,217
1910-1914.....	11,600	3,938,999	1,538,644	39.1	2,460,015
1915-1919.....	12,542	3,256,554	1,165,560	35.8	1,965,204
Not reported.....	8,191	1,539,344	972,629	63.2	1,196,112

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY, 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919		1909			
	Amount.	Per cent.	Amount.	Per cent.		
Total.....	19,191,716	14,433,285	4,758,431	33.0	26,020,477	35,890,821
Streams, gravity.....	14,527,060	12,767,351	1,759,709	13.8	19,269,136	26,040,237
Streams, pumped.....	1,226,510	608,659	617,851	101.5	2,118,942	2,885,698
Streams, pumped and gravity.....	199,595	(*)	199,595	.....	237,700	284,353
Wells, pumped.....	1,263,086	486,341	773,757	158.1	1,674,819	2,356,748
Wells, flowing.....	65,856	144,420	-78,564	-54.4	79,777	131,187
Wells, flowing and pumped.....	35,685	(*)	35,685	.....	42,703	84,379
Lakes, pumped.....	35,730	17,826	17,904	100.4	59,760	80,564
Lakes, gravity.....	100,648	59,631	41,015	68.8	149,377	312,169
Springs.....	198,008	198,198	1,822	0.9	251,792	408,528
Stored storm water.....	98,873	105,792	-6,919	-6.5	223,434	319,972
City water.....	930	(*)	930	.....	1,401	1,666
Sewage.....	2,578	(*)	2,578	.....	3,301	5,540
Streams, gravity, and pumped wells.....	344,713	(*)	344,713	.....	389,790	465,293
Streams, gravity, and flowing wells.....	82,665	(*)	82,665	.....	104,569	205,121
Other mixed.....	996,621	44,079	952,542	.....	1,398,004	2,290,850
Other and not reported.....	13,148	(*)	13,148	.....	15,972	17,566

\* A minus sign (-) denotes decrease. Percent not shown when more than 1,000.  
 \* Not included in classification.

ACREAGE, BY CHARACTER OF ENTERPRISE.

The dates on which the different states enacted laws accepting the conditions of the Federal Carey Act (act of Aug. 18, 1894) and the dates on which they enacted their original irrigation district laws are given in the following table:

DATES OF ACCEPTING CAREY ACT AND OF ENACTING IRRIGATION DISTRICT LAWS.

STATE.	Date of accepting Carey Act.	Date of original irrigation district laws.	STATE.	Date of accepting Carey Act.	Date of original irrigation district laws.
Arizona.....	1912	1912	New Mexico.....	1909	1907
Arkansas.....	(1)	(2)	North Dakota.....	(4)	1917
California.....	1915	1887	Oklahoma.....	(5)	1916
Colorado.....	1895	1905	Oregon.....	1901	1895
Idaho.....	1895	1895	South Dakota.....	1909	1917
Kansas.....	(3)	1891	Texas.....	(1)	1905
Louisiana.....	(1)	(2)	Utah.....	1897	1895
Montana.....	1895	1907	Washington.....	1895	1890
Nebraska.....	(3)	1895	Wyoming.....	1895	1909
Nevada.....	1895	1891			

<sup>1</sup> Carey Act does not apply.  
<sup>2</sup> Has no district law.  
<sup>3</sup> Has not accepted Carey Act.

The United States Reclamation Act (act of June 17, 1902) applies to all of the states included in the irrigation census except Arkansas and Louisiana, and this service supplies water to some land in all of the states to which it applies except Kansas and Oklahoma. One small project was established in Kansas but it has been disposed of. No project has been undertaken in Oklahoma.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	19,191,716	14,433,285	4,758,431	33.0
Individual and partnership.....	6,848,907	6,594,614	254,193	3.9
Cooperative.....	6,581,400	4,643,539	1,937,861	41.7
Irrigation district.....	1,822,987	528,642	1,294,245	244.8
Carey Act.....	523,929	288,553	235,376	81.6
Commercial.....	1,822,001	1,809,379	12,622	0.7
U. S. Reclamation Service.....	1,254,569	395,646	858,923	217.1
U. S. Indian Service.....	294,551	172,912	111,639	64.6
State.....	5,620	(*)	5,620	.....
City.....	40,146	(*)	40,146	.....
Other and mixed.....	7,236	(*)	7,236	.....
Not reported.....	570	(*)	570	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	26,020,477	20,285,408	5,735,074	28.3
Individual and partnership.....	9,255,756	8,086,766	1,168,990	14.5
Cooperative.....	8,403,298	6,191,577	2,211,721	35.7
Irrigation district.....	2,531,425	800,451	1,730,974	216.2
Carey Act.....	804,298	1,089,677	-285,379	-28.2
Commercial.....	2,799,563	2,954,166	-154,603	-5.2
U. S. Reclamation Service.....	1,680,643	786,190	894,453	113.8
U. S. Indian Service.....	484,486	376,576	107,910	28.7
State.....	7,379	(*)	7,379	.....
City.....	44,458	(*)	44,458	.....
Other and mixed.....	3,546	(*)	3,546	.....
Not reported.....	625	(*)	625	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	35,890,821	32,245,464	3,645,357	11.3
Individual and partnership.....	13,008,415	10,621,067	2,387,348	22.5
Cooperative.....	10,628,543	8,830,197	1,798,346	20.4
Irrigation district.....	3,432,109	1,581,465	1,850,644	117.0
Carey Act.....	1,188,937	2,573,574	-1,384,637	-53.8
Commercial.....	3,999,591	5,736,777	-1,737,186	-30.9
U. S. Reclamation Service.....	2,627,176	1,973,016	654,160	33.2
U. S. Indian Service.....	932,985	879,068	53,917	6.1
State.....	9,581	(*)	9,581	.....
City.....	49,650	(*)	49,650	.....
Other and mixed.....	13,144	(*)	13,144	.....
Not reported.....	700	(*)	700	.....

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.

In addition to supplying water to land within its own projects the Reclamation Service, under the Warren Act (act of Feb. 21, 1911), furnishes, in most cases, stored water in bulk to supplement the supply of private systems otherwise dependent on unregulated stream flow. The area receiving such supplemental supply from the Reclamation Service varies from time to time, and was somewhat in excess of 900,000 acres in 1919. This area is not included in that credited to the Reclamation Service in any of the tables in this summary.

**ACREAGE, BY CHARACTER OF WATER RIGHTS.**

In the United States all laws relating to the character of rights and to the use of water are enacted by the several states. In 1866 Congress passed an act providing that rights "recognized and acknowledged by local customs, laws, and the decisions of courts" shall be maintained and protected (R. S., sec. 2339), and the United States Reclamation Act (act of June 17, 1902) recognizes state control over water. The Supreme Court of the United States also has upheld the exclusive right of the states to control the waters within their boundaries, subject only to the right of Congress to preserve and improve navigation. (*Kansas v. Colorado*, 206 U. S. 46).

Every one of the states in which irrigation is generally practiced, except Arkansas and Louisiana, where irrigation is limited almost exclusively to rice growing, has assumed some measure of public control over irrigation and rights to water. In Table 6 the acreage irrigated is classified with reference to the degree to which rights under which water is received are defined and controlled by public authority, and the nature of the control exercised.

**TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.**

CLASS.	1919		1909 <sup>1</sup>
	Acres.	Per cent of total.	Per cent of total.
Total.....	19,191,716	100.0	100.0
Appropriation and use.....	2,521,682	13.1	34.0
Notice filed and posted.....	2,765,636	14.4	16.2
Adjudicated by court.....	7,159,964	37.3	35.3
Permit from state.....	1,960,924	10.2	6.7
Certificate or license from state.....	1,288,124	6.7	5.7
Riparian rights.....	370,896	1.9	2.1
Underground.....	1,067,606	5.6	.....
Other and mixed.....	494,564	2.6	.....
Not reported.....	<sup>2</sup> 1,662,330	8.1	.....

<sup>1</sup> Acreage irrigated for rice growing in Louisiana, Arkansas, and Texas not included.  
<sup>2</sup> Acreage for Arkansas and Louisiana included.

The laws of the states relating to water rights are summarized in the following paragraphs. The areas served under rights of the different kinds for the United States as a whole are given in Table 6, and for the several states on page 36.

*Appropriation and use.*—In every one of the arid states the laws recognize the right of persons needing water for irrigation or other beneficial purposes to "appropriate" water from streams and other sources. This right is limited in various ways, and all of the states prescribe some procedure which shall be followed by those appropriating water. However, all of these states have in the past recognized rights acquired by merely taking and using water, in the absence of laws, or without conforming to the laws, when there are such. All rights acquired in this way that have not been passed upon by the courts or by some official body to which has been given the right to adjudicate water rights, are reported in this class in Table 6.

*Notice filed and posted.*—The first step in the public regulation of the appropriation of water was the enacting of laws requiring those intending to take water from streams or other sources to post notices at the points of intended diversion and to file copies of these notices with some public official, usually the county clerk or county recorder. In some cases notices were filed only. The names of the states in which such laws were enacted with the dates of enactment and the dates at which they were superseded by other laws are shown in the following table. The practice of posting and filing notices was so general that many notices were filed in states where there was no legislation on the subject.

**DATES OF LAWS REQUIRING POSTING OR FILING OF NOTICES OF APPROPRIATION.**

STATE.	Date of enactment of law.	Date when law was superseded.	STATE.	Date of enactment of law.	Date when law was superseded.
Arizona.....	1871	1919	New Mexico.....	1891	1907
California.....	1872	1913	North Dakota.....	<sup>2</sup> 1881	1905
Colorado.....	1881	(1)	Oklahoma.....	1897	1905
Idaho.....	1881	1903	South Dakota.....	<sup>1</sup> 1881	1905
Kansas.....	1886	(1)	Texas.....	1895	1913
Montana.....	1885	(1)	Utah.....	1897	1903
Nebraska.....	1889	1895	Washington.....	1889	1917
Nevada.....	1889	1893	Wyoming.....	1886	1890

<sup>1</sup> Still in force.

<sup>2</sup> Territory of Dakota.

*Defining of rights.*—The fact that many rights to water have been acquired without public supervision and consequently are not defined as to date or extent when they are acquired has created the necessity for the defining of such rights by some public authority. Originally rights were defined in ordinary suits between water users whose claims conflicted, but this led to such a multiplicity of suits that most of the states in which irrigation is generally practiced have enacted laws providing either some special procedure in the courts for the adjudication of rights or for adjudication by some board or official, or for a combination of the two systems in which testimony is taken, surveys

are made, and decrees are prepared by boards or officials, but the decrees are issued by the courts. In all of the states, rights were defined by the courts before any other system was adopted, and some of the states have changed their systems more than once.

The laws of the various states and the periods during which they were in force are shown in the following table:

METHODS OF DEFINING RIGHTS TO WATER AND PERIODS OF TIME DURING WHICH THEY HAVE BEEN IN FORCE.

STATE.	Defined by courts without the aid of state officials or boards.	Defined by courts on basis of information collected by state officials or boards.	Defined by state boards or officials.
Arizona.....	Until 1919.	1919 to date.	
Arkansas.....	To date.		
California.....	Until 1913.	1913 to date.	
Colorado.....	To date.		
Idaho.....	To date. <sup>1</sup>		
Kansas.....	To date.		
Louisiana.....	To date.		
Montana.....	To date.		
Nebraska.....	Until 1895.		1895 to date.
Nevada.....	Until 1903.	1915 to date.	1903-1915.
New Mexico.....	Until 1907.	1907 to date.	
North Dakota.....	Until 1905.	1905 to date.	
Oklahoma.....	Until 1905.	1905 to date.	
Oregon.....	Until 1909.	1909 to date.	
South Dakota.....	To date. <sup>1</sup>		
Texas.....	Until 1917.	1917 to date.	
Utah.....	Until 1903.	1903 to date.	
Washington.....	Until 1917.	1917 to date.	
Wyoming.....	Until 1890.		1890 to date.

<sup>1</sup> Law providing otherwise declared unconstitutional.

*Permits, certificates, and licenses from state.*—The names of the states requiring a party wishing to acquire rights to water to apply to some state board or official for a permit and providing for the issuing of a certifi-

cate or license setting forth the rights acquired, with the dates of the laws, are given in the following table:

STATE.	Date of law.	STATE.	Date of law.
Arizona.....	1919	Oklahoma.....	1905
California.....	1913	Oregon.....	1909
Idaho.....	1903	South Dakota.....	1905
Nebraska.....	1895	Texas.....	1913
Nevada.....	1905	Utah.....	1903
New Mexico.....	1907	Washington.....	1917
North Dakota.....	1905	Wyoming.....	1890

*Riparian rights.*—The states that recognize riparian rights to some extent are as follows: California, Kansas, Montana, Oregon, South Dakota, Texas, and Washington.

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).	DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>				1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	19,191,716	8,874,408	116.3	35,890,821	26,020,477						
Missouri River and tributaries.....	4,147,378	2,533,237	63.7	8,483,171	5,905,630	Missouri River and tributaries—Continued.					
Missouri River direct.....	27,707	20,834	83.0	92,270	62,559	Yellowstone River and tributaries.....	839,025	427,559	107.9	1,826,970	1,322,804
Jefferson River and tributaries.....	425,685	231,788	83.7	831,898	574,672	Yellowstone River direct.....	189,453	40,015	57.5	279,211	262,801
Jefferson River direct.....	21,276	15,721	35.3	40,347	34,894	Clark Fork and tributaries.....	77,738	69,195	12.3	141,007	130,627
Beaverhead River.....	145,678	99,014	47.1	296,079	199,797	Clark Fork direct.....	72,525	67,488	7.5	190,736	121,318
Big Hole River.....	184,656	67,422	178.9	306,885	237,920	Tributaries of Clark Fork.....	5,211	1,707	205.3	10,371	8,809
Boulder River.....	7,265	9,333	-22.2	40,677	13,297	Shields River.....	25,940	19,836	30.8	94,238	53,062
Passamari River.....	34,474	21,101	63.4	76,107	48,036	Stillwater River.....	23,561	13,572	73.6	34,278	20,664
Other tributaries of Jefferson River.....	32,342	19,197	68.5	71,803	50,728	Big Horn River and tributaries.....	358,949	115,520	210.7	842,297	534,404
Madison River.....	34,425	20,338	69.3	88,324	62,085	Big Horn River direct.....	93,902	4,147		162,331	123,151
Gallatin River.....	95,063	58,004	63.9	228,056	152,515	Pope Agie River.....	22,073	14,340	53.9	34,723	34,375
Smith River.....	16,861	18,677	-9.7	38,369	29,691	Wind River.....	43,620	3,787		228,338	77,122
Sun River.....	31,785	32,927	-3.5	244,071	95,522	Poison Creek.....	5	2,690	-99.8	10	10
Teton River.....	44,945	34,961	28.6	146,468	82,241	Owl Creek.....	11,610	6,558	77.0	14,546	12,951
Marias River.....	63,758	22,188	187.4	308,158	123,431	No Wood River.....	18,416	10,099	82.4	26,193	22,080
Judith River.....	15,173	44,672	-66.0	40,993	35,459	Greybull River.....	49,231	35,552	38.5	98,543	79,134
Musselshell River.....	45,559	87,233	-47.8	141,363	113,964	Shell Creek.....	11,955	4,319	176.8	24,005	22,406
Milk River and tributaries.....	108,555	56,597	91.8	349,716	179,083	Shoshone River.....	95,091	26,311	261.4	217,998	134,431
Milk River direct.....	19,766	2,135	-87.4	26,358	23,443	Little Horn River.....	1,408	4,761	-70.4	11,353	4,340
Sage Creek.....	4,947			2,850	1,750	Other tributaries of Big Horn River.....	11,638	2,956	293.7	29,257	24,404
Snake River.....	910			3,130	2,276	Rosebud River.....	365	13,618	-97.3	1,365	1,365
Other tributaries of Milk River.....	87,879	25,210	248.6	317,378	151,595	Tongue River and tributaries.....	54,195	48,245	12.3	100,563	80,693

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Includes springs and wells.

# IRRIGATION.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902—Continued.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).	DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>				1919	1902	Per cent of increase. <sup>1</sup>		
Missouri River, etc.—Con.						Mississippi River and tributaries exclusive of Missouri River.....	958,498	393,687	148.5	1,543,004	1,152,261
Yellowstone River, etc.—Con.						Mississippi River direct.....	17,416	.....	.....	24,070	23,755
Tongue River—Con.						Arkansas River and tributaries.....	851,150	393,085	116.5	1,344,646	1,009,921
Tongue River direct.....	20,975	19,907	5.4	43,075	32,174	Arkansas River direct.....	514,702	234,594	119.4	629,409	563,690
Goose Creek.....	27,827	20,653	33.8	43,817	37,749	South Fork.....	10,401	5,422	91.8	12,374	10,430
Other tributaries of Tongue River.....	5,593	7,685	-27.2	13,671	10,770	Mountain River.....	20,465	13,870	47.5	39,224	24,964
Powder River and tributaries.....	80,631	66,747	34.3	138,856	117,181	St. Charles River.....	11,855	3,432	245.4	22,310	13,791
Powder River direct.....	3,193	2,390	33.6	10,346	9,803	Huerfano River.....	55,528	14,078	294.4	103,554	64,474
Red Fork Creek.....	3,341	2,610	28.0	4,271	3,385	Apishapa River.....	8,292	4,089	102.8	65,615	11,430
Crazy Woman Creek.....	21,965	6,950	216.0	29,684	24,151	Purgatoire or Las Animas River and tributaries.....	43,922	20,393	115.4	52,083	47,870
Clear Creek.....	50,648	47,801	6.0	71,580	63,735	Purgatoire or Las Animas River direct.....	43,533	19,702	121.0	51,172	47,402
Other tributaries of Powder River.....	10,484	6,996	49.9	22,495	16,107	Trinchera River.....	389	691	-43.7	911	468
Other tributaries of Yellowstone River.....	69,195	40,311	69.5	105,055	112,567	Canadian River and tributaries.....	90,876	57,412	58.3	180,804	137,882
Little Missouri River.....	1,080	3,730	-71.0	7,398	4,883	Canadian River direct.....	2,371	2,365	0.3	3,022	2,615
Moroso River.....	205	335	-9.0	3,094	1,721	Cimarron River.....	31,967	8,122	293.6	70,318	45,628
Cheyenne River and tributaries.....	110,143	66,487	65.7	197,288	159,083	Vermejo River.....	23,678	4,110	476.1	23,978	23,878
Cheyenne River direct.....	92,333	49,547	100.5	179,715	143,847	Ocate Creek.....	4,881	1,380	252.2	13,098	13,095
North Fork (Belle Fourche).....	1,966	6,178	-68.2	5,054	3,621	Mora River.....	17,057	32,796	-48.0	36,670	29,528
South Fork and tributaries.....	8,844	10,555	-18.2	15,519	11,615	Ute Creek.....	77	4,061	-98.1	709	519
South Fork direct.....	5,906	7,908	-25.3	11,784	7,910	Other tributaries of Canadian River.....	10,865	4,578	137.3	32,199	22,619
Flat Creek.....	2,938	2,649	10.9	3,735	3,705	Cimarron River.....	8,345	10,427	-20.0	25,312	21,472
Other tributaries of Cheyenne River.....	212	.....	.....	21,922	16,930	Other tributaries of Arkansas River.....	86,764	29,368	105.4	213,961	123,918
White River.....	3,038	9,705	-17.5	21,922	16,930	St. Francis River.....	4,965	(*)	.....	14,198	5,520
Niobrara River.....	6,138	8,185	-25.0	28,950	10,255	White River.....	74,918	(*)	.....	131,346	96,709
Platte River and tributaries.....	2,136,402	1,289,343	66.1	3,431,037	2,579,720	Ouchita River.....	42	(*)	.....	140	105
Platte River direct.....	37,532	30,887	21.6	151,377	68,732	Red River and tributaries.....	7,149	283	.....	23,306	13,378
North Platte River and tributaries.....	872,140	548,781	53.9	1,603,305	1,172,858	Other tributaries of Mississippi River.....	2,853	320	791.6	5,358	3,473
North Platte River direct.....	351,050	170,470	105.9	579,728	429,252	Gulf streams other than Mississippi River and Rio Grande.....	698,077	21,833	.....	1,602,169	1,157,529
Beaver Creek.....	2,621	7,370	-64.4	3,666	3,186	Achafalaya River and tributaries.....	28,342	(*)	.....	31,930	30,885
Grand Encampment Creek.....	7,053	6,622	6.5	10,173	7,203	Vermilion River and tributaries.....	74,034	(*)	.....	138,066	126,649
Spring Creek.....	13,123	7,679	70.9	18,702	18,177	Mermentau River and tributaries.....	268,840	(*)	.....	458,483	382,755
Sage Creek.....	375	1,634	-77.1	570	670	Calcasieu Lake, River and tributaries.....	54,318	(*)	.....	169,193	137,178
Pass Creek.....	8,557	8,390	2.0	12,500	11,373	Sabine River and tributaries.....	25,857	(*)	.....	45,318	41,358
Medicine Bow River.....	54,500	40,661	34.0	139,599	67,103	Neches River.....	64,900	(*)	.....	149,800	82,000
Sweetwater River.....	5,448	11,403	-52.2	14,166	10,593	Trinity River.....	42,770	(*)	.....	96,320	52,720
Muddy Creek.....	657	1,525	-56.9	1,112	677	Bravo River.....	7,535	448	.....	22,896	19,560
Box Elder Creek.....	4,648	4,740	-1.9	7,916	7,696	Colorado River.....	71,278	10,402	685.2	277,268	125,666
La Prele Creek.....	9,103	4,524	101.2	21,697	15,690	San Antonio River.....	13,179	2,955	348.0	61,789	60,177
Labonte Creek.....	4,376	3,639	20.3	6,525	5,756	Nueces River.....	13,753	2,663	416.4	50,006	31,977
Laramie River and tributaries.....	150,150	138,176	13.0	373,353	298,183	Other Gulfstreams.....	38,271	5,365	613.3	101,130	66,604
Laramie River direct.....	78,560	57,335	37.0	177,979	129,116	Rio Grande and tributaries.....	1,298,863	496,587	160.6	2,594,127	1,887,433
Little Laramie River.....	30,860	53,105	-41.9	42,852	33,144	Rio Grande direct.....	664,718	246,106	178.2	1,386,144	1,099,365
Sybilie Creek.....	6,183	7,234	-14.5	9,519	8,044	Saguache River.....	38,032	11,730	224.2	41,447	39,363
North Laramie River.....	6,858	5,721	19.9	20,144	11,749	San Luis River.....	51,329	3,679	.....	175,871	68,309
Chugwater Creek.....	5,914	3,907	51.4	9,863	9,258	Alamosa River.....	35,601	15,753	128.0	72,528	40,551
Other tributaries of Laramie River.....	27,784	10,874	155.5	113,006	106,842	La Jara River.....	10,627	(*)	.....	15,424	12,005
Rawhide Creek.....	2,045	4,187	-51.2	8,651	2,481	Conchos River.....	88,676	44,035	101.4	115,887	95,680
Horse Creek.....	28,369	15,534	82.7	71,188	39,702	Trinchera River.....	12,465	3,768	231.3	59,699	19,319
Blue River.....	7,376	4,929	49.6	7,391	7,391	Rio Costilla River.....	4,417	2,115	108.8	7,385	4,303
Pumpkin Creek.....	7,373	2,314	214.3	10,564	9,158	Pueblo River.....	11,780	7,075	68.5	12,443	11,791
Other tributaries of North Platte River.....	309,407	49,250	325.2	320,814	238,597	Rio Chama.....	26,166	8,549	208.1	42,235	30,237
South Platte River and tributaries.....	1,294,974	691,342	77.3	1,671,199	1,335,109	Rio Santa Cruz.....	9,171	3,086	197.2	9,893	9,221
South Platte River direct.....	362,191	229,388	57.9	519,535	398,310	Tesuque Creek.....	3,012	4,744	-36.5	3,411	3,183
Bear Creek.....	8,778	11,174	-21.4	12,093	10,373	Rio Puerco.....	14,309	2,927	388.9	42,877	25,991
Clear Creek.....	79,172	70,259	3.8	84,450	79,940	Pecos River and tributaries.....	176,458	78,855	123.8	397,443	281,150
St. Vrain Creek.....	244,531	96,583	153.5	291,467	265,731	Pecos River direct.....	119,848	24,691	245.5	274,243	198,286
Big Thompson Creek.....	95,678	68,806	40.6	105,673	98,711	Gallinas River.....	4,097	6,281	-34.8	41,810	24,201
Cache la Poudre River.....	267,197	146,280	82.7	291,702	282,307	Hondo River.....	20,561	24,608	-18.4	33,118	23,525
Lone Tree Creek.....	4,328	1,444	241.3	124,506	7,337	Penasco River.....	13,375	5,102	162.2	19,889	13,733
Crow Creek.....	4,525	3,643	24.2	13,040	7,117	Other tributaries of Pecos River.....	18,577	8,173	127.3	28,383	21,405
Big Beaver Creek.....	6,429	17,100	-62.4	11,825	10,699	Los Moras Creek.....	1,469	680	116.0	1,534	1,519
Lodgepole Creek.....	20,004	12,306	62.6	33,823	26,646	Other tributaries of Rio Grande.....	125,613	83,485	97.9	209,936	144,946
Other tributaries of South Platte River.....	130,241	28,359	350.3	193,085	148,948	Independent streams in Rio Grande drainage basin.....	18,992	8,355	127.3	34,026	26,862
Loup River.....	1,177	12,872	-90.9	4,512	2,377	Rio Mimbres.....	12,557	6,548	91.8	24,243	19,554
Other tributaries of Platte River.....	579	2,461	-76.5	644	644	Fresno River.....	1,798	200	792.0	3,598	2,331
Kansas River and tributaries.....	34,672	22,344	55.2	53,644	44,402	Rio Tularosa.....	4,547	1,568	190.0	6,095	4,877
Republican River.....	34,360	21,022	63.4	52,080	43,022	Other independent streams.....	90	41	.....	90	90
Smoky Hill River.....	378	770	-63.9	1,450	1,366						
Big Blue River.....	19	(*)	.....	44	44						
Other tributaries of Kansas River.....	15	552	-97.3	70	70						
Other tributaries of Missouri River.....	51,989	30,329	-35.3	403,076	156,151						

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Includes 63,744 acres in Colorado for which main stream was not reported.  
<sup>4</sup> Not reported separately in 1902.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902—Continued.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).	DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>				1919	1902	Per cent of increase. <sup>1</sup>		
Colorado River and tributaries.....	2,312,047	927,183	149.4	4,064,492	2,986,937	Great Basin Drainage.....	2,313,163	1,639,473	41.1	4,238,023	2,869,868
Colorado River direct.....	495,710	18,713	.....	728,326	551,506	Tributaries of Great Salt Lake.....	848,639	534,861	58.7	1,249,721	989,019
Green River and tributaries.....	586,387	254,951	130.0	1,148,821	855,264	Bear River and tributaries.....	480,452	274,071	75.3	685,746	547,673
Green River direct.....	22,826	12,723	79.4	36,121	31,072	Bear River direct.....	249,100	89,632	177.9	360,256	290,577
New Fork.....	27,743	10,975	152.8	83,918	43,614	Little Bear River.....	46,541	38,592	20.6	48,358	46,890
Horse Creek.....	15,520	6,569	136.3	21,670	19,453	Malad River.....	1,189	(*)	.....	1,935	1,189
Cottonwood Creek.....	17,437	4,673	273.1	32,317	29,283	Thomas Fork.....	8,905	6,116	45.6	8,929	8,905
South Pinyon Creek.....	11,928	16,179	-26.3	30,924	26,397	Mill Creek.....	2,973	6,561	-54.7	10,028	5,238
La Barge Creek.....	5,459	5,055	8.0	11,700	7,725	Little Malad Creek.....	16,679	9,024	84.8	43,404	17,128
Fontenelle Creek.....	4,428	3,241	36.6	5,858	5,033	Other tributaries of Bear River.....	155,065	124,146	24.9	212,836	177,746
Bitter Creek.....	2,395	1,405	70.5	12,495	11,447	Weber River and tributaries.....	97,589	80,355	21.4	149,081	112,961
Blacks Creek.....	65,980	28,139	134.5	175,970	104,305	Weber River direct.....	44,726	41,967	6.6	83,796	49,341
Henrys Fork.....	8,298	6,813	21.8	25,940	23,694	Ogden River.....	21,884	22,373	-2.2	27,097	26,852
Ashley Fork River.....	20,787	15,834	69.2	44,087	44,087	East Canyon Creek.....	6,202	4,414	40.5	6,538	6,468
Duchesne River.....	138,446	(*)	.....	322,689	217,809	Other tributaries of Weber River.....	24,777	11,601	113.6	31,650	30,320
Price River.....	23,811	6,621	259.6	37,191	24,848	Jordan River and tributaries and Utah Lake.....	270,598	180,435	50.0	414,894	329,265
San Rafael River.....	77,290	21,546	258.7	85,028	80,028	Jordan River direct.....	48,052	32,401	48.3	90,495	55,720
Yampa River and tributaries.....	81,661	76,422	6.9	142,636	102,661	Spanish Fork River.....	61,434	23,778	158.4	96,178	83,142
Yampa River direct.....	18,029	(*)	.....	28,221	18,832	Hobbs Creek.....	5,620	18,424	-69.5	6,589	5,446
Little Snake River.....	23,080	17,343	32.9	34,280	28,807	Provo River.....	54,782	36,639	48.3	62,703	56,672
Other tributaries of Yampa River.....	40,552	(*)	.....	80,135	55,222	American Fork River.....	19,146	20,446	-6.4	20,371	20,241
White River.....	25,625	22,752	12.6	40,441	29,238	Little Cottonwood Creek.....	12,144	7,673	59.3	16,698	16,691
Other tributaries of Green River.....	30,753	416,004	92.2	69,836	54,370	Big Cottonwood Creek.....	10,991	8,813	24.7	13,207	12,271
Grand River and tributaries.....	595,041	304,474	95.4	1,066,252	752,334	Other tributaries of Jordan River.....	58,429	431,961	82.8	108,655	78,582
Grand River direct.....	81,698	41,721	95.8	150,037	119,778	Independent streams.....	1,464,524	1,104,612	32.6	2,088,307	1,879,939
Fraser River.....	9,331	2,676	248.7	27,010	10,795	Sevier River and tributaries.....	325,718	131,048	148.5	630,484	402,387
Muddy Creek.....	5,050	4,105	23.0	7,255	5,075	Sevier River direct.....	153,651	69,257	159.3	351,553	226,199
Blue River.....	10,541	2,794	277.3	16,297	11,771	San Pitch River.....	77,616	42,502	82.6	105,519	78,348
Eagle River.....	15,118	10,865	39.1	28,435	15,586	Otter Creek.....	7,289	5,260	38.6	7,845	7,269
Roaring Fork.....	30,738	21,050	46.0	47,305	34,104	South Fork.....	18,325	3,495	424.3	32,620	19,170
Plateau Creek.....	26,260	13,380	96.3	40,757	25,616	Other tributaries of Sevier River.....	68,837	20,534	235.2	132,947	71,361
Gunnison River and tributaries.....	250,913	150,254	67.0	409,934	329,758	Beaver River.....	28,732	15,599	84.2	53,729	46,469
Gunnison River direct.....	16,813	9,000	86.8	21,649	19,909	Coal Creek.....	27,206	2,945	896.3	60,891	33,893
Taylor River.....	560	12,018	-85.3	620	620	Deep Creek (Utah).....	1,983	1,515	30.9	4,326	3,446
Tomichi Creek.....	21,752	10,152	114.3	30,298	23,068	Grouse Creek.....	3,469	990	250.4	4,599	3,639
North Fork.....	9,331	17,174	80.5	57,189	33,891	Humboldt River and tributaries.....	197,778	219,767	-10.0	348,573	231,251
Smith Fork River.....	15,314	5,954	157.2	31,340	25,600	Humboldt River direct.....	69,186	97,742	-29.2	84,049	77,726
Uncompahgre River.....	86,119	56,399	52.7	139,756	137,756	East Fork of Humboldt River.....	33,473	11,680	186.6	74,264	43,649
Other tributaries of Gunnison River.....	79,349	39,557	100.6	129,082	88,912	La Moille Creek.....	22,278	7,765	186.9	40,610	26,065
Rio Dolores.....	74,916	21,560	247.5	180,611	84,973	North Fork of Humboldt River.....	7,940	3,960	100.5	28,697	10,470
Other tributaries of Grand River.....	90,476	36,069	150.8	158,611	114,890	South Fork of Humboldt River.....	33,052	26,733	28.6	48,338	41,261
Fremont River.....	26,513	15,701	68.9	42,005	34,005	Pine Creek.....	8,250	1,010	221.8	3,530	3,250
Virgin River.....	35,350	15,651	125.9	100,242	45,558	Reese.....	11,178	14,906	-25.0	40,769	10,898
San Juan River and tributaries.....	140,607	55,224	154.6	251,188	167,488	Little Humboldt River.....	6,350	31,562	-79.9	6,790	6,350
San Juan River direct.....	23,031	8,232	179.8	51,021	26,443	Other tributaries of Humboldt River.....	11,071	24,409	-54.6	21,526	11,582
Mancos River.....	9,040	5,115	76.7	18,149	9,494	Truckee River and tributaries.....	20,002	40,541	-50.7	34,659	20,920
Los Pinos River.....	30,022	6,593	355.4	55,586	42,033	Truckee River direct.....	14,606	32,748	-55.4	28,040	15,436
Animas River.....	41,174	17,391	136.8	73,413	47,974	Steamboat Creek.....	3,152	7,000	-55.0	3,288	3,218
La Plata River.....	23,004	9,977	130.6	29,918	26,766	Other tributaries of Truckee River.....	2,244	4,793	183.0	3,321	2,266
Other tributaries of San Juan River.....	14,836	7,916	81.1	28,101	15,779	Carson River and tributaries.....	75,439	74,950	0.7	233,668	104,464
Kanab Wash.....	450	700	-35.7	710	610	Carson River direct.....	37,810	70,838	-60.7	35,413	30,670
Williams River.....	1,653	1,256	31.6	3,232	1,809	Other tributaries of Carson River.....	47,629	4,112	.....	198,255	73,794
Little Colorado River and tributaries.....	17,036	11,855	43.7	35,356	21,880	Walker River and tributaries.....	152,625	107,030	42.6	400,232	179,562
Little Colorado River direct.....	10,260	7,270	41.1	20,821	14,131	Walker River direct.....	162,055	106,960	42.2	397,772	178,212
Nutriso Creek.....	636	320	98.8	1,224	952	Other tributaries of Walker River.....	570	70	.....	2,460	1,350
Concho Creek.....	244	163	49.7	500	250	Duck Creek.....	6,252	4,109	52.2	13,855	7,872
Other tributaries of Little Colorado River.....	5,896	4,102	43.7	12,813	6,547	Steptoe Creek.....	3,708	6,705	-44.7	12,069	3,628
Gila River and tributaries.....	401,400	233,113	72.2	658,416	544,014	Long Valley Creek.....	12,543	4,060	208.9	18,840	15,951
Gila River direct.....	83,406	60,620	37.6	210,531	174,229	Mono Lake and tributaries.....	4,190	3,818	9.7	70,377	45,760
San Francisco River.....	3,591	4,907	-26.8	11,134	3,859	Susan River.....	31,784	23,533	35.1	36,225	33,313
San Pedro River.....	7,773	10,912	-28.8	18,959	10,881	Mohave River.....	4,608	540	753.3	21,523	6,510
Santa Cruz River.....	23,019	10,606	211.3	76,617	45,115	Owens River.....	144,024	51,902	177.5	200,177	182,748
Salt River and tributaries.....	247,260	140,642	75.8	277,034	268,644	San Jacinto River.....	20,889	5,040	314.1	34,974	22,263
Salt River direct.....	235,825	125,007	88.6	253,603	253,308	Whitewater River.....	14,643	(*)	.....	37,604	22,282
Tonto Creek.....	502	1,829	-72.6	2,928	720	Quinn River.....	9,935	38,150	-74.0	19,635	13,452
Rio Verde.....	6,564	11,502	-42.9	9,978	7,470	Deep Creek (Oregon).....	1,906	2,185	-12.0	2,118	2,088
Other tributaries of Salt River.....	4,369	2,304	89.6	10,525	7,146	Donner and Blitzen River.....	21,356	34,701	-38.5	64,931	27,956
Agua Fria River.....	18,824	884	.....	38,699	30,000	Silver Creek.....	16,819	13,608	23.6	42,779	17,394
Hassayampa River.....	956	1,091	-12.4	3,657	1,778						
Other tributaries of Gila River.....	6,571	3,451	90.4	21,785	9,533						
Other tributaries of Colorado River.....	11,900	15,545	-28.4	29,942	12,469						
Whitewater Draw and tributaries.....	5,871	884	.....	16,623	9,950						

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.  
<sup>2</sup> Not reported separately in 1902.  
<sup>3</sup> Includes 59,069 acres in Colorado for which main stream was not reported.  
<sup>4</sup> Includes springs and wells.



# IRRIGATION.

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TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902—Continued.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).	DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase.				1919	1902	Per cent of increase.		
Great Basin drainage—Con. Independent streams—Con. Silves River.....	64,842	26,041	149.0	102,258	95,867	Columbia River, etc.—Con. Independent streams, etc.—Con. Other independent streams.....	1,562	* 3,977	-60.7	6,720	1,802
Thomas Creek.....	5,388	1,980	172.0	5,866	5,466	Walla Walla River.....	39,784	9,649	312.3	54,614	47,745
Other independent streams.....	268,707	* 293,974	-8.6	548,945	351,368	Klickitat River.....	12,332	372	32.7	19,241	13,440
Columbia River and tributaries.....	3,878,245	1,297,437	198.5	6,336,801	4,968,518	White Salmon River.....	6,247	912	685.0	11,958	7,277
Columbia River direct.....	24,563	782	130.1	49,432	32,615	Umatilla River.....	43,571	4,485	871.5	99,012	83,241
Kootenai River.....	5,982	2,600	130.1	14,423	9,724	Willow Creek.....	5,553	3,013	84.8	7,159	6,618
Clark Fork and tributaries.....	286,290	229,851	24.6	603,088	444,928	John Day River.....	36,141	27,604	30.9	48,191	41,492
Clark Fork direct.....	3,188	8,808	-63.8	15,834	5,786	Deschutes River.....	111,916	21,108	430.2	291,014	174,790
Missoula River and tributaries.....	238,769	221,043	8.0	433,021	325,992	Hood River.....	19,765	2,637	596.7	39,660	21,101
Missoula River direct.....	2,550	1,181	115.9	8,322	5,777	Willamette River.....	2,892	448	545.5	4,656	4,302
Helgate River.....	77,381	78,139	-1.0	165,391	108,181	Other tributaries of Columbia River.....	25,778	3,423	206.0	59,099	35,538
Big Blackfoot River.....	40,604	36,622	10.9	83,716	61,476	Pacific Ocean streams other than the Colorado and Columbia Rivers.....	3,570,687	1,556,232	129.4	6,978,320	5,155,500
Bitter Root River.....	112,622	98,965	13.8	158,241	139,481	Dungeness River.....	6,160	685	799.3	12,660	9,860
Other tributaries of Missoula River.....	5,612	* 6,136	-8.5	17,351	11,097	McDowell Creek.....	38,569	13,900	177.5	131,131	52,816
Flathead River.....	44,333	(*)		154,233	113,150	Rogue River and tributaries.....	3,266	636	505.2	14,166	4,673
Colville River.....	6,960	810		18,200	13,993	Rogue River direct.....	6,706	1,208	455.1	54,383	8,417
Spokane River and tributaries.....	20,614	210		50,860	27,356	Little Butte Creek.....	8,319	2,902	186.7	28,275	14,573
Spokane River direct.....	16,453	210		40,391	21,675	Bear Creek.....	1,333	225	492.4	2,746	1,614
Coeur d'Alene Lake and River.....	4,161	(*)		10,469	5,681	Applegate River.....	10,659	4,239	151.5	17,335	13,012
Okanogan River and tributaries.....	20,583	2,257	812.0	42,042	30,261	Illinois River.....	4,961	2,804	76.9	8,705	6,323
Okanogan River direct.....	2,357	14		3,708	2,899	Other tributaries of Rogue River.....	3,335	1,984	68.1	5,521	4,204
Salmon Creek.....	6,729	1,065	514.6	11,478	11,238	Klamath River and tributaries.....	153,105	80,433	90.4	362,793	205,374
Other tributaries of Okanogan River.....	11,497	* 1,148	901.5	26,856	16,124	Klamath River direct.....	65,720	52,814	24.4	128,763	76,075
Methow River.....	12,579	1,675	651.0	24,017	16,529	Lost River.....	58,568	1,180	111.4	194,748	95,304
Entiat River.....	2,054	2,919	-29.6	2,652	2,251	Sprague River.....	7,800	3,690	111.4	10,150	9,980
Wenatchee River.....	23,734	3,285	622.5	39,288	34,568	Other tributaries of Klamath River.....	21,017	* 22,749	-7.6	29,132	24,015
Crab Creek.....	6,088	1,937	214.3	10,400	8,948	Russian River.....	3,045	314	869.7	12,475	4,200
Yakima River and tributaries.....	337,283	121,705	177.1	496,797	353,944	Sacramento River and tributaries.....	640,950	206,312	210.7	1,204,769	864,606
Yakima River direct.....	254,262	66,371	283.1	345,373	269,163	Sacramento River direct.....	194,397	10,942	439,169	206,748	
Wilson Creek.....	11,297	6,613	70.8	12,042	11,607	Pit River.....	89,994	72,072	24.9	129,984	107,478
Naches River.....	19,864	20,232	-1.8	21,656	20,284	Cow Creek.....	6,063	2,321	161.4	12,438	7,446
Ahtanum River.....	9,287	3,849	141.3	9,982	9,842	Cottonwood Creek.....	2,972	1,858	60.0	21,016	4,112
Other tributaries of Yakima River.....	42,583	* 24,640	72.8	47,744	43,048	Battle Creek.....	2,966	2,642	12.3	6,590	5,108
Snake River and tributaries.....	2,712,618	807,044	236.1	4,057,747	3,376,146	Stony Creek.....	23,559	4,110	473.2	45,143	36,191
Snake River direct.....	744,066	66,397	90.7	948,252	897,088	Feather River.....	142,841	67,111	112.8	186,756	167,463
Gree Ventre River.....	6,718	3,523	90.7	9,866	7,493	Yuba River.....	19,473	(*)	69,074	23,492	
Little Gros Ventre River.....	6,243	3,599	73.5	9,157	6,997	Cache Creek.....	24,541	3,756	553.4	56,498	31,212
Salt River.....	34,338	22,570	52.1	57,288	46,234	American River.....	47,156	10,112	366.3	82,695	52,842
Pierre River and tributaries.....		5,372	-100.0			Other tributaries of Sacramento River.....	86,998	* 31,888	177.2	155,356	132,513
Henry Fork.....	208,534	85,793	143.1	325,114	286,514	San Joaquin River and tributaries.....	2,103,694	932,931	125.5	4,294,966	3,248,919
South Fork of Snake River.....	151,597	62,326	189.7	207,292	192,473	San Joaquin River direct.....	642,261	129,647	395.4	1,032,862	873,300
Blackfoot River.....	53,910	9,035	496.7	77,255	60,225	Kern River.....	200,641	116,189	72.7	432,481	299,665
Port Neuf River.....	37,996	18,528	105.1	75,923	59,270	Tulare Lake.....	70,134	(*)	204,860	147,444	
Raft River.....	23,620	23,793	-0.7	42,906	26,438	Tule River.....	61,223	(*)	175,777	109,412	
Goose Creek.....	25,000	2,000		50,000	50,000	Kaweah River.....	149,932	(*)	356,703	299,474	
Salmon Falls River.....	41,330	(*)		87,260	49,920	Kings River.....	552,601	596,091	-7.3	1,052,406	896,263
Little Wood River.....	30,153	(*)		97,867	55,475	Fresno River.....	12,414	10,729	15.7	30,004	14,016
Big Wood River.....	117,748	33,961	246.7	203,795	178,497	Merced River.....	65,151	19,636	231.8	222,715	71,709
Bruneau River.....	22,598	13,930	62.2	37,751	25,636	Tuolumne River.....	165,633	(*)	298,418	250,425	
Owyhee River.....	104,830	21,840	380.0	239,242	116,238	Stanislaus River.....	75,359	13,840	444.5	165,453	111,192
Boise River.....	328,395	84,438	288.9	368,313	368,854	Calaveras River.....	13,323	(*)	21,598	16,489	
Malheur River.....	52,850	40,656	29.9	117,658	79,618	Mokelumne River.....	36,848	5,558	563.0	155,480	72,144
Payette River.....	123,072	50,893	141.8	165,142	117,011	Cosumnes River.....	3,269	(*)	9,011	6,405	
Weiser River.....	58,569	26,709	119.9	79,925	69,718	Other tributaries of San Joaquin River.....	55,015	* 41,241	33.4	96,198	81,961
Burnt River.....	34,287	16,042	113.7	54,467	37,506	Tributaries of San Francisco Bay other than the Sacramento and San Joaquin Rivers.....	76,947	38,549	99.6	100,730	86,779
Powder River.....	146,036	58,482	149.7	188,463	165,826	Coyote Creek.....	25,092	8,483	195.8	30,979	26,526
Plne Creek.....	12,635	10,148	24.5	40,637	39,321	Quadruple River.....	29,248	6,647	346.7	34,549	31,008
Imnaha River.....	4,828	8,781	27.7	10,146	6,069	Other tributaries.....	22,607	23,519	-3.9	35,202	29,245
Salmon River.....	115,108	58,403	97.1	224,527	163,036	Pajaro River.....	19,771	14,157	39.7	33,620	25,769
Grande Ronde River.....	79,257	22,628	250.3	98,912	87,317	Salinas River.....	45,097	10,604	353.6	60,989	57,456
Clearwater River.....	4,623	1,944	137.8	6,777	5,545	Santa Maria River.....	9,623	1,544	523.3	22,903	20,460
Asotin Creek.....	3,051	3,225	-5.4	4,051	4,051	Santa Ynez River.....	3,491	1,493	133.8	10,082	9,645
Putaha River.....	1,480	619	139.1	2,362	2,209	Santa Clara River.....	28,270	14,214	98.9	43,265	30,216
Palouse River.....	1,735	508	241.5	3,645	2,620	Los Angeles River.....	59,073	5,310	77.9	82,657	73,608
Other tributaries of Snake River Basin.....	187,711	65,810	109.3	304,724	169,649	San Gabriel River.....	127,146	33,766	276.6	161,737	145,022
Independent streams in Snake River Basin.....	109,913	44,011	149.7	353,251	182,811	Santa Ana River.....	185,508	70,492	163.2	281,650	218,735
Caras Creek.....	17,490	4,107	325.9	95,199	46,190	San Diego River.....	8,812	5,130	71.8	14,039	10,789
Beaver Creek.....	1,502	2,330	-35.5	2,690	1,970	Other Pacific Ocean streams.....	58,427	120,193	-53.7	147,934	91,258
Medicine Lodge.....	5,019	3,225	55.6	12,445	8,390						
Little Lost River.....	11,562	6,525	69.3	31,452	18,732						
Big Lost River.....	72,788	29,547	209.1	204,845	105,727						

\* A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.  
 † Includes springs and wells.  
 ‡ Not reported separately in 1902.

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.**

GENUS YEAR.	Amount.	Percent of increase.	AVERAGE PER ACRE.	
			Amount.	Percent of increase.
1920.....	\$697,657,328	117.0	\$26.81	69.1
1910.....	321,454,008	359.2	15.85	75.2
1900.....	70,010,594	137.1	9.04	13.6
1890.....	29,533,921		7.96	

**TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Amount.	Percent of total.	Average per acre.
Total.....	\$697,657,328	100.0	\$26.81
Before 1860.....	9,527,597	1.4	20.72
1860-1869.....	24,130,038	3.5	16.84
1870-1879.....	37,722,304	5.4	11.16
1880-1889.....	76,427,344	11.0	15.63
1890-1899.....	77,443,017	11.1	21.75
1900-1904.....	95,749,105	13.7	32.31
1905-1909.....	183,930,169	26.4	48.22
1910-1914.....	102,507,009	14.7	41.07
1915-1919.....	67,613,693	9.7	34.41
Not reported.....	22,557,052	3.2	18.83

**TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$697,657,328	100.0	\$26.81	16,260,750	\$2.43
Streams, gravity.....	439,570,623	63.0	22.81	12,190,697	1.25
Streams, pumped.....	59,343,298	8.5	28.01	1,151,313	6.50
Streams, pumped and gravity.....	9,512,907	1.4	40.02	198,656	2.33
Wells, pumped.....	78,747,251	11.0	45.85	1,064,338	10.07
Wells, flowing.....	2,945,059	0.4	36.92	27,543	2.77
Wells, flowing and pumped.....	2,498,672	0.4	58.51	29,600	8.04
Lakes, pumped.....	2,274,601	0.3	38.06	45,558	5.20
Lakes, gravity.....	2,906,612	0.4	19.46	78,586	1.30
Springs.....	5,793,988	0.8	23.01	139,244	1.63
Stored storm water.....	15,075,592	2.2	67.47	87,666	2.39
City water.....	219,793	(*)	156.88	301	20.73
Sewage.....	174,444	(*)	52.85	1,631	9.05
Streams, gravity, and pumped wells.....	28,347,835	4.1	72.73	315,640	5.97
Streams, gravity, and flowing wells.....	2,863,194	0.4	27.38	79,354	1.36
Other mixed.....	48,467,251	6.9	34.67	838,622	2.71
Other and not reported.....	878,218	0.1	54.86	11,941	10.75

<sup>1</sup> Based on area irrigated in 1919.  
\* Less than one-tenth of 1 per cent.

**TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.**

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>		DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.				Amount.	Per cent.
Total.....	\$697,657,328	\$32,531,665	\$615,125,663	745.3	Missouri River, etc.—Con.				
Missouri River and tributaries.....	131,553,106	16,176,277	115,376,829	713.2	Yellowstone River, etc.—Can.				
Missouri River direct.....	2,300,975	121,537	2,179,438	606.3	Rosebud River.....	\$9,303	\$61,708	—\$52,405	—84.9
Jefferson River and tributaries.....	5,370,454	760,328	4,610,126	406.4	Tongue River and tributaries.....	1,419,629	430,275	989,354	229.9
Jefferson River direct.....	587,388	115,095	472,393	406.4	Tongue River direct.....	734,059	262,620	471,439	179.5
Beaverhead River.....	1,723,746	255,779	1,467,967	573.9	Goose Creek.....	563,518	127,100	436,418	343.4
Big Hole River.....	1,669,767	135,609	1,534,158	244.0	Other tributaries of Tongue River.....	122,052	* 40,555	81,497	201.0
Boulder River.....	149,655	43,510	106,145	244.0	Powder River and tributaries.....	1,195,398	297,584	897,814	301.7
Passamari River.....	559,000	122,658	436,342	355.7	Powder River direct.....	187,502	12,500	175,002	175.0
Other tributaries of Jefferson River.....	680,898	* 86,777	594,121	684.7	Red Fork Creek.....	78,500	12,800	65,700	513.3
Madison River.....	460,823	92,986	367,837	395.6	Crazy Woman Creek.....	127,791	22,275	105,516	473.7
Gallatin River.....	977,786	454,845	522,941	115.0	Clear Creek.....	553,465	189,375	364,090	192.2
Smith River.....	190,836	64,777	126,059	194.6	Other tributaries of Powder River.....	248,140	* 60,634	187,506	309.2
Sun River.....	4,709,303	173,599	4,535,704	969.5	Other tributaries of Yellowstone River.....	1,430,417	* 257,569	1,172,848	455.4
Teton River.....	1,251,130	111,990	1,139,140	909.5	Little Missouri River.....	71,608	* 38,437	33,171	85.3
Marias River.....	5,502,770	142,443	5,360,327	959.5	Moresau River.....	40,927	3,731	37,196	906.9
Judith River.....	281,842	124,513	157,329	126.4	Cheyenne River and tributaries.....	5,605,911	447,624	5,158,287	4,952.125
Musselshell River.....	986,755	285,868	700,887	245.2	Cheyenne River direct.....	5,277,762	325,657	4,952,105	4,952.125
Milk River and tributaries.....	7,271,098	283,698	7,007,400	29.4	North Fork (Belle Fourche).....	76,066	50,165	25,901	51.6
Milk River direct.....	154,208	119,200	35,008	29.4	South Fork and tributaries.....	252,063	68,362	183,701	268.7
Sage Creek.....	2,400,248	16,127	2,384,121	—13.4	South Fork direct.....	166,820	49,272	117,548	238.6
Snake River.....	8,900	9,935	—1,035	—13.4	Hat Creek.....	85,243	* 19,090	66,153	346.5
Other tributaries of Milk River.....	4,708,042	* 118,436	4,589,606	969.5	Other tributaries of Cheyenne River.....		* 3,440	—3,440	—100.0
Yellowstone River and tributaries.....	30,181,550	2,770,235	27,411,315	909.5	White River.....	183,349	* 155,924	27,425	17.6
Yellowstone River direct.....	7,508,390	303,888	7,204,502	265.0	Niobrara River.....	380,439	* 77,100	283,339	367.5
Clark Fork and tributaries.....	1,225,483	335,777	889,706	265.0	Platte River and tributaries.....	62,893,983	9,241,861	53,652,122	580.5
Clark Fork direct.....	1,163,583	321,452	842,131	262.0	Platte River direct.....	488,642	565,470	—76,828	—13.6
Tributaries of Clark Fork.....	61,890	14,325	47,565	332.0	North Platte River and tributaries.....	25,702,212	3,337,627	22,364,585	670.1
Shields River.....	424,108	109,074	315,029	288.8	North Platte River direct.....	17,624,060	* 1,197,959	16,426,101	1,197.959
Stillwater River.....	298,570	51,502	247,068	479.7	Beaver Creek.....	37,497	51,168	—13,671	—26.7
Big Horn River and tributaries.....	16,670,257	922,858	15,747,399	383.7	Grand Encampment Creek.....	72,692	50,828	21,864	43.0
Big Horn River direct.....	3,635,033	25,425	3,609,608	383.7	Spring Creek.....	184,290	38,496	145,794	378.7
Pojo Agie River.....	349,546	72,264	277,282	383.7	Sage Creek.....	4,206	13,790	—9,584	—69.5
Wind River.....	2,101,819	17,904	2,083,915	—94.7	Pass Creek.....	50,051	41,877	8,174	19.5
Poison Creek.....	1,000	18,700	—17,700	—94.7	Medicine Bow River.....	346,664	244,287	102,377	41.9
Owl Creek.....	52,915	40,154	12,761	31.8	Sweetwater River.....	87,322	54,701	32,621	59.8
No Wood River.....	161,588	81,978	79,610	97.1	Muddy Creek.....	7,770	6,546	1,224	18.7
Oreybull River.....	503,184	204,604	298,580	145.9	Box Elder Creek.....	104,676	37,655	67,021	178.0
Shell Creek.....	380,420	32,730	347,690	10.4	La Prele Creek.....	327,411	37,590	289,821	773.1
Shoshone River.....	8,702,480	378,278	8,324,202	10.4	Labonte Creek.....	71,826	32,640	39,186	120.1
Little Horn River.....	35,000	31,695	3,305	10.4					
Other tributaries of Big Horn River.....	747,272	* 19,126	728,146						

<sup>1</sup> A minus sign (—) denotes decrease. Per cent not shown when more than 1,000.  
\* Includes springs and wells.  
\* Includes \$143,300 in Colorado for which main stream was not reported.

IRRIGATION.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902—Continued.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>		DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.				Amount.	Per cent.
Missouri River, etc.—Com.					Rio Grande and tributaries...	\$34,172,940	\$6,387,065	\$27,785,875	436.7
Platte River, etc.—Com.					Rio Grande direct.....	21,340,536	2,481,393	18,859,143	780.0
North Platte River, etc.—Com.					Saguache River.....	103,048	16,165	86,883	537.5
Laramie River and tributaries.....	\$4,286,696	\$283,096	\$3,408,600	393.9	San Luis River.....	194,312	4,220	190,092	.....
Laramie River direct.....	974,841	661,206	313,635	47.4	Alamosa River.....	558,900	27,680	529,220	.....
Little Laramie River.....	48,753	110,122	-70,369	-69.1	La Jara River.....	30,275	0	30,275	.....
Sybilie Creek.....	65,041	32,200	32,841	102.0	Conejos River.....	564,739	68,242	496,497	727.6
North Laramie River.....	396,708	13,836	382,872	.....	Trinchera River.....	659,890	23,650	636,240	.....
Chugwater Creek.....	83,155	30,945	52,210	168.7	Rio Costilla.....	11,471	4,697	6,774	144.2
Other tributaries of Laramie River.....	2,818,188	* 30,737	2,787,451	.....	Pueblo River.....	19,932	11,500	8,432	72.9
Rawhide Creek.....	27,330	49,445	-22,115	-44.7	Rio Chama.....	141,891	29,849	112,042	375.4
Horse Creek.....	526,475	132,847	408,628	303.8	Rio Santa Cruz.....	18,281	12,852	5,429	42.1
Blue River.....	31,050	22,620	8,430	37.3	Tesuque Creek.....	16,864	22,630	-5,766	-25.6
Pumpkin Creek.....	92,060	19,926	72,135	362.0	Rio Puerco.....	88,109	89,823	-1,714	.....
Other tributaries of North Platte River.....	1,710,186	* 273,947	1,436,189	524.3	Pecos River and tributaries.....	7,483,049	3,185,355	4,297,694	134.9
South Platte River and tributaries.....	26,676,829	4,990,435	31,688,394	634.9	Pecos River direct.....	5,514,099	2,735,221	2,778,878	101.6
South Platte River direct.....	9,199,612	2,057,210	7,142,402	347.2	Gallinas River.....	519,566	30,931	488,635	.....
Bear Creek.....	137,240	76,635	60,605	79.1	Hondo River.....	878,094	261,863	616,231	120.5
Clear Creek.....	862,209	404,775	457,434	113.0	Penasco River.....	222,693	50,363	172,330	342.2
St. Vrain Creek.....	9,298,122	398,660	8,899,472	.....	Other tributaries of Pecos River.....	648,697	* 107,477	541,220	503.5
Big Thompson Creek.....	1,102,316	600,166	502,150	83.7	Las Moras Creek.....	192,566	7,925	184,641	.....
Cache la Poudre River.....	7,945,409	1,067,354	6,878,055	644.5	Other tributaries of Rio Grande.....	2,781,018	* 417,384	2,363,634	561.5
Lone Tree Creek.....	2,767,273	17,380	2,749,893	.....	Independent streams in Rio Grande drainage basin.....	651,171	126,550	524,621	414.6
Crow Creek.....	100,619	43,925	56,694	129.1	Rio Mimbres.....	818,062	* 112,192	705,870	183.5
Big Beaver Creek.....	52,600	98,000	-45,400	-46.3	Fresno River.....	297,724	2,440	295,284	.....
Lodgepole Creek.....	445,738	87,140	358,598	411.5	Rio Tularosa.....	38,900	5,868	33,032	477.7
Other tributaries of South Platte River.....	4,764,691	* 139,200	4,625,491	.....	Other independent streams.....	1,485	* 6,050	-4,565	-75.5
Loup River.....	21,300	320,615	-299,315	-93.4	Colorado River and tributaries.....	86,696,940	11,298,671	75,398,269	667.3
Other tributaries of Platte River.....	5,000	* 27,714	-22,714	-82.0	Colorado River direct.....	22,214,932	753,973	21,460,959	.....
Kansas River and tributaries.....	537,605	437,209	100,396	23.0	Green River and tributaries.....	8,592,846	1,470,459	7,121,887	484.3
Republican River.....	600,285	404,917	195,368	22.6	Green River direct.....	547,168	57,900	489,268	845.0
Smoky Hill River.....	34,953	3,410	31,543	925.0	New Fork.....	283,043	27,258	255,785	975.3
Big Blue River.....	1,625	(*)	1,625	.....	Horse Creek.....	61,163	13,350	47,813	283.2
Other tributaries of Kansas River.....	742	28,882	-28,140	-97.4	Cottonwood Creek.....	456,827	11,000	445,827	.....
Other tributaries of Missouri River.....	2,373,962	407,772	1,966,190	482.2	South Piney Creek.....	85,728	35,761	49,967	121.2
Mississippi River and tributaries, exclusive of Missouri River.....	35,183,789	4,619,814	30,563,975	661.6	La Barge Creek.....	39,150	20,365	18,785	92.2
Mississippi River direct.....	302,385	(*)	302,385	.....	Fontenelle Creek.....	33,000	9,777	23,223	237.5
Arkansas River and tributaries.....	30,241,390	4,536,655	25,704,735	559.3	Bitter Creek.....	93,158	4,500	88,658	.....
Arkansas River direct.....	15,092,972	3,320,325	11,772,647	354.6	Blacks Creek.....	566,776	85,296	481,480	729.9
South Fork.....	69,000	24,785	44,215	178.4	Henrys Fork.....	77,320	11,291	66,029	584.8
Fourth River.....	965,267	108,240	857,027	808.6	Ashley Fork River.....	874,140	57,836	816,305	546.9
St. Charles River.....	241,884	22,030	219,854	996.5	Duchesne River.....	2,428,174	(*)	2,428,174	.....
Huerfano River.....	3,204,519	72,690	3,131,829	.....	Price River.....	458,725	41,719	417,006	999.6
Aplshapa River.....	1,190,695	4,970	1,185,725	.....	San Rafael River.....	283,100	295,850	-12,750	-2.6
Purgatoire or Las Animas River and tributaries.....	494,963	162,423	332,540	294.7	Yampa River and tributaries.....	1,197,975	* 659,892	538,083	110.2
Purgatoire or Las Animas River direct.....	491,450	151,413	340,037	224.6	Yampa River direct.....	162,768	(*)	162,768	.....
Trinchera River.....	3,513	1,010	2,503	247.8	Little Snake River.....	511,556	325,107	186,449	57.4
Canadian River and tributaries.....	5,155,486	435,860	4,719,626	.....	Other tributaries of Yampa River.....	623,651	(*)	623,651	.....
Canadian River direct.....	148,331	22,108	126,223	570.9	White River.....	447,141	137,005	310,136	226.4
Cimarron River.....	2,188,908	150,530	2,038,378	.....	Other tributaries of Green River.....	1,154,780	* 105,665	1,049,095	992.9
Vermejo River.....	1,248,537	131,020	1,117,517	882.9	Grand River and tributaries.....	24,501,211	3,561,457	20,939,754	532.0
Ocate Creek.....	319,529	9,400	310,129	.....	Grand River direct.....	6,142,951	491,710	5,651,241	.....
Mora River.....	262,575	99,475	163,100	164.0	Fraser River.....	55,860	5,235	50,625	967.0
Ute Creek.....	7,000	10,000	-3,000	-30.0	Muddy Creek.....	33,122	8,650	24,472	282.9
Other tributaries of Canadian River.....	980,806	* 33,277	947,529	.....	Blue River.....	116,608	21,359	95,249	445.9
Cimarron River.....	416,304	83,277	333,027	399.9	Eagle River.....	109,012	75,570	33,442	44.3
Other tributaries of Arkansas River.....	3,410,290	* 364,025	3,046,265	836.8	Roaring Fork.....	407,266	163,170	244,096	149.6
St. Francis River.....	213,727	(*)	213,727	.....	Plateau Creek.....	341,755	60,035	281,720	469.3
White River.....	3,992,967	(*)	3,992,967	.....	Gunnison River and tributaries.....	10,745,767	1,351,906	9,393,861	694.9
Ouachita River.....	1,100	(*)	1,100	.....	Gunnison River direct.....	1,001,819	55,380	946,439	.....
Red River and tributaries.....	396,534	3,218	395,316	.....	Taylor River.....	6,900	64,985	-58,085	-89.4
Other tributaries of Mississippi River.....	28,686	* 20,941	-7,745	-4.2	Tomichi Creek.....	120,243	28,350	91,893	355.9
Gulf streams other than Mississippi River and Rio Grande.....	20,480,808	501,272	19,979,536	.....	North Fork Creek.....	622,647	272,705	349,942	128.3
Atchafalaya River and tributaries.....	407,956	(*)	407,956	.....	Smith Fork River.....	396,075	21,600	374,475	.....
Vermilion River and tributaries.....	3,355,327	(*)	3,355,327	.....	Uncompaghe River.....	6,945,793	643,121	6,302,672	980.0
Mormontau River and tributaries.....	7,718,797	(*)	7,718,797	.....	Other tributaries of Gunnison River.....	1,643,381	* 265,765	1,377,616	518.4
Calcasieu Lake and River and tributaries.....	1,816,380	(*)	1,816,380	.....	Rio Dolores.....	4,847,569	1,156,798	3,690,776	319.1
Sabine River and tributaries.....	678,935	(*)	678,935	.....	Other tributaries of Grand River.....	1,701,301	* 227,029	1,474,272	649.4
Noches River.....	1,590,770	(*)	1,590,770	.....	Fremont River.....	567,050	189,390	377,660	199.4
Trinity River.....	1,743,621	(*)	1,743,621	.....	Virgin River.....	1,622,997	171,355	1,451,642	347.2
Brazos River.....	569,543	25,443	544,100	.....	San Juan River and tributaries.....	3,038,495	534,288	2,504,207	478.1
Colorado River.....	3,560,916	154,529	3,406,387	.....	San Juan River direct.....	1,039,358	179,919	859,439	477.7
San Antonio River.....	5,087,542	63,765	5,023,777	.....	Mancos River.....	35,477	14,910	20,567	137.9
Nueces River.....	1,328,555	56,808	1,271,747	.....	Los Pinos River.....	524,590	84,580	440,010	520.2
Other Gulf streams.....	1,587,466	300,727	1,386,739	690.9	Animas River.....	1,148,058	157,303	990,753	629.8
					La Plata River.....	142,588	61,329	81,259	132.5
					Other tributaries of San Juan River.....	198,394	36,245	162,149	447.4
					Kanab Wash.....	20,500	4,700	15,800	336.2
					Williams River.....	55,604	15,686	39,918	256.0
					Little Colorado River and tributaries.....	460,208	265,701	194,505	78.2
					Little Colorado River direct.....	146,913	218,900	-71,987	-32.9
					Nutrosio Creek.....	16,500	2,600	13,900	534.6
					Concho Creek.....	40,228	850	39,378	.....
					Other tributaries of Little Colorado River.....	247,565	* 43,351	204,214	471.1

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

\* Not reported separately in 1902.  
<sup>4</sup> Includes \$244,785 in Colorado for which main stream was not reported.

AGRICULTURE.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902—Continued.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>		DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.				Amount.	Per cent.
Colorado River, etc.—Con.					Great Basin Drainage—Con.				
Gila River and tributaries.....	\$25,236,237	\$4,205,619	\$21,030,618	500.1	Independent streams—Con.				
Gila River direct.....	2,888,708	1,240,898	1,638,812	131.1	Whitewater River.....	\$2,242,944	(?)	\$2,242,944	.....
San Francisco River.....	25,224	35,040	-9,816	-28.0	Quinn River.....	50,548	\$61,100	-10,552	-17.3
San Pedro River.....	359,153	40,135	319,018	794.9	Deep Creek (Oregon).....	6,829	6,100	729	12.0
Santa Cruz River.....	5,168,524	79,656	5,088,868	.....	Donner and Blitzen River.....	131,750	35,400	96,350	272.7
Salt River and tributaries.....	14,939,034	2,697,139	12,241,895	453.9	Silver Creek.....	26,016	21,846	4,171	19.1
Salt River direct.....	14,339,874	2,404,100	11,935,774	498.5	Silvies River.....	1,005,862	74,310	931,552	.....
Tonto Creek.....	9,468	15,085	-5,617	-37.2	Thomas Creek.....	6,506	5,360	1,146	21.4
Rio Verde.....	209,482	250,813	-41,331	-16.5	Other independent streams.....	7,569,204	989,269	6,579,935	.....
Other tributaries of Salt River.....	380,210	* 27,131	353,079	.....	Columbia River and tributaries	145,072,382	10,851,415	134,820,967	.....
Agua Fria River.....	1,428,077	20,998	1,407,079	.....	Columbia River direct.....	2,240,216	8,700	2,231,516	.....
Hassayampa River.....	51,299	11,160	40,139	359.7	Kootenai River.....	221,976	13,539	208,437	.....
Other tributaries of Gila River.....	376,218	* 71,515	304,703	426.1	Clark Fork and tributaries.....	8,421,384	1,308,488	7,112,896	543.6
Other tributaries of Colorado River.....	837,462	* 126,103	211,359	167.6	Clark Fork direct.....	209,549	64,591	144,958	224.4
Whitewater Draw and tributaries.....	299,368	6,735	292,633	.....	Missoula River and tributaries.....	3,474,524	1,248,895	2,225,629	179.3
Great Basin Drainage.....	66,569,376	10,890,199	55,699,177	511.5	Missoula River direct.....	159,771	27,367	132,404	483.8
Tributaries of Great Salt Lake.....	18,109,805	5,640,308	12,469,497	221.1	Halgate River.....	1,349,403	392,065	957,338	244.2
Bear River and tributaries.....	7,438,075	3,020,489	4,417,586	146.3	Big Blackfoot River.....	624,291	114,450	509,841	445.5
Bear River direct.....	4,512,182	2,247,689	2,264,493	100.7	Bitter Root River.....	1,138,329	674,130	464,199	68.9
Little Bear River.....	720,363	163,170	557,193	341.5	Other tributaries of Mis-				
Malad River.....	18,097	(?)	18,097	.....	soula River.....	202,730	35,883	166,847	465.0
Thomas Fork.....	25,389	16,210	9,179	56.6	Flathead River.....	4,737,311	(?)	4,737,311	.....
Mill Creek.....	21,012	18,640	2,372	12.7	Colville River.....	486,747	938	485,809	.....
Little Malad Creek.....	332,175	30,945	301,230	973.4	Spokane River and tributaries.....	2,214,417	2,994	2,211,423	.....
Other tributaries of Bear River.....	1,808,857	543,835	1,265,022	232.6	Spokane River direct.....	1,637,743	2,994	1,634,749	.....
Weber River and tributaries.....	2,106,048	796,837	1,309,211	164.3	Coeur d'Alene Lake and River.....	576,674	(?)	576,674	.....
Weber River direct.....	1,353,323	549,432	803,891	146.3	Okanagan River and tributaries.....	2,259,018	12,374	2,246,644	.....
Ogden River.....	423,755	168,406	255,349	151.6	Okanagan River direct.....	227,290	360	226,930	.....
East Canyon Creek.....	74,010	22,890	51,120	223.3	Salmon Creek.....	1,069,972	5,085	1,064,887	.....
Other tributaries of Weber River.....	254,960	56,109	198,851	354.4	Other tributaries of Okano-				
Jordan River and Utah Lake and tributaries.....	8,585,682	1,822,982	6,762,700	369.9	gan River.....	961,756	6,929	954,827	.....
Jordan River direct.....	748,836	753,100	-6,264	-0.8	Methow River.....	483,809	20,825	462,984	.....
Spanish Fork River.....	4,126,999	123,930	4,003,069	.....	Entiat River.....	73,889	17,150	56,739	330.8
Hobble Creek.....	41,024	32,588	8,436	25.9	Wenatchee River.....	1,868,541	95,755	1,772,786	.....
Provo River.....	985,979	328,691	657,288	200.0	Crab Creek.....	859,050	5,415	853,635	.....
American Fork River.....	302,449	182,130	140,319	88.5	Yakima River and tributaries.....	14,849,689	1,968,555	12,881,134	654.3
Little Cottonwood Creek.....	226,221	25,825	200,396	776.0	Yakima River direct.....	13,912,727	1,580,195	12,332,532	780.4
Big Cottonwood Creek.....	315,563	45,590	269,973	562.2	Wilson Creek.....	45,875	17,925	27,950	165.9
Other tributaries of Jordan River and Utah Lake.....	1,820,611	351,128	1,469,483	418.5	Naches River.....	458,027	276,223	181,804	65.8
Independent streams.....	48,479,571	5,249,891	43,229,680	823.5	Ahtanum River.....	88,443	14,950	73,493	491.6
Sevier River and tributaries.....	9,509,836	808,872	8,700,964	.....	Other tributaries of Yakima River.....	344,617	79,262	265,355	334.8
Sevier River direct.....	7,002,349	443,032	6,559,317	.....	Snake River and tributaries.....	93,625,117	6,749,247	86,875,870	.....
San Pitch River.....	1,142,510	226,536	913,974	399.9	Snake River direct.....	37,728,943	578,500	37,150,443	.....
Otter Creek.....	151,850	18,355	133,495	727.3	Gros Ventre River.....	31,225	14,802	16,423	111.0
South Fork.....	372,628	15,650	356,976	.....	Little Gros Ventre River.....	18,746	13,330	5,416	40.6
Other tributaries of Sevier River.....	840,501	103,299	737,202	713.7	Salt River.....	149,207	41,724	107,483	257.6
Beaver River.....	842,305	65,325	776,980	.....	Pierre River and tributaries.....	.....	12,695	-12,595	-100.0
Coal Creek.....	179,171	7,078	172,093	.....	Henry's Fork.....	2,001,841	428,430	1,573,411	367.3
Deep Creek (Utah).....	8,844	6,692	2,152	32.2	South Fork of Snake River.....	6,193,701	633,698	5,560,003	877.4
Grouse Creek.....	28,338	2,850	25,488	894.3	Blackfoot River.....	1,022,276	43,690	978,586	.....
Humboldt River and tributaries.....	1,751,566	763,110	988,456	129.5	Port Neuf River.....	1,141,528	58,255	1,083,273	.....
Humboldt River direct.....	739,995	486,730	253,265	52.0	Raft River.....	100,928	46,635	54,293	116.4
East Fork of Humboldt River.....	202,071	7,610	194,461	.....	Goose Creek.....	393,755	3,000	390,755	.....
La Moille Creek.....	91,280	14,840	76,440	515.1	Salmon Falls River.....	4,152,745	(?)	4,152,745	.....
North Fork of Humboldt River.....	57,403	10,045	47,358	471.5	Little Wood River.....	1,016,699	(?)	1,016,699	.....
South Fork of Humboldt River.....	288,162	53,870	234,292	434.9	Big Wood River.....	5,395,133	239,228	5,155,905	.....
Pine Creek.....	2,809	2,450	359	14.7	Brunson River.....	574,955	238,140	336,815	141.4
Reese River.....	79,120	36,815	42,305	114.9	Owyhee River.....	1,411,424	206,881	1,204,543	582.2
Little Humboldt River.....	2,544	53,580	-51,036	-95.3	Boise River.....	16,013,734	1,674,583	14,339,151	856.3
Other tributaries of Humboldt River.....	288,182	97,170	191,012	198.6	Malheur River.....	2,027,683	282,898	1,744,785	616.8
Truckee River and tributaries.....	594,187	296,435	297,752	100.4	Payette River.....	2,915,780	685,232	2,230,548	325.5
Truckee River direct.....	485,900	253,470	232,430	91.7	Weiser River.....	2,018,450	119,601	1,898,849	.....
Steamboat Creek.....	42,070	39,670	2,400	6.0	Burnt River.....	639,491	65,691	573,800	873.5
Other tributaries of Truckee River.....	66,217	3,295	62,922	.....	Powder River.....	1,552,987	268,101	1,284,886	479.3
Carson River and tributaries.....	8,064,685	103,642	7,961,043	.....	Pine Creek.....	97,522	36,595	60,927	166.5
Carson River direct.....	164,395	147,157	17,238	11.7	Imnaha River.....	206,378	10,885	195,493	.....
Other tributaries of Carson River.....	7,900,290	18,485	7,881,805	.....	Salmon River.....	1,175,362	227,508	947,854	416.6
Walker River and tributaries.....	1,699,059	376,440	1,322,619	351.3	Grande Ronde River.....	476,998	82,011	394,987	481.6
Walker River direct.....	1,680,651	376,790	1,304,861	347.2	Clearwater River.....	298,755	90,585	208,170	229.8
Other tributaries of Walker River.....	18,408	650	17,758	.....	Asotin Creek.....	606,094	94,100	511,994	544.1
Duck Creek.....	252,851	10,700	242,151	.....	Pataha River.....	47,085	1,905	45,180	.....
Staptes Creek.....	189,986	19,940	170,046	852.8	Palouse River.....	175,100	2,810	172,290	.....
Long Valley Creek.....	171,642	16,345	155,297	930.1	Other tributaries of Snake River.....	4,040,602	550,734	3,489,868	633.7
Mono Lake and tributaries.....	5,363,858	15,200	5,348,658	.....	Independent streams in Snake River Basin.....	3,828,606	151,160	3,677,446	.....
Susan River.....	242,426	203,205	39,221	19.3	Camas Creek.....	578,627	6,263	572,364	.....
Mohave River.....	616,769	114,800	501,969	437.3	Beaver Creek.....	7,259	4,290	2,969	69.2
Owens River.....	5,785,132	408,875	5,376,257	.....	Medicine Lodge.....	31,690	3,800	27,890	733.9
San Jacinto River.....	2,139,267	775,000	1,364,267	176.0	Little Lost River.....	474,465	32,710	441,755	.....
					Big Lost River.....	2,709,698	79,717	2,629,981	.....
					Other independent streams.....	26,867	24,380	2,487	10.2
					Walla Walla River.....	1,171,914	31,907	1,140,007	.....
					Klickitat River.....	64,423	1,882	62,541	.....
					White Salmon River.....	91,786	6,700	85,086	.....
					Umatilla River.....	4,308,892	61,430	4,247,462	.....
					Willow Creek.....	80,139	20,376	59,763	195.2
					John Day River.....	510,248	120,060	390,188	325.9
					Deschutes River.....	5,078,636	138,755	4,939,881	.....
					Hood River.....	807,269	54,000	753,269	.....
					Willamette River.....	100,561	3,240	97,321	.....
					Other tributaries of Columbia River.....	2,046,055	57,928	1,988,127	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Not reported separately in 1902.

## IRRIGATION.

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**TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN, 1920 AND 1902—Continued.**

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>		DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.				Amount.	Per cent.
Pacific Ocean streams other than the Colorado and Columbia Rivers.....	\$167,398,448	\$21,693,667	\$145,704,781	87.1	Pacific Ocean streams other than the Colorado and Columbia Rivers—Continued.				
Dungeness River.....	94,010	8,000	86,010	91.5	San Joaquin River and tributaries.	\$71,694,653	\$9,103,242	\$62,591,411	87.2
McDowell Creek.....	2,000	—	2,000	100.0	San Joaquin River direct.....	9,224,164	1,504,238	7,719,926	83.7
Rogue River and tributaries.....	1,783,939	147,223	1,636,716	91.8	Kern River.....	17,573,637	796,340	16,777,297	95.5
Rogue River direct.....	165,665	7,540	158,125	95.4	Tulare Lake.....	3,910,620	(*)	3,910,620	100.0
Little Butte Creek.....	604,794	10,490	594,304	98.3	Tulare River.....	2,842,405	(*)	2,842,405	100.0
Bear Creek.....	615,878	20,895	594,983	96.5	Kaweah River.....	6,186,840	(*)	6,186,840	100.0
Evans Creek.....	40,836	2,676	38,160	93.5	Kings River.....	8,145,440	2,976,688	5,168,752	63.4
Applegate River.....	180,894	60,325	120,569	66.7	Fresno River.....	415,385	406,514	8,871	2.1
Illinois River.....	87,966	27,748	60,218	68.5	Merced River.....	3,512,235	1,542,834	1,969,401	56.1
Other tributaries of Rogue River.....	87,956	17,550	70,406	79.9	Tuolumne River.....	7,173,802	(*)	7,173,802	100.0
Klamath River and tributaries.....	5,502,890	529,458	4,973,434	90.4	Stanislaus River.....	7,840,430	968,964	6,871,466	87.8
Klamath River direct.....	1,734,099	282,996	1,451,103	83.8	Calaveras River.....	818,995	(*)	818,995	100.0
Lost River.....	3,451,383	17,550	3,433,833	99.5	Mokelumne River.....	1,675,137	305,239	1,369,898	81.8
Sprague River.....	32,368	26,590	5,778	17.8	Cosumnes River.....	153,899	(*)	153,899	100.0
Other tributaries of Klamath River.....	285,040	202,350	82,690	28.8	Other tributaries of San Joaquin River.....	1,921,512	608,425	1,313,087	68.3
Russian River.....	162,630	2,463	160,167	98.5	Tributaries of San Francisco Bay other than Sacramento and San Joaquin Rivers.....	4,940,061	487,451	4,452,610	90.5
Sacramento River and tributaries.....	28,833,106	1,882,227	26,950,879	93.5	Coyote Creek.....	1,453,138	43,345	1,409,793	97.0
Sacramento River direct.....	11,830,374	49,368	11,781,006	99.6	Guadalupe River.....	1,883,049	75,795	1,807,254	95.9
Pit River.....	799,913	274,671	525,242	65.8	Other tributaries.....	1,603,874	368,311	1,235,563	77.0
Cow Creek.....	128,946	15,246	111,700	86.6	Pajaro River.....	1,248,343	168,592	1,079,750	86.5
Cottonwood Creek.....	573,601	124,473	449,128	78.3	Salinas River.....	2,570,331	101,960	2,468,371	96.0
Battle Creek.....	95,139	34,796	60,343	63.5	Santa Maria River.....	573,194	32,380	540,814	94.4
Stony Creek.....	1,539,614	42,250	1,497,364	97.2	Santa Ynez River.....	284,037	33,745	250,292	88.1
Feather River.....	3,937,380	869,841	3,067,539	77.7	Santa Clara River.....	2,211,473	374,151	1,837,322	83.1
Yuba River.....	2,518,770	(*)	2,518,770	100.0	Los Angeles River.....	5,508,400	309,611	5,198,789	94.4
Cache Creek.....	918,477	28,115	890,362	97.0	San Gabriel River.....	12,862,319	772,597	12,089,722	94.0
American River.....	2,890,114	112,758	2,777,356	96.1	Santa Ana River.....	19,918,550	1,619,531	17,999,019	89.9
Other tributaries of Sacramento River.....	3,604,778	330,709	3,274,069	90.9	San Diego River.....	1,789,124	32,100	1,757,024	98.2
					Other Pacific Ocean streams.....	7,421,338	5,786,937	1,634,401	22.2

<sup>1</sup> A minus sign (—) denotes decrease. Per cent not shown when more than 1,000. <sup>2</sup> Not reported separately in 1902. <sup>3</sup> Includes springs and wells.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly from census data. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of most of

the other classes shown in the table and a part of its expenditure is properly chargeable to those lands, but it is not possible to tell how much should be so charged or how it should be distributed among the various classes, since the area to which water is supplied varies from season to season.

**TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.		CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>		Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$697,657,328	100.0	16,260,750	\$2.43	U. S. Reclamation Service.....	\$129,509,819	18.6	1,098,573	\$2.20
Individual and partnership.....	154,634,169	22.2	5,133,421	3.02	U. S. Indian Service.....	14,851,236	2.1	264,378	1.80
Cooperative.....	183,041,500	26.2	5,754,232	1.67	State.....	344,174	(*)	1,008	4.86
Irrigation district.....	88,573,514	12.7	1,701,231	2.59	City.....	2,935,678	0.4	33,597	3.85
Carey Act.....	32,680,695	4.7	497,011	1.34	Other.....	5,310,399	0.8	6,594	3.14
Commercial.....	85,735,470	12.3	1,779,595	3.48	Not reported.....	39,674	(*)		

<sup>1</sup> Based on area irrigated in 1919.

<sup>2</sup> Less than one-tenth of 1 per cent.

## DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive. Data for the several states are given in County Table I at the end of this summary.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE.

Number of enterprises reporting land drained or needing drainage.....	3,068
Acreage included in enterprises reporting land drained or needing drainage.....	8,860,760
Acreage for which drains have been installed.....	1,519,853
Additional acreage needing drainage.....	1,476,771
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	17.2
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises.....	4.2
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises.....	8.3

## QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. Although the data are incomplete, the reports represent sufficient acreage to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals.....second-feet..	234,020	109,714	124,
Area irrigated in 1919.....acres..	9,645,331	6,560,188	3,085,
Average number of acres per second-foot..	41	60	
Total quantity of water entering canals.....acre-feet..	60,005,556	36,626,781	23,378,
Area irrigated in 1919.....acres..	10,879,174	7,771,979	3,107,
Average quantity per acre.....acre-feet..	5.5	4.7	
Total quantity of water delivered.....acre-feet..	15,339,104	8,673,241	6,665,
Area irrigated in 1919.....acres..	6,059,953	3,980,026	2,079,
Average quantity per acre.....acre-feet..	2.5	2.2	

IRRIGATION.

IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total.....</b>	<b>23,894</b>	<b>3,931</b>	<b>51,621</b>	<b>631,079</b>	<b>103,177</b>	<b>57,553</b>	<b>56,087</b>	<b>7,538</b>	<b>21,246,486</b>
Before 1860.....	603	102	846	9,539	3,296	1,313	1,454	156	113,700
1860-1869.....	2,044	158	3,400	31,956	7,031	3,297	3,013	136	259,163
1870-1879.....	3,124	203	5,737	70,068	11,783	5,615	6,367	298	422,100
1880-1889.....	5,798	662	11,033	130,074	21,673	9,277	7,825	653	1,065,135
1890-1899.....	3,578	507	7,523	89,970	15,902	11,317	7,664	672	671,008
1900-1904.....	2,054	438	4,638	84,723	9,741	4,040	6,744	641	3,929,610
1905-1909.....	2,018	502	4,264	101,707	10,976	8,691	12,334	1,048	8,232,276
1910-1914.....	1,662	537	5,288	48,342	9,198	5,958	6,536	1,568	5,174,285
1915-1919.....	1,549	481	4,887	42,202	6,680	5,407	3,550	1,495	1,266,014
Not reported.....	1,466	201	4,005	22,438	6,688	2,638	1,200	671	83,145

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
<b>Total.....</b>	<b>8,878.3</b>	<b>4,606</b>	<b>935,057</b>	<b>32,094</b>	<b>16,396,549</b>	<b>29,458</b>	<b>748,971</b>	<b>33,804</b>	<b>36,275,005</b>
Before 1860.....	88.0	26	3,292	37	19,028	46	684	55	28,073
1860-1869.....	79.1	58	4,399	79	38,909	43	574	44	43,439
1870-1879.....	285.9	127	32,240	82	46,174	83	3,697	108	86,287
1880-1889.....	825.2	498	38,439	327	144,829	290	14,938	407	1,476,530
1890-1899.....	674.4	340	51,819	846	400,373	668	37,387	862	4,378,623
1900-1904.....	504.7	490	100,628	1,591	745,045	1,455	56,286	1,741	3,706,532
1905-1909.....	1,349.6	763	216,806	3,304	1,741,309	2,898	98,729	3,492	4,379,501
1910-1914.....	2,334.5	741	220,667	10,467	5,436,719	9,408	226,748	10,667	8,316,741
1915-1919.....	2,136.3	629	135,326	10,971	5,861,661	10,469	242,629	11,713	10,663,654
Not reported.....	600.6	934	131,441	4,390	1,962,502	4,038	64,299	4,515	3,185,625

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total.....</b>	<b>23,894</b>	<b>3,931</b>	<b>51,621</b>	<b>631,079</b>	<b>103,177</b>	<b>57,553</b>	<b>56,087</b>	<b>7,538</b>	<b>21,246,486</b>
Individual and partnership.....	20,360	2,835	46,418	266,418	64,990	33,947	15,174	6,253	2,365,816
Cooperative.....	2,904	788	3,940	198,720	22,555	11,921	16,887	854	3,644,830
Irrigation district.....	252	80	457	51,847	4,907	2,502	6,150	86	1,682,577
Carey Act.....	47	29	69	18,812	1,471	550	2,574	31	893,956
Commercial.....	183	117	412	54,193	6,252	4,430	7,486	209	2,356,057
U. S. Reclamation Service.....	57	40	92	32,903	1,924	3,205	5,802	43	9,017,803
U. S. Indian Service.....	54	19	152	6,899	876	739	2,388	27	349,302
State.....	10	6	14	158	31	74	26	11	706
City.....	17	12	35	757	138	140	178	25	561
Other.....	10	4	32	342	33	45	22	6	34,828

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
<b>Total.....</b>	<b>8,878.3</b>	<b>4,606</b>	<b>935,057</b>	<b>32,094</b>	<b>16,396,549</b>	<b>29,458</b>	<b>748,971</b>	<b>33,804</b>	<b>36,275,005</b>
Individual and partnership.....	4,795.2	3,964	826,570	30,415	14,953,276	28,336	537,381	31,564	22,563,649
Cooperative.....	2,091.1	255	62,021	1,082	1,014,138	752	82,963	1,252	3,515,742
Irrigation district.....	813.7	302	12,080	100	93,770	103	48,394	312	1,837,264
Carey Act.....	59.3	8	5,842	1	1	1	746	25	25
Commercial.....	845.2	58	26,185	298	235,272	188	66,409	464	6,814,220
U. S. Reclamation Service.....	174.4	17	2,339	49	46,000	15	14,423	84	973,170
U. S. Indian Service.....	19.4	17	2,339	72	7,268	14	733	25	87,243
State.....	18.7	12	35	34	9,636	16	416	21	60,810
City.....	53.3	10	10	32	27,619	18	2,225	40	411,722
Other.....	8.0	2	100	12	9,570	15	281	17	11,185



TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total, states included.</b>	<b>23,894</b>	<b>2,931</b>	<b>51,621</b>	<b>631,079</b>	<b>103,177</b>	<b>57,553</b>	<b>56,657</b>	<b>7,538</b>	<b>21,946,436</b>
<b>Missouri River and tributaries.</b>	<b>5,973</b>	<b>1,246</b>	<b>12,784</b>	<b>167,891</b>	<b>28,144</b>	<b>13,448</b>	<b>11,455</b>	<b>1,220</b>	<b>4,860,618</b>
Missouri River direct	45	22	106	1,617	517	236	148	22	871,819
Jefferson River and tributaries	1,174	45	2,106	25,319	3,422	3,468	890	59	165,003
Jefferson River direct	23	2	52	1,331	189	18	39		
Beaverhead River	516	15	805	5,340	1,120	954	253	16	130,275
Big Hole River	442	8	726	7,171	1,132	2,231	480	10	6,171
Boulder River	48	3	105	649	185	83	2	3	11
Passamari River	54	7	184	1,456	298	101	61	18	19,676
Other tributaries of Jefferson River	91	10	234	9,372	498	81	55	12	8,870
Madison River	100	10	251	2,709	560	129	112	12	4,602
Gallatin River	88	5	410	4,243	885	146	228	2	1,200
Smith River	66	4	285	983	325	600	124	7	181
Sun River	91	14	109	2,497	313	166	199	16	854
Teton River	21	7	76	2,566	266	74	112	7	145,742
Marias River	38	15	76	2,634	227	260	719	15	22,926
Judith River	147	5	214	1,479	311	252	84	7	85
Musselshell River	192	35	443	4,277	866	806	286	16	34,479
Milk River and tributaries	201	104	301	7,416	692	895	554	94	146,041
Milk River direct	5		7	200	31	9	2	1	16
Sage Creek	5	6	8	11	12	16	15	5	2,089
Snake River	13	6	17	72	23	86	38	4	158
Other tributaries of Milk River	178	92	269	7,133	626	784	499	84	142,778
Yellowstone River and tributaries	1,014	160	2,678	32,064	6,662	2,018	2,171	196	516,248
Yellowstone River direct	14	11	102	5,608	720	279	447	11	2,519
Clark Fork and tributaries	105	5	358	3,353	797	403	224	5	2,795
Clark Fork direct	101	5	304	3,177	719	399	223	1	91
Tributaries of Clark Fork	4		54	176	78	4	1	4	2,704
Shields River	88	1	208	1,620	457	210	75	5	9,016
Stillwater River	5		128	1,284	279	40	46	2	2
Big Horn River and tributaries	311	31	783	9,817	2,227	518	914	70	466,867
Big Horn River direct	55	2	78	2,387	341	60	265	1	2
Pope Agie River	37		122	605	270	20	34	1	112
Wind River	7	1	88	1,005	233	12	13	2	2,050
Poison Creek			1					1	3
Owl Creek	6		12	279	89	12	18	6	275
No Wood River	21	5	94	388	206	8	5	4	60
Greybull River	46	1	100	1,276	327	20	71	4	181
Shell Creek	31	5	53	433	145	10	20	5	1,637
Shoshone River	38	9	64	3,079	327	294	448	17	460,806
Little Horn River	2		7	46	42	15	1	1	25
Other tributaries of Big Horn River	68	8	164	379	247	67	41	28	1,716
Rosebud River	11	2	17	73	21	6		2	18
Tongue River and tributaries	188	37	260	2,508	582	191	126	36	11,377
Tongue River direct	43	12	82	1,333	231	128	35	9	1,150
Goose Creek	91	21	99	874	229	30	58	16	10,879
Other tributaries of Tongue River	49	4	79	301	122	35	33	11	648
Powder River and tributaries	152	32	258	2,620	679	90	125	25	4,112
Powder River direct	18	13	35	183	40	18	6	10	50
Red Fork Creek	19		25	60	50	1	1		
Crazy Woman Creek	17	2	49	525	118	18	10	4	37
Clear Creek	45	9	83	1,468	312	40	94	3	3,389
Other tributaries of Powder River	52	8	66	384	164	13	14	8	636
Other tributaries of Yellowstone River	145	41	564	5,221	900	281	214	30	19,542
Little Missouri River	21	24	46	160	51	59	26	33	3,796
Moreau River	3	55	29	33	24	26	4	19	2,262
Cheyenne River and tributaries	264	137	455	6,438	778	757	679	109	212,529
Cheyenne River direct	182	95	297	5,210	568	511	580	64	205,941
North Fork (Belle Fourche)	24	25	49	397	75	108	19	26	2,433
South Fork and tributaries	58	17	109	831	135	138	80	19	4,155
South Fork direct	47	15	89	806	91	137	79	13	4,046
Hat Creek	11	2	40	25	44	1	1	6	109
White River	63	23	81	237	131	104	66	17	1,302
Niobrara River	30	12	51	212	92	92	36	1	13,005
Platte River and tributaries	2,187	469	4,117	67,344	10,354	2,621	4,607	508	2,663,549
Platte River direct	4	1	26	1,776	207	36	137	1	1
North Platte River and tributaries	1,199	141	2,504	27,254	4,902	1,238	2,121	164	1,734,839
North Platte River direct	52	11	154	10,490	1,058	512	1,284	13	1,247,874
Beaver Creek	12	2	20	50	62	1	1	3	673
Grand Encampment Creek	13	1	31	106	52	7	7	1	150
Spring Creek	3	2	48	343	79	68	45	3	3,598
Sage Creek	2		4	3	4				
Pass Creek	3		54	293	84	18	9	1	2,000
Medicine Bow River	112	13	283	927	414	68	58	9	7,459
Sweetwater River	42	1	85	174	141	37	20	9	2,474
Muddy Creek	1		5	12	7				
Box Elder Creek	13	3	33	44	68	5	16	3	36
La Prele Creek	11	3	47	326	81	13	62	2	20,012
Labonte Creek	40		42	54	76	24	24		

# IRRIGATION.

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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Missouri River and tributaries—Continued.</b>									
<b>Platte River and tributaries—Continued.</b>									
<b>North Platte River and tributaries—Continued.</b>									
Laramie River and tributaries.....	390	41	662	6,411	972	161	345	49	396,106
Laramie River direct.....	72	8	107	2,196	350	104	239	8	263,425
Little Laramie River.....	42	5	98	435	141	26	15		
Sybilie Creek.....	98	11	122	297	119	4	3	10	260
North Laramie River.....	101	6	128	462	86	9	15	6	8,019
Chugwater Creek.....	37	10	100	152	107	10		8	394
Other tributaries of Laramie River.....	40	6	107	2,869	169	8	73	17	124,008
Rawhide Creek.....	12	2	13	42	13	33	9	2	46
Horse Creek.....	46	26	121	774	169	32	41	26	27,335
Blue River.....	3		5	139	27				
Pumpkin Creek.....	13		43	209	71	44	21		
Other tributaries of North Platte River.....	630	29	854	6,551	1,594	215	177	48	27,078
<b>South Platte River and tributaries.....</b>									
South Platte River direct.....	930	321	1,578	36,215	5,226	1,347	2,343	238	927,789
Bear Creek.....	106	14	207	13,272	1,296	351	464	22	421,292
Clear Creek.....	29	7	37	339	54	27	8	7	918
St. Vrain Creek.....	81	5	60	1,806	177	65	94	12	6,767
Big Thompson Creek.....	171	83	195	5,600	1,649	219	356	69	123,395
Cachela Poudre River.....	33	23	42	2,310	241	64	146	20	44,617
Lone Tree Creek.....	107	92	267	8,362	653	313	1,016	98	287,565
Crow Creek.....	16	5	39	62	15	1		7	722
Big Beaver Creek.....	14	13	59	220	55	13	9	16	4,673
Lodgepole Creek.....	4	1	8	226	27	1		3	108
Other tributaries of South Platte River.....	63	16	123	607	153	135	95	19	9,789
Loup River.....	3	5	7	91	16	5	6	3	60
Other tributaries of Platte River.....	1	1	2	8	3			2	860
<b>Kansas River and tributaries.....</b>									
Republican River.....	53	16	87	1,333	224	116	70	9	197
Smoky Hill River.....	53	16	74	1,307	216	102	60	6	192
Big Blue River.....	5	2	10	30	7	14	1	1	5
Other tributaries of Kansas River.....			1	1	1				
Other tributaries of Missouri River.....	229	82	363	4,360	1,444	623	340	81	64,796
<b>Mississippi River and tributaries, exclusive of Missouri River.....</b>									
Mississippi River direct.....	1,794	399	2,957	63,974	4,934	5,364	3,232	321	1,163,396
<b>Arkansas River and tributaries.....</b>									
Arkansas River direct.....	340	242	241	869	174	1,533	182	6	43
South Fork.....	1,249	22	2,565	39,166	4,629	3,550	2,062	367	1,155,259
Fountain River.....	61	22	230	11,328	1,163	1,443	1,875	44	266,182
St. Charles River.....	30	65	65	348	122	42	25		
Huerfano River.....	6	9	113	1,046	219	64	31	36	13,246
Apishapa River.....	87	12	114	757	162	42	24	14	3,418
Purgatoire or Las Animas River and tributaries.....	285	22	336	4,336	531	506	350	40	111,627
Purgatoire or Las Animas River direct.....	30	15	62	1,806	108	21	32	15	54,621
Trinchera River.....	110	11	156	2,615	364	52	24	19	403,690
Canadian River and tributaries.....	101	9	147	2,606	256	38	30	16	403,690
Canadian River direct.....	9	9	9	9	8	14	4	1	
Cimarron River.....	264	63	314	8,123	676	498	206	67	79,212
Vermilion River.....	1	2	11	59	12	17	3	6	52
Vermejo River.....	60	9	63	2,035	178	87	154	7	21,235
Ocate Creek.....	23	10	42	2,357	96	15	52	10	18,111
Mora River.....	27	3	29	1,217	74	61	19	14	20,739
Ute Creek.....	106	12	113	1,075	231	262	41	6	277
Other tributaries of Canadian River.....	3	2	4	6	4	6	1	1	
Cimarron River.....	52	9	89	642	150	228	70	9	59
Other tributaries of Arkansas River.....	315	69	1,096	8,168	1,089	654	325	123	94,596
St. Francis River.....			1	2					
White River.....	62	14	85	1,067	49	40	11	5	
Quachita River.....	1		1						
Red River and tributaries.....	13	3	54	163	53	163	75	3	8,004
Other tributaries of Mississippi River.....	30		37	707	29	58	7		
<b>Gulf streams other than Mississippi River and Rio Grande.....</b>									
Atchafalaya River and tributaries.....	148	168	1,632	20,331	2,369	3,276	2,677	360	308,415
Vermilion River and tributaries.....	17	1	91	723	109	62	42	1	2,041
Mentemau River and tributaries.....			68	1,699	202	1,071	667	1	
Calcasieu Lake, River and tributaries.....	14	47	771	6,067	863	1,032	568	61	5,633
Sabine River and tributaries.....	4	4	84	1,700	159	92	168	3	690
Neches River.....		2	10	592	83	52	58	1	
Trinity River.....		7	7	1,380	40	30	77		
Brazos River.....		1	6	1,023	77	47	102	1	25,000
Colorado River.....		2	155	287	130	270	136	3	800
San Antonio River.....	46	53	244	3,925	324	333	639	30	8,092
Nueces River.....	4	4	50	1,782	60	80	32	24	360,346
Other Gulf streams.....	54	29	85	163	96	139	42	223	1,987
	9	18	61	1,586	67	67	96	12	1,091

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Rio Grande and tributaries.....</b>	<b>1,855</b>	<b>117</b>	<b>2,740</b>	<b>36,811</b>	<b>5,770</b>	<b>2,642</b>	<b>2,752</b>	<b>223</b>	<b>2,223,019</b>
Rio Grande direct.....	106	22	204	17,925	1,517	632	1,966	66	2,718,543
Saguache River.....	152		251	752	176	88	73	11	202
San Luis River.....	40	2	252	1,670	249	50	70	2	179
Alamosa River.....	20	2	39	1,321	142	22	56	2	31,750
La Jara River.....	30		31	390	69	9	12		
Conchos River.....	103	2	105	3,188	317	52	72	2	3,001
Trinchera River.....	27	2	25	159	182	7	4	2	25,500
Rio Costilla.....	48		52	129	43				
Pueblo River.....	40		42	434	80	7	3		
Rio Chama.....	187	2	183	832	298	167	80	2	150
Rio Santa Cruz.....	11		32	134	52	10	3		
Tesque Creek.....	18		39	72	50	7	6	1	
Rio Puercio.....	30	9	50	215	237	41	20	11	44,068
<b>Pecos River and tributaries.....</b>	<b>394</b>	<b>25</b>	<b>774</b>	<b>5,619</b>	<b>1,168</b>	<b>942</b>	<b>914</b>	<b>156</b>	<b>169,963</b>
Pecos River direct.....	195	11	323	4,143	577	437	517	107	144,296
Gallinas River.....	28	5	42	276	83	60	9	8	25,619
Hondo River.....	99	2	196	547	222	196	161	13	18
Penasco River.....	16		96	245	102	152	168		
Other tributaries of Pecos River.....	46	7	117	408	184	97	59	28	30
Las Moras Creek.....	2	1	4	75	8	260	67		
Other tributaries of Rio Grande.....	337	40	557	3,886	1,012	338	406	78	229,663
<b>Independent streams in Rio Grande drainage basin.....</b>	<b>84</b>	<b>8</b>	<b>150</b>	<b>2,813</b>	<b>190</b>	<b>134</b>	<b>90</b>	<b>18</b>	<b>145</b>
Rio Mimbres.....	45	5	77	3,168	78	60	13	11	40
Fresno River.....	33		53	205	66	17	7	5	5
Rio Tularosa.....	6	2	20	240	46	57	70	2	100
<b>Colorado River and tributaries.....</b>	<b>2,468</b>	<b>545</b>	<b>7,098</b>	<b>66,249</b>	<b>14,052</b>	<b>5,781</b>	<b>3,485</b>	<b>798</b>	<b>1,675,938</b>
Colorado River direct.....	5	1	53	7,290	550	668	2,211		
<b>Green River and tributaries.....</b>	<b>919</b>	<b>124</b>	<b>2,067</b>	<b>16,875</b>	<b>4,383</b>	<b>1,900</b>	<b>2,320</b>	<b>138</b>	<b>86,254</b>
Green River direct.....	25	1	65	1,474	200	26	9	2	114
New Fork.....	9	2	78	1,011	241	133	86	1	
Horse Creek.....	6		41	403	82				
Cottonwood Creek.....	19		53	485	131	125	75		
South Piney Creek.....	26	1	110	221	163	333	116		
La Barge Creek.....	22		19	131	44	6	2		
Fontonelle Creek.....	20		24	73	35	8	6		
Bitter Creek.....	3	1	21	25	28	1	4	16	1,105
Blacks Creek.....	156	9	325	1,867	532	54	114	11	3,333
Henry's Fork.....	45	22	110	301	143	74	42	3	23
Ashley Fork River.....	109		18	113	75	8	15		
Duchesne River.....	156	8	106	2,416	543	306	771	7	41,871
Price River.....	13	1	54	636	161	37	34	2	1,248
San Rafael River.....	11	2	30	591	170	401	570	6	8,800
<b>Yampa River and tributaries.....</b>	<b>109</b>	<b>57</b>	<b>600</b>	<b>2,736</b>	<b>1,145</b>	<b>192</b>	<b>371</b>	<b>66</b>	<b>8,318</b>
Yampa River direct.....	16	4	65	498	142	19	12	4	1,569
Little Snake River.....	10	6	135	873	265	17	7	8	1,346
Other tributaries of Yampa River.....	83	47	400	1,365	738	156	352	54	5,403
White River.....	43	16	265	2,883	408	114	43	19	1,703
Other tributaries of Green River.....	147	4	117	1,509	282	82	62	5	19,739
<b>Grand River and tributaries.....</b>	<b>857</b>	<b>239</b>	<b>2,914</b>	<b>25,214</b>	<b>5,562</b>	<b>1,484</b>	<b>2,016</b>	<b>295</b>	<b>133,742</b>
Grand River direct.....	45	10	149	2,827	493	308	257	11	13,627
Fraser River.....	14	2	61	352	112	2	1	2	10
Muddy Creek.....	49	10	50	254	64			10	1,727
Blue River.....	40	3	143	467	172	34	7	7	39
Eagle River.....	12	4	122	449	202	10	10	8	106
Roaring Fork.....	17	4	240	1,314	413	163	58	13	804
Plateau Creek.....	2	41	104	790	213	127	81	45	15,972
<b>Gunnison River and tributaries.....</b>	<b>358</b>	<b>118</b>	<b>1,210</b>	<b>12,419</b>	<b>2,257</b>	<b>358</b>	<b>601</b>	<b>140</b>	<b>47,521</b>
Gunnison River direct.....	14	1	63	1,168	151	35	19	1	120
Taylor River.....	1		4	16	6				
Tomichi Creek.....	157	1	258	1,731	279	7	5	1	
North Fork Creek.....	19	17	138	1,154	306	87	76	26	11,134
Smith Fork River.....	5	9	46	562	119	21	38	9	1,265
Uncompahgre River.....	26	4	180	2,402	446	151	359	5	220
Other tributaries of Gunnison River.....	167	86	521	5,387	950	87	104	98	34,782
Rio Dolores.....	87	19	255	2,622	622	143	417	21	42,988
Other tributaries of Grand River.....	208	28	580	3,720	1,014	309	584	38	10,948
Fremont River.....	148	117	43	548	121	87	65	18	4,078
Virgin River.....	120	13	238	773	358	224	189	26	20,009
<b>San Juan River and tributaries.....</b>	<b>133</b>	<b>21</b>	<b>521</b>	<b>4,510</b>	<b>1,242</b>	<b>412</b>	<b>282</b>	<b>35</b>	<b>5,566</b>
San Juan River direct.....	27	6	67	669	176	64	89	15	1,591
Mancos River.....	11		38	285	87	11	12	1	150
Los Pinos River.....	9		67	853	200	24	69		
Animas River.....	45		144	1,694	384	130	82	4	
La Plata River.....	30	8	69	612	185	47	48	2	165
Other tributaries of San Juan River.....	11	12	136	397	210	136	12	18	3,660
Kanab Wash.....	1		1	1		4	4	4	258
Williams River.....	5		27	40	34	1	1	1	4
<b>Little Colorado River and tributaries.....</b>	<b>32</b>	<b>14</b>	<b>82</b>	<b>341</b>	<b>156</b>	<b>43</b>	<b>43</b>	<b>45</b>	<b>37,098</b>
Little Colorado River direct.....	19	9	26	208	78	15	22	18	30,823
Nutriso Creek.....	4	1	7	17	8			4	1,050
Concho Creek.....	2		3	3	2	1	1	2	625
Other tributaries of Little Colorado River.....	9	4	27	113	68	27	20	21	4,600

IRRIGATION.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Colorado River and tributaries—Continued.</b>									
Gila River and tributaries.....	231	25	1,081	10,449	1,515	866	1,327	215	1,377,432
Gila River direct.....	31	1	112	2,819	439	230	211	2	210
San Francisco River.....	54	1	90	110	66	11	2	3	.....
San Pedro River.....	30	9	114	270	162	31	15	45	894
Santa Cruz River.....	31	5	287	1,196	260	147	75	25	392
Salt River and tributaries.....	44	3	174	5,084	290	313	911	11	1,367,307
Salt River direct.....	8	1	18	4,447	111	271	898	2	1,367,300
Tonto Creek.....	9	1	34	58	26	.....	.....	1	1
Rio Verde.....	22	.....	75	359	107	29	7	5	1
Other tributaries of Salt River.....	5	1	47	220	46	13	6	3	5
Agua Fria River.....	12	5	106	525	107	105	101	16	24
Hassayampa River.....	1	1	24	46	18	.....	.....	1	180
Other tributaries of Gila River.....	28	10	174	399	173	29	12	111	6,425
Other tributaries of Colorado River.....	14	1	116	208	131	92	27	26	11,547
Whitewater Draw and tributaries.....	6	51	175	533	121	92	7	76	25,071
<b>Great Basin Drainage.....</b>	<b>2,244</b>	<b>460</b>	<b>5,545</b>	<b>57,717</b>	<b>11,292</b>	<b>6,381</b>	<b>6,486</b>	<b>925</b>	<b>2,395,379</b>
<b>Tributaries of Great Salt Lake.....</b>									
Bear River and tributaries.....	1,128	158	1,705	19,501	4,512	2,106	2,487	208	596,859
Bear River direct.....	670	104	967	10,589	2,858	913	739	92	30,708
Bear River direct.....	78	7	206	5,061	737	152	280	11	3,659
Little Bear River.....	47	6	104	1,074	195	395	183	4	4
Malad River.....	2	1	3	13	10	.....	.....	1	2
Thomas Fork.....	25	.....	29	203	63	.....	.....	.....	.....
Mill Creek.....	4	.....	8	27	38	4	2	.....	.....
Little Malad Creek.....	190	58	12	400	788	49	49	4	12,788
Other tributaries of Bear River.....	324	32	606	3,311	1,027	313	225	72	14,255
Weber River and tributaries.....	256	18	391	2,823	570	146	106	52	30,794
Weber River direct.....	72	1	101	1,417	181	53	46	5	22
Ogden River.....	27	.....	73	480	109	57	29	4	4
East Canyon Creek.....	38	1	40	179	49	5	5	2	28,004
Other tributaries of Weber River.....	119	16	177	747	231	31	26	41	2,764
Jordan River and Utah Lake and tributaries.....	202	36	347	6,089	1,084	1,047	1,642	64	535,357
Jordan River direct.....	14	4	20	1,151	296	101	26	3	600
Spanish Fork River.....	12	6	46	1,358	93	95	202	8	502,116
Hobble Creek.....	1	.....	13	31	9	10	4	1	2
Provo River.....	31	11	99	1,752	304	416	262	21	6,681
American Fork River.....	27	.....	23	70	43	63	130	4	.....
Little Cottonwood Creek.....	21	1	36	650	60	50	45	1	750
Big Cottonwood Creek.....	32	3	27	228	58	160	31	4	300
Other tributaries of Jordan River and Utah Lake.....	64	11	83	849	221	152	942	22	24,908
<b>Independent streams.....</b>	<b>2,116</b>	<b>302</b>	<b>3,340</b>	<b>38,216</b>	<b>6,780</b>	<b>4,275</b>	<b>3,999</b>	<b>727</b>	<b>1,798,520</b>
<b>Sevier River and tributaries.....</b>									
Sevier River direct.....	95	50	321	7,762	1,391	903	1,195	63	869,405
San Pitch River.....	23	13	44	4,693	468	330	608	14	741,900
San Pitch River.....	26	20	80	970	372	254	401	21	30,698
Otter Creek.....	2	3	12	66	42	24	9	3	3,900
South Fork.....	9	.....	32	381	114	65	42	2	24,015
Other tributaries of Sevier River.....	25	14	153	1,632	395	230	235	23	68,892
Beaver River.....	36	14	128	775	210	196	229	9	40,555
Coal Creek.....	22	2	58	1,158	136	97	63	63	967
Deep Creek (Utah).....	3	.....	21	50	36	.....	.....	2	.....
Grouse Creek.....	14	3	29	35	45	.....	.....	1	10
<b>Humboldt River and tributaries.....</b>									
Humboldt River direct.....	715	12	1,040	1,204	1,292	965	281	27	42,791
East Fork of Humboldt River.....	55	3	51	384	147	303	119	5	32,025
La Mollie Creek.....	195	2	226	75	188	241	44	4	688
North Fork of Humboldt River.....	173	.....	196	90	193	128	41	.....	.....
South Fork of Humboldt River.....	47	.....	62	48	109	88	22	.....	.....
Pine Creek.....	161	.....	281	297	354	96	29	4	7,974
Reese River.....	47	.....	170	155	267	2	1	.....	.....
Little Humboldt River.....	6	.....	4	.....	4	13	4	.....	.....
Other tributaries of Humboldt River.....	31	7	49	155	60	96	21	14	2,104
<b>Truckee River and tributaries.....</b>									
Truckee River direct.....	54	5	40	2,465	158	21	14	8	201
Steamboat Creek.....	23	2	26	426	134	17	11	1	2
Other tributaries of Truckee River.....	6	1	8	2,001	14	4	3	1	.....
.....	25	2	6	38	10	.....	.....	6	199
<b>Carson River and tributaries.....</b>									
Carson River direct.....	143	13	113	3,905	190	193	341	16	400,064
Tributaries of Carson River.....	80	9	97	688	114	50	16	9	4
Walker River and tributaries.....	63	4	16	3,217	76	143	325	7	400,060
Walker River direct.....	77	14	184	2,192	659	99	162	9	11,503
Tributaries of Walker River.....	67	1	164	2,177	645	75	160	7	11,503
Duck Creek.....	10	13	20	15	14	24	2	2	.....
Stoptoe Creek.....	14	.....	21	45	36	17	12	1	50
Long Valley Creek.....	14	1	17	47	48	20	13	3	4,000
Mono Lake and tributaries.....	59	2	102	585	181	90	44	6	857
Susan River.....	4	3	21	526	26	11	8	3	34,700
Mohave River.....	93	7	82	1,861	215	114	45	15	63,949
Owens River.....	2	.....	21	189	23	9	4	18	27
San Jacinto River.....	6	4	33	1,598	138	5	4	20	26,006
Whitewater River.....	7	11	32	251	50	28	14	94	105,688
Quinn River.....	3	.....	12	57	47	15	2	41	50
Deep Creek (Oregon).....	5	1	14	98	22	20	16	2	.....
Donner and Blitzen River.....	1	.....	10	18	11	.....	.....	.....	.....
Silver Creek.....	44	6	30	239	74	122	34	6	57,580
Silves River.....	24	1	24	398	39	31	2	.....	.....
Thomas Creek.....	206	72	187	876	220	115	54	17	360
Other independent streams.....	10	.....	28	10	28	.....	.....	1	.....
<b>Other independent streams.....</b>	<b>475</b>	<b>81</b>	<b>1,370</b>	<b>11,873</b>	<b>1,555</b>	<b>1,204</b>	<b>1,412</b>	<b>302</b>	<b>139,767</b>



## AGRICULTURE.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Columbia River and tributaries.....</b>	<b>6,494</b>	<b>603</b>	<b>12,614</b>	<b>134,536</b>	<b>22,700</b>	<b>11,986</b>	<b>10,099</b>	<b>646</b>	<b>5,711,783</b>
Columbia River direct.....	9	18	99	632	155	174	44	41	1,530
Kootenai River.....	30	7	64	1,095	93	41	26	13	324
<b>Clark Fork and tributaries.....</b>	<b>716</b>	<b>103</b>	<b>2,106</b>	<b>14,618</b>	<b>3,136</b>	<b>1,747</b>	<b>1,103</b>	<b>62</b>	<b>93,705</b>
Clark Fork direct.....	6	1	87	1,399	85	10	1	3	50
<b>Missoula River and tributaries.....</b>	<b>609</b>	<b>70</b>	<b>1,863</b>	<b>11,998</b>	<b>2,655</b>	<b>1,217</b>	<b>367</b>	<b>46</b>	<b>8,640</b>
Missoula River direct.....	5	1	15	200	116	11	11	1	1
Hellgate River.....	246	27	777	4,623	1,195	455	142	24	527
Big Blackfoot River.....	137	10	310	2,378	364	193	48	3	200
Bitter Root River.....	173	37	644	4,073	870	424	158	10	7,334
Other tributaries of Missoula River.....	48	4	117	724	110	134	19	8	279
<b>Flathead River.....</b>	<b>100</b>	<b>23</b>	<b>156</b>	<b>1,221</b>	<b>396</b>	<b>520</b>	<b>735</b>	<b>13</b>	<b>85,015</b>
<b>Colville River.....</b>	<b>40</b>	<b>1</b>	<b>101</b>	<b>393</b>	<b>174</b>	<b>131</b>	<b>21</b>	<b>3</b>	<b>.....</b>
<b>Spokane River and tributaries.....</b>	<b>34</b>	<b>11</b>	<b>76</b>	<b>912</b>	<b>120</b>	<b>92</b>	<b>156</b>	<b>36</b>	<b>6,262</b>
Spokane River direct.....	15	8	61	802	101	74	134	31	5,662
Coeur d'Alene Lake and River.....	19	3	15	110	19	18	22	5	600
<b>Okanogan River and tributaries.....</b>	<b>12</b>	<b>11</b>	<b>124</b>	<b>552</b>	<b>158</b>	<b>69</b>	<b>132</b>	<b>19</b>	<b>24,186</b>
Okanogan River direct.....	1	3	39	45	24	25	4	8	2,211
Salmon Creek.....	1	3	15	143	32	3	67	5	16,550
Other tributaries of Okanogan River.....	10	5	70	364	102	41	61	6	5,376
<b>Methow River.....</b>	<b>52</b>	<b>11</b>	<b>166</b>	<b>1,230</b>	<b>231</b>	<b>59</b>	<b>45</b>	<b>19</b>	<b>209</b>
Entiat River.....	5	1	32	85	41	.....	.....	.....	.....
Wanatchee River.....	41	6	87	553	195	66	18	8	2,000
Crab Creek.....	24	9	87	100	34	18	9	10	4,501
<b>Yakima River and tributaries.....</b>	<b>105</b>	<b>10</b>	<b>459</b>	<b>7,486</b>	<b>1,070</b>	<b>477</b>	<b>1,156</b>	<b>10</b>	<b>423,810</b>
Yakima River direct.....	12	7	88	4,823	473	446	1,079	7	423,800
Wilson Creek.....	.....	.....	50	163	62	6	5	1	10
Naches River.....	2	.....	63	724	113	7	21	.....	.....
Ahtanum River.....	10	.....	49	180	82	3	1	.....	.....
Other tributaries of Yakima River.....	61	3	209	1,596	340	15	50	2	.....
<b>Snake River and tributaries.....</b>	<b>3,598</b>	<b>304</b>	<b>6,510</b>	<b>89,418</b>	<b>12,728</b>	<b>5,722</b>	<b>6,188</b>	<b>321</b>	<b>4,832,921</b>
Snake River direct.....	60	11	206	19,056	998	1,459	2,443	12	2,641,746
Gros Ventre River.....	20	.....	29	118	64	1	1	.....	.....
Little Gros Ventre.....	14	.....	32	103	50	.....	.....	.....	.....
Salt River.....	50	2	169	1,355	297	116	54	1	80
Henry's Fork.....	526	25	274	12,693	750	340	437	20	8,462
South Fork of Snake River.....	112	7	146	8,609	431	161	620	7	15,332
Blackfoot River.....	43	3	45	1,214	182	136	172	3	200,060
Fort Neuf River.....	101	7	149	1,274	345	58	76	10	59,228
Raft River.....	101	2	99	642	133	42	30	.....	.....
Goose Creek.....	35	.....	3	100	100	35	70	3	39,000
Salmon Falls River.....	40	6	48	1,857	102	56	250	6	206,000
Little Wood River.....	83	9	107	1,893	234	22	7	2	40,000
Big Wood River.....	188	15	234	4,765	421	108	443	13	191,993
Bruneau River.....	141	18	171	826	204	140	58	12	10,772
Owyhee River.....	348	27	432	2,508	573	188	106	25	27,296
Boise River.....	70	14	198	6,669	801	744	191	18	573,203
Malheur River.....	256	34	350	2,022	540	92	84	31	368,446
Payette River.....	51	12	267	4,450	645	63	140	17	63,284
Weiser River.....	30	9	134	1,822	369	81	89	10	95,796
Burnt River.....	213	8	318	781	400	20	14	14	12,331
Powder River.....	291	19	651	3,754	1,133	287	202	37	13,484
Pine Creek.....	51	4	83	176	107	7	18	3	10,350
Imnaha River.....	34	1	86	102	73	16	13	1	200
Salmon River.....	363	13	980	4,747	1,423	898	270	14	2,183
Grande Ronde River.....	207	19	482	1,894	491	329	138	6	206,230
Clearwater River.....	2	2	13	69	23	8	1	6	4
Asotin Creek.....	2	1	1	1	.....	1	.....	1	100
Pataha River.....	10	.....	33	377	24	31	1	1	.....
Palouse River.....	13	5	21	219	31	42	11	2	4
Other tributaries of Snake River.....	443	32	749	5,322	1,764	241	249	46	56,740
<b>Independent streams in Snake River Basin.....</b>	<b>303</b>	<b>17</b>	<b>429</b>	<b>6,428</b>	<b>867</b>	<b>490</b>	<b>288</b>	<b>14</b>	<b>144,312</b>
Camas Creek.....	81	6	97	3,042	165	159	112	5	65,179
Beaver Creek.....	27	1	34	72	23	2	4	1	35
Medicine Lodge.....	62	1	72	266	61	137	44	2	412
Little Lost River.....	33	2	59	774	101	15	7	2	22,000
Big Lost River.....	98	7	160	2,237	491	183	119	4	56,688
Other independent streams.....	2	.....	7	37	26	4	.....	.....	.....
<b>Walla Walla River.....</b>	<b>236</b>	<b>14</b>	<b>412</b>	<b>1,453</b>	<b>1,205</b>	<b>1,905</b>	<b>150</b>	<b>8</b>	<b>15,000</b>
Klickitat River.....	19	.....	30	352	66	17	4	.....	.....
White Salmon River.....	19	3	28	478	99	21	15	3	.....
Umatilla River.....	139	10	229	2,007	318	201	143	4	54,700
Willow Creek.....	71	7	94	110	94	18	11	.....	.....
John Day River.....	504	8	670	1,052	655	151	52	10	39,236
Deschutes River.....	361	25	390	4,023	768	226	333	8	52,927
Hood River.....	34	5	72	435	88	86	132	5	13
Willamette River.....	15	.....	40	148	53	15	5	2	.....
Other tributaries of Columbia River.....	128	22	329	976	352	260	59	50	16,197

IRRIGATION.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Pacific Ocean streams, other than the Colorado and Columbia Rivers.....	2,231	469	6,928	100,804	13,835	8,450	10,304	2,771	1,815,714
Dungness River.....	6		7	570	36	75	82		
McDowell Creek.....									
Rogue River and tributaries.....	257	18	645	1,078	837	169	117	47	35,882
Rogue River direct.....	8		26	149	38	2	3	9	1
Little Butte Creek.....	18	2	58	161	108	86	50	3	5,350
Bear Creek.....	29	6	99	512	159	19	87	10	30,507
Evans Creek.....	22		34	66	41	11	8		
Applegate River.....	55	4	184	434	241	17	8	15	16
Illinois River.....	87	3	135	400	127	19	10	4	1
Other tributaries of Rogue River.....	48	3	129	256	123	16	6	6	7
Klamath River and tributaries.....	505	41	1,046	8,878	1,289	548	487	90	1,022,865
Klamath River direct.....	452	23	947	8,778	1,101	287	113	70	95,084
Lost River.....	8	13	30	1,889	71	113	232	14	925,823
Sprague River.....	9	5	15	212	34	6	8	6	1,388
Other tributaries of Klamath River.....	36		45	999	83	137	84		
Russian River.....	9	10	18	28	8	25	364	10	142
Sacramento River and tributaries.....	859	200	1,821	23,514	4,574	1,743	1,955	220	348,435
Sacramento River direct.....	6	3	192	5,803	585	559	693	24	285
Pit River.....	322	63	489	5,160	730	150	78	63	202,877
Cow Creek.....	40		64	367	118	30	23	1	
Cottonwood Creek.....	16	1	41	147	78	19	30	8	6,300
Battle Creek.....	26		71	358	114	17	4		
Stony Creek.....	44	5	63	1,590	81	22	130	4	51,001
Feather River.....	221	52	332	4,399	455	424	180	12	243
Yuba River.....	41	33	136	1,235	481	65	96	22	56,672
Cache Creek.....	6	3	20	1,197	87	30	115	4	181
American River.....	51	31	109	1,264	1,498	135	374	53	30,682
Other tributaries of Sacramento River.....	86	9	304	1,994	347	292	282	19	194
San Joaquin River and tributaries.....	299	85	1,452	55,628	5,995	4,394	6,904	1,419	329,522
San Joaquin River direct.....	23	2	176	11,431	1,237	1,203	2,103	120	1,937
Kern River.....	17	11	142	6,273	427	156	140	188	60,469
Tulare Lake.....	26		67	562	101	200	601	671	110,553
Tule River.....	44	2	115	2,465	426	209	155	118	523
Kaweah River.....	19	1	95	5,133	339	271	497	72	2,348
Kings River.....	27	5	128	17,194	892	465	981	67	6,116
Frasno River.....	5		7	814	5	6	107	19	263
Meroed River.....	17	1	159	2,171	478	597	290	9	8,019
Tuolumne River.....	17	15	110	5,834	626	835	907	12	86,007
Stanislaus River.....	12	13	59	1,444	190	143	813	17	42,526
Calaveras River.....	22	8	129	224	88	33	12	25	17
Mokelumne River.....	31	25	126	1,568	1,024	62	153	33	678
Cosumnes River.....	6		13	103	55	2	15	2	
Other tributaries of San Joaquin River.....	3	2	126	682	111	213	130	66	10,066
Tributaries of San Francisco Bay other than Sacramento and San Joaquin Rivers.....	26	9	78	381	45	149	40	44	235
Coyote Creek.....	6		6	24	5			3	1
Guadalupe River.....	8		12	371	21		20		
Other tributaries.....	12	9	60	86	19	145	20	41	234
Pajaro River.....	20	9	94	278	66	81	39	19	5,995
Salinas River.....	7	4	140	553	117	403	98	21	73
Santa Maria River.....	1	1	16	69	13	25	3	6	36
Santa Ynez River.....	9	8	18	227	10	10	4	16	2,502
Santa Clara River.....	15	3	38	191	49	56	30	30	2,741
Los Angeles River.....	11	3	79	268	81	191	78	164	4,950
San Gabriel River.....	18	1	54	3,940	89	81	47	129	7,163
Santa Ana River.....	39	12	123	2,096	302	139	34	139	3,514
San Diego River.....	4	2	11			5	4		
Other Pacific Ocean streams.....	157	54	286	2,212	324	381	128	352	18,904

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
<b>Total, states included.....</b>	<b>8, 878. 3</b>	<b>4, 608</b>	<b>935, 057</b>	<b>33, 094</b>	<b>16, 396, 549</b>	<b>29, 458</b>	<b>748, 971</b>	<b>33, 804</b>	<b>36, 275, 006</b>	<b>41</b>
<b>Missouri River and tributaries.....</b>	<b>59. 5</b>	<b>41</b>	<b>4, 271</b>	<b>385</b>	<b>171, 464</b>	<b>592</b>	<b>18, 329</b>	<b>689</b>	<b>800, 218</b>	<b>22</b>
Missouri River direct.....	4. 3					31	6, 602	45	168, 725	32
Jefferson River and tributaries.....	0. 1	2	2			3	135	4	4, 968	24
Jefferson River direct.....	0. 1					2	25	2	1, 968	24
Beaverhead River.....		1								
Boulder River.....						1	110	2	3, 000	24
Other tributaries of Jefferson River.....		1	2							
Gallatin River.....	0. 5					4	70	4	5, 329	16
Smith River.....						1	18	1	6, 000	9
Sun River.....	1. 2					15	326	20	20, 210	15
Teton River.....	0. 5	3	1, 000	1	10	8	130	8	13, 410	17
Marias River.....	1. 6			3	8, 000	22	623	22	37, 165	15
Judith River.....	2. 4			1	1, 500	8	72	16	10, 600	11
Musselshell River.....						10	178	12	16, 250	19
Milk River and tributaries.....	1. 2	1	50			22	377	23	24, 345	16
Milk River direct.....						4	70	4	2, 570	18
Other tributaries of Milk River.....	1. 2	1	50			18	307	19	21, 775	16
Yellowstone River and tributaries.....	13. 1	21	194	6	1, 005	101	3, 965	120	182, 508	25
Yellowstone River direct.....	2. 0	3	69			35	2, 801	45	127, 662	24
Clark Fork.....						2	10	2	470	8
Shields River.....				1	40					
Big Horn River and tributaries.....	10. 0	1		1	950	20	406	25	11, 800	38
Big Horn River direct.....	4. 5			1	950	16	357	20	8, 840	40
Popo Agie River.....	2. 0					1	3	1	175	12
Owl Creek.....	0. 1									
No Wood River.....	0. 2					1	26	1	1, 200	58
Shell Creek.....	0. 2									
Shoshone River.....	2. 5									
Little Horn River.....	0. 5									
Other tributaries of Big Horn River.....		1				2	20	3	1, 585	10
Tongue River and tributaries.....	0. 3			2		18	361	18	19, 275	18
Tongue River direct.....	0. 1					16	286	16	14, 575	15
Goose Creek.....						1	50	1	3, 000	38
Other tributaries of Tongue River.....	0. 2			2		1	25	1	1, 700	22
Powder River and tributaries.....	0. 3	17	125	2	15	15	570	19	14, 670	30
Powder River direct.....		15	119	1	10	11	245	15	14, 265	16
Clear Creek.....	0. 3					2	268	2	200	54
Other tributaries of Powder River.....		2	6	1	5	2	27	2	205	70
Other tributaries of Yellowstone River.....	0. 5					11	117	11	8, 631	12
Little Missouri River.....	0. 1					4	175	4	8, 000	32
Moran River.....	0. 3					3	60	3	1, 800	30
Cheyenne River and tributaries.....	7. 0	4	2, 750	2	2, 800	19	292	19	14, 041	
Cheyenne River direct.....	6. 8	4	2, 750	1	800	14	173	14	9, 550	16
North Fork (Belle Fourche).....				1	2, 000	4	103	4	3, 391	20
South Fork.....	0. 2					1	16	1	1, 100	10
White River.....	0. 4			2	2, 200	3	53	3	4, 000	35
Niobrara River.....	0. 1					1	8	1	480	8
Platte River and tributaries.....	50. 8	6	270	313	143, 904	282	3, 889	307	220, 040	22
Platte River direct.....				14	10, 551	13	180	14	14, 580	31
North Platte River and tributaries.....	3. 6	2	40	9	4, 330	26	410	34	24, 039	21
North Platte River direct.....	0. 7			2	3, 180	15	311	16	21, 002	22
Grand Encampment Creek.....	0. 1									
Spring Creek.....		1		2		1		1		
Medicine Bow River.....	1. 0			3		5	33	12	787	18
Muddy Creek.....	0. 5									
Box Elder Creek.....		1	40							
Laramie River and tributaries.....	0. 4			2	1, 150	3	6	3	1, 650	13
Laramie River direct.....	0. 3					1		1	500	10
North Laramie River.....				1	700	1		1	700	16
Chugwater Creek.....				1	450	1	6	1	450	
Other tributaries of Laramie River.....	0. 1									
Horse Creek.....	0. 1									
Other tributaries of North Platte River.....	0. 8					2	60	2	600	28
South Platte River and tributaries.....	46. 9	4	230	290	129, 023	233	3, 229	248	176, 680	21
South Platte River direct.....	9. 8	3	170	94	44, 302	78	1, 132	80	52, 662	22
Bear Creek.....	1. 0					1	7	5		40
Clear Creek.....	0. 1									
St. Vrain Creek.....	12. 7			1		4	100	4	1, 000	22
Big Thompson Creek.....	1. 9			1	1, 200	6	106	6	5, 831	17
Cache la Poudre River.....	17. 5	1	60	123	53, 643	107	1, 386	107	74, 943	21
Lone Tree Creek.....	0. 5			20	5, 968	13	172	20	10, 160	24
Big Beaver Creek.....				7	15, 250	4	65	6	15, 250	26
Lodgepole Creek.....				3	2, 835	5	90	5	8, 567	11
Other tributaries of South Platte River.....	3. 4			41	4, 825	15	171	15	8, 267	26
Loup River.....	0. 3					7	49	7	4, 280	17
Other tributaries of Platte River.....						3	21	4	461	30
Kansas River and tributaries.....	2. 5			45	10, 600	22	844	37	39, 903	30
Republican River.....	2. 0			14	8, 500	13	491	13	32, 703	33
Smoky Hill River.....	0. 1			31	2, 100	6	303	21	5, 350	29
Big Blue River.....	0. 4					2	30	2	1, 000	18
Other tributaries of Kansas River.....						1	20	1	850	25
Other tributaries of Missouri River.....	3. 4	4	5	12	1, 445	34	512	40	22, 444	18

IRRIGATION.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Mississippi River and tributaries, exclusive of Missouri River.....	148.3	27	8,340	2,085	1,576,840	1,539	79,799	1,715	2,227,441	48
Mississippi River direct.....	6.2					67	2,846	74	102,500	12
Arkansas River and tributaries.....	140.9	24	3,640	1,354	934,452	768	34,404	872	1,119,743	42
Arkansas River direct.....	13.8	2	316	572	641,744	503	27,148	526	798,295	47
Fountain River.....	11.7	3	30	19	7,700	8	126	8	8,200	21
St. Charles River.....	0.4			3	616	2	16	2	475	32
Huerfano River.....	4.5			11	2,070	6	36	6	2,045	40
Apishapa River.....	0.3			1	144	1	20	1	144	14
Purgatoire or Las Animas River.....	0.1					1	7	1	500	7
Canadian River and tributaries.....	19.0			20	6,417	21	259	26	6,663	79
Canadian River direct.....	4.2			15	3,106	15	193	19	5,141	88
Cimarron River.....	4.8					1	10	1	1,500	22
Vermilion River.....	1.1			2		1	50	2		100
Ocate Creek.....	1.5									
Mora River.....				1	3,300	2	5	2	10	35
Other tributaries of Canadian River.....	7.4			2	11	2	1	2	12	72
Cimarron River.....	0.2	6	500	12	5,321	19	221	11	4,817	26
Other tributaries of Arkansas River.....	90.9	18	2,795	716	270,641	216	6,573	291	298,604	29
Red River and tributaries.....		3	2,600	49	48,950	63	3,444	67	55,780	76
St. Francis River.....				56	73,050	52	2,223	64	78,450	31
White River.....				636	820,388	584	30,537	633	858,693	50
Osachita River.....	0.4									
Other tributaries of Mississippi River.....	0.8					5	285	5	22,300	15
Gulf streams, other than Mississippi River and Rio Grande.....	158.9	127	57,009	1,615	2,072,580	2,335	126,953	2,208	2,308,748	27
Atchafalaya River and tributaries.....	42.2	1		42	59,980	105	4,070	171	230,675	19
Vermilion River and tributaries.....		2	425	82	67,007	136	7,052	223	694,044	29
Mermentau River and tributaries.....	0.1			594	1,209,750	800	56,300	1,293	2,927,213	35
Calcasieu Lake, River, and tributaries.....	0.4	5	5,800	92	243,400	128	13,933	161	937,294	30
Sabine River and tributaries.....				2	27,500	12	2,905	22	241,500	20
Neches River.....						6	5,850	23	1,929,500	24
Trinity River.....	1.5					11	7,688	20	445,100	34
Brazos River.....	2.2	2	3,500	150	136,322	160	6,276	176	153,585	33
Colorado River.....	8.5	2	5,400	57	30,667	311	13,500	359	912,048	30
San Antonio River.....	10.9	25	15,465	43	12,864	77	1,438	80	31,039	39
Nueces River.....	92.6	81	26,065	276	72,937	321	6,533	342	160,472	47
Other Gulf streams.....	0.5	7	354	278	212,143	262	11,408	340	540,278	42
Rio Grande and tributaries.....	81.5	1,015	401,081	416	239,199	523	28,867	617	2,670,157	39
Rio Grande direct.....	42.8	329	13,595	31	13,381	124	22,115	202	2,398,079	46
Saguache River.....		23	2,672	1		1		1		
San Luis River.....	0.2	22	175							
Alamosa River.....	0.1	8	207							
Conejos River.....	0.1	1	20							
Trinchera River.....	4.0									
Rio Santa Cruz.....	0.1									
Rio Puerco.....						1		1		26
Pecos River and tributaries.....	18.8	563	384,325	287	174,938	282	5,174	309	221,289	31
Pecos River direct.....	6.1	300	207,465	138	92,107	144	3,098	159	124,701	34
Gallinas River.....	0.5			1	3	1		1	3	75
Hondo River.....	11.0	176	125,606	79	46,585	74	1,041	79	57,275	21
Penasco River.....	0.5	31	30,132	10	7,210	11	216	11	9,000	29
Other tributaries of Pecos River.....	0.7	56	21,122	59	29,033	52	819	59	30,310	36
Las Moras Creek.....						1	6	1	250	20
Other tributaries of Rio Grande.....	15.4	9	87	97	50,890	103	1,572	103	50,529	53
Independent streams in Rio Grande drainage basin.....	8.3	1	75	37	46,944	39	2,074	38	48,779	67
Rio Mimbres.....	1.1	1	75	35	46,825	35	2,065	30	46,660	57
Fresno River.....	7.7			2	119	3	9	2	119	68
Rio Tularosa.....										
Colorado River and tributaries.....	168.5	370	24,087	803	974,353	621	24,194	631	1,066,394	43
Colorado River direct.....	0.4			4	1,650	9	437	12	62,300	23
Green River and tributaries.....	1.5	2		1	1,350	18	647	23	44,920	16
Green River direct.....	0.4			1	1,350	10	559	14	13,085	29
Bitter Creek.....		2								
Duchesne River.....						1		2	27,000	70
Price River.....	0.6									
Yampa River and tributaries.....	0.3					4	48	4	3,200	15
Yampa River direct.....						4	48	4	3,200	15
Little Snake River.....	0.1									
Other tributaries of Yampa River.....	0.2									
White River.....	0.2					1	10	1	900	10
Other tributaries of Green River.....						2	30	2	735	17
Grand River and tributaries.....	45.9	1				38	3,728	46	40,663	27
Grand River direct.....	12.5					18	2,872	24	32,882	29
Muddy Creek.....	0.1									
Bhus River.....	1.3									
Eagle River.....	5.2									
Roaring Fork.....	0.3					2	33	2	1,000	58
Plateau Creek.....	0.1									

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Colorado River and tributaries—Continued.										
Grand River and tributaries—Continued.										
Gunnison River and tributaries.....	18.1					17	822	19	6,806	22
Gunnison River direct.....	1.0					13	759	15	5,706	20
Tomichi Creek.....	0.4									
North Fork River.....	2.8					1	8	1	300	14
Smith Fork River.....	5.1									
Uncompahgre River.....	4.5					1	40	1		53
Other tributaries of Gunnison River.....	4.8					2	15	2	800	16
Rio Dolores.....	1.2					1	1	1		15
Other tributaries of Grand River.....	7.2	1								
Fremont River.....	1.0									
Virgin River.....	7.6	4	106	8	1,730	9	75	10	3,145	39
San Juan River and tributaries.....	7.2	10	1,035	1		4	27	4	1,200	128
San Juan River direct.....	7.1	2	90			2	22	2	1,200	85
Los Pinos River.....	0.1									
Animas River.....		4	100							
Other tributaries of San Juan River.....		4	845	1		2	5	2		170
Kanab Wash.....	1.8									
Williams River.....	10.1			5	2,015	6	39	8	2,560	20
Little Colorado River and tributaries.....		2		2	1,000	1	1	2	1,000	30
Little Colorado River direct.....		2								
Tributaries of Little Colorado River.....				2	1,000	1	1	2	1,000	30
Gila River and tributaries.....	90.4	298	14,044	774	965,338	527	19,091	767	890,248	45
Gila River direct.....	1.8			78	78,531	80	2,382	84	92,581	34
San Francisco River.....	1.4			4	225	12	70	13	6,110	19
San Pedro River.....	5.1	138	5,195	25	11,474	27	285	29	12,949	30
Santa Cruz River.....	85.0			385	576,234	241	8,073	366	528,649	44
Salt River and tributaries.....	4.8	1		132	150,874	75	2,653	124	153,184	68
Salt River direct.....	1.5			72	75,319	14	629	60	75,719	54
Tonto Creek.....				1	500	2	25	2	1,500	16
Rio Verde.....	1.8	1		3		11	96	11	1,070	63
Other tributaries of Salt River.....	1.0			56	75,055	48	1,903	51	74,895	75
Agua Fria River.....	34.3	1		114	120,685	41	4,749	100	68,575	47
Hessayampa River.....	4.1			15	6,420	13	204	13	5,810	35
Other tributaries of Gila River.....	4.9	163	8,849	41	20,985	38	675	38	22,390	48
Other tributaries of Colorado River.....	3.1	53	18,572	8	1,175	9	99	9	3,333	32
Whitewater Draw and tributaries.....	5.1	10	503	209	72,787	198	3,403	209	73,967	44
Great Basin Drainage.....	945.5	1,861	168,497	1,431	461,393	1,173	27,861	1,270	1,238,708	46
Tributaries of Great Salt Lake.....	108.9	452	42,248	68	16,067	144	10,490	175	701,180	37
Bear River and tributaries.....	23.3	171	12,635	57	11,597	104	3,016	111	118,285	40
Bear River direct.....	7.7			2	902	29	2,208	32	80,025	37
Little Bear River.....	2.0	20	3,025			4	50	4	3,740	18
Malad River.....		2	219							
Little Malad Creek.....		57	7,468							
Other tributaries of Bear River.....	13.6	83	1,923	55	10,695	71	758	75	34,520	42
Weber River and tributaries.....	8.2	33	1,358	6	1,640	23	232	25	27,145	16
Weber River direct.....	1.3	12	388			9	106	10	6,615	14
Ogden River.....	1.8	9	320	1	230	1	7	1	230	33
Other tributaries of Weber River.....	5.1	12	650	5	1,410	13	119	14	20,300	17
Jordan River and Utah Lake and tributaries.....	77.4	248	28,255	5	2,830	17	7,242	39	555,730	38
Jordan River direct.....	0.5	9	130			5	4,300	20	885,500	19
Spanish Fork River.....	9.8	21	1,390							
Hobble Creek.....		18	766	1		1	6	1		14
Provo River.....	1.2	61	11,716	1	830	1	20	1	900	45
American Fork River.....	2.2	27	2,665	1	900	3	23	3	1,830	21
Big Cottonwood Creek.....	2.0	9	92			1	1	1	500	25
Other tributaries of Jordan River and Utah Lake.....	61.9	108	11,496	2	1,100	6	2,822	18	164,000	65
Independent streams.....	836.6	1,409	123,249	1,363	445,326	1,020	16,871	1,095	535,546	48
Sevier River and tributaries.....	9.0	258	38,863	3	178	8	117	10	18,318	30
Sevier River direct.....	1.9	184	27,127			1		2	11,250	
San Pitch River.....	3.4	16	3	1	150	1	5	1	450	4
Otter Creek.....		6	112							
Other tributaries of Sevier River.....	3.7	52	11,621	2	28	6	112	7	6,618	35
Beaver River.....	1.5	1		11	3,810	9	91	9	4,010	21
Coal Creek.....	0.7	135	9,955	41	10,500	20	370	24	10,400	47
Grouse Creek.....				1	265	1	6	3	265	240
Humboldt River and tributaries.....	15.7	12	805	18	2,540	18	71	19	22,495	30
Humboldt River direct.....	2.0	2		8	1,495	8	34	8	2,345	32
East Fork of Humboldt River.....		1		1	25	1		1	25	12
North Fork of Humboldt River.....	0.4			1		1	8	1		30
South Fork of Humboldt River.....				1	100	1	5	1	100	12
Pino Creek.....				1	10	1	10	1	10	
Reese River.....		4	190	4		3		3		
Other tributaries of Humboldt River.....	13.3	6	615	2	910	3	14	4	20,015	39
Truckee River and tributaries.....	0.9			1	250	1	6	1	250	6
Truckee River direct.....	0.7									
Tributaries of Truckee River.....	0.2			1	250	1	6	1	250	8



# IRRIGATION.

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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
<b>Great Basin Drainage—Continued.</b>										
<b>Independent streams—Continued.</b>										
Carson River and tributaries.....	4.6	3	22	1	50	12	134	13	1,660	12
Carson River direct.....	1.1			1	50	4	53	4	50	13
Tributaries of Carson River.....	3.5	3	22			8	81	9	1,600	11
Walker River and tributaries.....		26	242	71	5	2	2	2		10
Walker River direct.....		17	240	70	5	2	2	2		10
Tributaries of Walker River.....		9	2	1						
Duck Creek.....	0.1	2	794	6	2,285	5	56	8	2,465	20
Staptes Creek.....				4	503	4	17	4	1,203	23
Long Valley Creek.....	2.1			1	480	3	9	3	1,180	17
Susan River.....	2.0			1	75	4	34	4	3,400	23
Mohave River.....	28.8	31	4,874	88	45,477	98	2,145	86	45,960	80
Owens River.....	388.5	23	537	9	4,088	12	137	12	4,556	24
San Jacinto River.....	145.0	9	115	236	66,833	183	3,546	203	76,386	73
Whitewater River.....	77.5	242	36,800	325	121,466	235	3,212	247	126,356	41
Quinn River.....				10	50	3	4	5		25
Deep Creek (Oregon).....		1				1	6	2	1,000	10
Donner and Blitzen River.....		1	10					1		16
Silver Creek.....		1	2	2	450	3	6	3	550	15
Silvies River.....				2	1,200	2	26	2	1,265	22
Other independent streams.....	160.2	664	30,170	532	185,021	416	6,976	484	213,775	40
<b>Columbia River and tributaries.....</b>	<b>1,125.2</b>	<b>176</b>	<b>27,135</b>	<b>782</b>	<b>377,555</b>	<b>1,547</b>	<b>62,451</b>	<b>1,745</b>	<b>2,523,910</b>	<b>50</b>
Columbia River direct.....	164.7	8	4,390	175	58,401	334	6,493	359	233,881	66
Kootenai River.....	3.6	2	30			1		1	5	10
Clark Fork and tributaries.....	27.8	11	3,333	3	80	27	283	27	12,447	32
Clark Fork direct.....	2.5									
Missoula River and tributaries.....	17.2	1	2,250	3	80	11	106	11	3,282	24
Missoula River direct.....	3.8			2		6	52	6	1,096	29
Hellgate River.....	3.2	1	2,250	1	80	2	10	2	130	29
Big Blackfoot River.....	0.4					1	16	1	650	12
Bitter Root River.....	3.4					1	12	1	1,406	7
Other tributaries of Missoula River.....	0.4					1	16	1		
Flathead River.....	8.1	10	1,083			16	177	16	9,165	37
Colville River.....	14.6			1	40	5	23	5	8,450	55
Spokane River and tributaries.....	163.5			47	58,504	89	4,468	104	118,684	77
Spokane River direct.....	132.7			47	58,504	83	3,476	93	68,643	79
Coeur d'Alene Lake and River.....	30.8					6	932	11	50,041	51
Okanogan River and tributaries.....	20.9			48	13,278	111	1,599	119	47,993	40
Okanogan River direct.....	14.9			44	12,428	97	930	104	33,258	40
Salmon Creek.....	0.6					5	607	6	7,385	58
Other tributaries of Okanogan River.....	5.4			4	850	9	82	9	2,350	26
Methow River.....	4.8	1		2	115	9	44	9	1,318	56
Entiat River.....	1.5					4	18	4	310	56
Wenatchee River.....	25.0			7	1,300	40	337	38	21,114	67
Crab Creek.....	34.9	3	60	111	36,285	137	2,321	147	66,270	65
Yakima River and tributaries.....	161.1	3	285	45	9,680	74	3,492	87	78,975	38
Yakima River direct.....	154.6	3	285	41	7,870	66	3,447	78	75,715	39
Wilson Creek.....	1.0									
Naches River.....	4.1			1	335	2	8	3	1,285	55
Ahtanum River.....				1	125	1	2	1	125	18
Other tributaries of Yakima River.....	1.4			2	1,350	5	35	5	1,850	18
<b>Snake River and tributaries.....</b>	<b>261.6</b>	<b>105</b>	<b>9,867</b>	<b>180</b>	<b>40,957</b>	<b>362</b>	<b>39,327</b>	<b>469</b>	<b>1,661,834</b>	<b>30</b>
Snake River direct.....	81.4	10	860	40	13,855	124	32,689	225	1,340,211	39
Henry's Fork.....	0.8									
Blackfoot River.....	1.1									
Port Neuf River.....	2.8					1	18	1		20
Salmon Falls River.....	0.1	3	1,900			1	6	1	440	15
Little Wood River.....	0.2			1	2,500	1	2	1	50	10
Big Wood River.....	7.0					4	30	4	4,000	19
Bruneau River.....	0.8	38	1,626	1	27	6	457	7	27,465	24
Owyhee River.....	2.5	4	787	3	265	61	1,318	61	60,503	28
Boise River.....	30.5	8	75	2	900	9	324	10	9,650	30
Malheur River.....	2.0			2	60	10	521	10	30,010	17
Payette River.....	5.2	1	36	3	9,000	11	608	13	18,256	28
Weiser River.....	15.1					3	620	5	31,100	76
Burnt River.....	1.0					3	24	3	965	17
Powder River.....	7.9	8	315	13	4,780	14	1,601	14	69,132	33
Imnaha River.....	0.1					4	23	4	500	40
Salmon River.....	1.9					2	38	2	10,875	56
Grande Ronde River.....	1.1			20	4,203	35	189	35	10,743	12
Clearwater River.....	35.9			28	2,750	33	384	38	9,945	21
Asotin Creek.....	48.0									
Pataha River.....	1.0			2	350	3	37	3	3,250	52
Palouse River.....	1.4	8	1,100			2	40	3	4,400	16
Other tributaries of Snake River.....	13.8	25	3,166	15	2,267	25	388	31	10,339	25

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
<b>Columbia River and tributaries—Continued.</b>										
Independent streams in Snake River Basin.....	2.4					9	328	9	96,250	8
Camas Creek.....	0.4					9	328	9	96,250	8
Medicine Lodge.....	1.9									
Little Lost River.....	0.1									
Big Lost River.....	0.1									
Walla Walla River.....	80.0	24	6,080	124	51,835	143	1,148	155	40,265	24
Klickitat River.....	2.5					5	26	5	3,875	28
White Salmon River.....	2.5			2	24	4	42	4	320	83
Umatilla River.....	14.3	2		6	171	13	115	13	4,246	34
Willow Creek.....	0.3					1	2	1	200	12
John Day River.....	5.7			6	475	45	413	47	41,280	25
Deschutes River.....	8.5			3	386	22	764	26	36,564	38
Hood River.....	38.6	3	10	1	17	5	36	5	755	70
Willamette River.....	3.2			15	1,369	30	220	32	7,813	24
Other tributaries of Columbia River.....	82.2	4	3,080	28	4,638	77	954	79	40,061	88
<b>Pacific Ocean streams, other than the Colorado and Columbia Rivers.</b>										
	6,147.0	978	239,189	34,311	10,203,539	20,841	372,600	23,378	16,414,755	41
Dungeness River.....	1.0									
McDowell Creek.....	3.1									
Rogue River and tributaries.....	20.5	3	10,000	23	11,499	102	723	111	38,147	26
Rogue River direct.....	7.1			11	6,964	44	347	44	16,597	30
Little Butte Creek.....	0.8					1	9	1		23
Bear River.....	6.3			9	1,133	28	120	36	8,138	23
Evans Creek.....	0.5					5	77	5	1,175	29
Applegate River.....	2.1					8	93	8	3,200	26
Illinois River.....	1.0			2	402	7	32	8	3,067	11
Other tributaries of Rogue River.....	2.7	3	10,000	1	3,000	9	45	9	5,970	25
Klamath River and tributaries.....	22.1	4	35	16	5,975	74	3,996	83	174,184	25
Klamath River direct.....	20.8	3		14	4,375	57	3,138	62	142,484	28
Lost River.....	0.6			2	1,600	14	786	16	21,100	22
Other tributaries of Klamath River.....	0.7	1	35			3	62	5	10,600	30
Russian River.....	27.2	1		89	30,224	128	1,058	128	51,239	23
Sacramento River and tributaries.....	361.2	36	2,957	3,508	1,473,602	3,430	64,163	3,898	4,184,240	26
Sacramento River direct.....	61.2			514	279,458	655	28,625	807	2,616,658	24
Pit River.....	2.9	14	693	4	395	26	440	36	32,888	18
Cow Creek.....	0.4					11	87	11	8,955	14
Cottonwood Creek.....	0.6					9	100	10	7,565	33
Battle Creek.....	0.3			2	750	3	63	4	3,300	25
Stony Creek.....	17.5			68	40,451	61	759	66	45,959	26
Feather River.....	117.3	9	1,284	845	341,583	728	8,425	828	394,677	22
Yuba River.....	6.2	2	30	8	2,725	9	1,572	11	2,751	35
Cacho Creek.....	0.4			144	91,211	75	1,524	76	92,391	24
American River.....	77.8			183	93,894	172	2,358	190	95,838	28
Other tributaries of Sacramento River.....	76.6	11	950	1,760	623,337	1,671	20,210	1,859	883,260	30
San Joaquin River and tributaries.....	1,396.6	145	48,828	11,149	4,911,280	9,973	138,911	10,951	7,400,131	34
San Joaquin River direct.....	184.8	49	15,155	1,531	668,420	1,481	30,086	1,639	1,295,475	25
Kern River.....	83.1	17	13,850	441	219,674	384	6,676	405	223,606	47
Tulare Lake.....	261.9	24	8,253	1,100	434,565	906	12,841	1,069	1,330,434	59
Tule River.....	162.7	2	251	1,148	493,272	974	11,329	1,083	985,319	45
Kaweah River.....	269.7	3	17	2,136	842,085	1,734	21,932	1,930	876,254	41
Kings River.....	239.3	34	10,000	2,547	1,183,710	2,283	25,426	2,397	1,225,607	28
Fresno River.....	6.3	1	200	145	79,255	134	1,520	144	82,738	33
Merced River.....	5.2	1	75	216	120,466	213	2,774	235	157,865	21
Tuolumne River.....	14.4	1	400	63	53,880	66	1,231	69	59,360	33
Stanislaus River.....	41.0			34	26,490	36	1,158	41	73,140	26
Calaveras River.....	29.4	6	220	565	189,181	544	4,358	585	200,337	26
Mokelumne River.....	82.2	2	25	709	356,156	694	8,309	785	451,434	33
Cosumnes River.....	5.5			117	50,870	111	1,788	131	84,740	28
Other tributaries of San Joaquin River.....	11.1	5	382	399	193,267	413	7,483	458	343,822	28
<b>Tributaries of San Francisco Bay other than Sacramento and San Joaquin Rivers.</b>										
	264.6	74	13,075	2,451	708,510	1,897	36,219	2,102	862,987	55
Coyote Creek.....	60.2	14	3,450	821	246,483	657	12,407	725	312,320	50
Guadalupe River.....	90.3	61	7,700	725	242,912	512	13,480	572	278,231	67
Other tributaries.....	105.1	9	1,925	905	216,115	728	10,332	806	272,446	50
Pajaro River.....	83.2	17	2,000	688	186,255	370	7,083	417	203,845	35
Salinas River.....	169.6	18	3,808	697	422,195	239	10,085	286	424,002	25
Santa Maria River.....	28.9	13	2,700	118	66,393	62	2,934	78	204,534	47
Santa Ynez River.....	28.7	7	1,510	60	16,401	61	1,611	84	199,630	30
Santa Clara River.....	154.0	1	700	136	92,049	125	5,126	161	102,184	67
Los Angeles River.....	628.2	45	24,963	849	443,036	745	16,268	825	458,932	52
San Gabriel River.....	832.9	180	28,363	1,034	557,934	825	25,675	951	579,153	72
Santa Ana River.....	924.5	360	62,663	1,816	1,002,743	1,523	45,345	1,836	1,048,090	61
San Diego River.....	145.2	1	8	533	54,216	319	2,313	374	65,462	56
Other Pacific Ocean streams.....	1,155.5	93	37,649	1,144	224,207	968	13,150	1,093	417,995	59

# IRRIGATION.

## CROPS.

**TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATES INCLUDED: 1919 AND 1909.**

[Totals for the states included, used in making comparisons, are reported in the state bulletins on agriculture.]

	CROP.	AREA HARVESTED.				Per cent of increase. <sup>1</sup>	QUANTITY HARVESTED.					
		1919		1909			Unit.	1919		1909		Per cent of increase. <sup>1</sup>
		Acres.	Per cent of total for states included.	Acres.	Per cent of total for states included.			Amount.	Per cent of total for states included.	Amount.	Per cent of total for states included.	
1	<b>Cereals:</b>											
2	Corn.....	263,312	1.2	123,560	0.5	97.1	Bu.....	7,525,354	1.6	3,168,973	0.6	137.5
3	Oats.....	325,523	2.7	739,632	7.4	-56.0	Bu.....	9,361,125	2.9	27,213,262	9.8	-65.6
4	Winter wheat.....	381,127	1.4	548,173	2.1	120.6	Bu.....	7,115,303	1.8	14,045,117	3.6	76.5
5	Spring wheat.....	877,411	5.0				Bu.....	17,679,328	12.2			
6	Barley.....	280,287	6.9	239,928	5.4	16.8	Bu.....	7,202,430	9.8	6,985,841	7.2	3.1
7	Rye.....	19,014	0.5	5,986	2.9	217.6	Bu.....	168,977	0.6	95,685	3.9	76.2
8	Kafir, milo, etc.....	152,768	4.2	( <sup>2</sup> )			Bu.....	4,100,338	5.7	( <sup>2</sup> )		
9	Rough rice <sup>3</sup> .....	892,761	99.7	( <sup>2</sup> )			Bu.....	35,032,275	99.9	( <sup>2</sup> )		
10	<b>Other grains and seeds:</b>											
11	Clover and alfalfa seed <sup>4</sup> .....	39,431	25.0	31,946	28.1	23.4	Bu.....	161,587	48.7	104,610	39.9	54.5
12	Dry beans, navy, etc.....	177,762	24.8	17,798	9.1	898.7	Bu.....	2,862,567	34.0	314,271	8.8	810.9
13	Dry peas, Canada.....	51,464	33.0	18,422	20.2	179.4	Bu.....	637,560	38.0	254,219	32.0	150.7
14	<b>Hay and forage:</b>											
15	Timothy alone.....	140,607	16.5	202,763	18.8	-30.7	Tons.....	178,112	18.7	349,920	23.8	-49.1
16	Timothy and clover mixed.....	392,260	40.8	183,308	14.5	114.0	Tons.....	569,591	40.1	333,851	17.0	70.6
17	Clover alone.....	40,879	17.7	20,001	10.4	104.4	Tons.....	63,465	17.6	46,472	14.9	35.6
18	Alfalfa.....	3,151,675	42.2	2,216,628	50.1	42.2	Tons.....	8,430,766	51.6	6,524,498	58.3	29.2
19	Other tame grasses.....	254,313	15.9	219,035	14.1	16.1	Tons.....	316,803	15.2	335,977	16.4	-5.7
20	Wild, salt, or prairie grasses.....	1,034,507	7.8	1,530,669	11.7	32.4	Tons.....	951,345	8.7	1,627,804	12.5	-41.6
21	Small grains cut for hay.....	291,697	7.0	208,634	7.4	39.8	Tons.....	372,739	8.5	305,050	8.4	22.2
22	Annual legumes cut for hay.....	19,851	9.8	( <sup>5</sup> )			Tons.....	28,334	11.4	( <sup>5</sup> )		
23	Silage crops.....	56,424	9.2	( <sup>5</sup> )			Tons.....	388,830	13.3	( <sup>5</sup> )		
24	Corn cut for forage.....	38,689	1.6	( <sup>5</sup> )			Tons.....	87,389	2.5	( <sup>5</sup> )		
25	Kafir, sorghum, etc., for forage.....	51,981	1.2	( <sup>5</sup> )			Tons.....	106,035	1.5	( <sup>5</sup> )		
26	Root crops for forage.....	2,631	9.4	( <sup>5</sup> )			Tons.....	19,543	6.5	( <sup>5</sup> )		
27	<b>Vegetables:</b>											
28	Potatoes.....	154,194	23.0	148,712	21.2	3.7	Bu.....	22,978,739	40.7	22,267,845	30.3	3.2
29	Cantaloupes and muskmelons.....	20,874	60.3	( <sup>5</sup> )								
30	Tomatoes.....	20,649	41.6	( <sup>5</sup> )								
31	<b>Orchard fruits:</b>											
32	Grapes.....	<sup>6</sup> 73,675,084	46.7	( <sup>5</sup> )			Lbs.....	1,131,279,429	54.4	( <sup>5</sup> )		
33	Apples.....	<sup>6</sup> 9,085,326	35.2	( <sup>5</sup> )			Bu.....	22,406,308	44.0	( <sup>5</sup> )		
34	Peaches.....	<sup>6</sup> 7,062,092	35.6	( <sup>5</sup> )			Bu.....	13,224,500	47.2	( <sup>5</sup> )		
35	Pears.....	<sup>6</sup> 1,849,429	35.9	( <sup>5</sup> )			Bu.....	3,479,806	43.2	( <sup>5</sup> )		
36	Plums and prunes.....	<sup>6</sup> 4,306,976	29.7	( <sup>5</sup> )			Bu.....	7,074,240	40.9	( <sup>5</sup> )		
37	Cherries.....	<sup>6</sup> 667,907	22.5	( <sup>5</sup> )			Bu.....	578,354	29.9	( <sup>5</sup> )		
38	<b>Subtropical fruits:</b>											
39	Oranges.....	<sup>6</sup> 8,711,152	84.1	( <sup>5</sup> )			Boxes.....	18,774,366	86.4	( <sup>5</sup> )		
40	Lemons.....	<sup>6</sup> 2,299,716	79.6	( <sup>5</sup> )			Boxes.....	5,776,149	88.1	( <sup>5</sup> )		
41	<b>Miscellaneous:</b>											
42	Sugar beets grown for sugar.....	377,655	81.0	174,071	68.0	117.0	Tons.....	3,597,522	82.8	2,074,301	70.5	72.0
43	Cotton.....	214,576	1.5	( <sup>5</sup> )			Bales.....	113,682	2.8	( <sup>5</sup> )		

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not reported separately in 1909.  
<sup>3</sup> Quantity harvested and value given for irrigated land were not tabulated separately. The totals given include small amounts representing rice grown without irrigation.  
<sup>4</sup> Not including red clover seed.  
<sup>5</sup> Number of vines of bearing age.  
<sup>6</sup> Number of trees of bearing age.

## AGRICULTURE.

## CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATES INCLUDED: 1919 AND 1909—Continued.

[Totals for the states included, used in making comparisons, are reported in the state bulletins on agriculture.]

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.					
	Unit.	For states included.	On nonirrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>	
				Average.	Per cent of average for states included.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for states included.	Amount.	Per cent of total for states included.		
<b>Cereals:</b>												
1	Corn.....	Bu.....	21.9	21.8	28.6	130.6	131.2	\$11,652,813	1.8	\$2,421,420	0.8	383.1
2	Oats.....	Bu.....	28.5	28.5	28.8	108.7	108.7	9,534,495	3.7	14,055,424	12.4	-32.2
3	Winter wheat.....	Bu.....	14.1	14.1	18.7	132.6	132.6	15,269,840	1.9	12,839,582	3.5	311.4
4	Spring wheat.....	Bu.....	8.2	7.6	20.1	245.1	264.5	37,556,853	11.4			
5	Barley.....	Bu.....	17.9	17.3	25.7	143.6	148.6	10,775,076	11.2	4,395,928	8.4	145.1
6	Rye.....	Bu.....	7.4	7.4	8.9	120.3	120.3	295,987	0.7	70,065	4.4	322.4
7	Kafr, milo, etc.....	Bu.....	19.9	19.6	28.8	134.7	136.7	6,725,561	7.5	(?)		
8	Rough rice <sup>2</sup> .....	Bu.....	39.2	4.1	39.2	100.0	966.0	96,368,090	99.9	(?)		
<b>Other grains and seeds:</b>												
9	Clover and alfalfa seed <sup>3</sup> .....	Bu.....	21.0	1.4	4.1	19.5	292.9	3,461,762	46.8	765,775	37.5	352.1
10	Dry beans, navy, etc.....	Bu.....	11.8	10.3	16.1	136.4	156.3	12,986,298	34.6	570,193	8.3	249.6
11	Dry peas, Canada.....	Bu.....	10.8	10.0	12.4	114.8	124.0	2,042,455	36.6	358,568	29.3	469.6
<b>Hay and forage:</b>												
12	Timothy alone.....	Tons.....	1.12	1.09	1.27	113.4	116.5	4,582,905	23.0	3,210,820	26.2	42.7
13	Timothy and clover mixed.....	Tons.....	1.48	1.50	1.45	98.0	96.7	13,782,635	42.5	3,071,935	18.8	348.7
14	Clover alone.....	Tons.....	1.56	1.56	1.55	99.4	99.4	1,334,800	18.8	381,763	14.0	249.6
15	Alfalfa.....	Tons.....	2.19	1.84	2.68	122.4	145.7	186,391,209	54.0	50,850,633	59.6	266.5
16	Other tame grasses.....	Tons.....	1.31	1.32	1.25	95.4	94.7	6,473,377	17.4	2,584,968	17.5	152.4
17	Wild, salt, or prairie grasses.....	Tons.....	0.83	0.82	0.92	110.8	112.2	17,954,630	11.2	11,734,258	18.4	58.0
18	Small grains cut for hay.....	Tons.....	0.95	0.92	1.28	134.7	139.1	8,448,901	9.8	2,983,171	7.2	163.2
19	Annual legumes cut for hay.....	Tons.....	1.22	1.20	1.43	117.2	119.2	494,052	10.1	(?)		
20	Silage crops.....	Tons.....	4.75	4.54	6.89	145.1	151.8	3,831,525	14.6	(?)		
21	Corn cut for forage.....	Tons.....	1.52	1.51	2.38	156.6	157.6	1,121,730	2.8	(?)		
22	Kafr, sorghum, etc., for forage.....	Tons.....	1.69	1.68	2.04	120.7	121.4	1,614,325	1.6	(?)		
23	Root crops for forage.....	Tons.....	10.77	11.11	7.43	69.0	66.9	340,329	6.7	(?)		
<b>Vegetables:</b>												
24	Potatoes.....	Bu.....	84.3	64.9	149.0	176.7	229.6	50,778,993	40.3	8,965,658	27.1	466.4
25	Cantaloupes and muskmelons.....	Bu.....						3,853,037	66.6	(?)		
26	Tomatoes.....	Bu.....						2,701,968	39.1	(?)		
<b>Orchard fruits:</b>												
27	Grapes.....	Lbs.....	*13.2	*11.3	*15.4	116.7	136.3	36,304,252	53.8	(?)		
28	Apples.....	Bu.....	*2.0	*1.7	*2.5	125.0	147.1	24,568,584	28.6	(?)		
29	Peaches.....	Bu.....	*1.4	*1.2	*1.9	135.7	158.3	24,670,264	49.2	(?)		
30	Pears.....	Bu.....	*1.6	*1.4	*1.9	118.8	135.7	4,695,848	32.9	(?)		
31	Plums and prunes.....	Bu.....	*1.2	*1.0	*1.6	133.3	160.0	15,188,490	41.1	(?)		
32	Cherries.....	Bu.....	*0.7	*0.6	*0.9	126.6	150.0	2,139,891	29.4	(?)		
<b>Subtropical fruits:</b>												
33	Oranges.....	Boxes.....	*2.1	*1.8	*2.2	104.8	122.2	58,244,422	86.4	(?)		
34	Lemons.....	Boxes.....	*2.3	*1.8	*2.5	108.7	192.3	16,750,832	88.1	(?)		
<b>Miscellaneous:</b>												
35	Sugar beets grown for sugar.....	Tons.....	9.24	8.38	9.45	102.3	112.8	38,631,339	82.2	10,042,721	69.8	286.7
36	Cotton.....	Bales.....	0.28	0.28	0.53	189.3	189.3	30,457,881	4.3	(?)		

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.<sup>2</sup> Not reported separately in 1909.<sup>3</sup> Quantity harvested and value given for irrigated land were not tabulated separately. The totals given include small amounts representing rice grown without irrigation.<sup>4</sup> Not including red clover seed.<sup>5</sup> Yield per vine.<sup>6</sup> Yield per tree.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES.**

## ARIZONA.

	PRINCIPAL CROPS.											
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Kafir and milo.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.
<b>THE STATE.</b>												
Acres harvested.....	8,612	4,448	28,895	3,250	19,611	20,316	97,094	5,108	792	10,424	1,050	5,634
Production.....	1,205,909	1,136,227	1,682,332	1,86,378	1,600,52	1,609,333	7,323,052	9,555	1,081	14,457	1,096	35,130
Value.....dollars..	401,523	156,661	1,569,384	152,669	871,090	914,000	7,914,774	181,545	21,620	339,740	15,344	343,235
<b>ACRES HARVESTED.</b>												
<b>COUNTIES.</b>												
Apache.....	552	1,907	134	430	234	741	2,736	245	159	400	261	191
Cochise.....	1,010	36	128	.....	167	.....	2,583	481	.....	507	2	.....
Cocconino.....	62	22	.....	.....	.....	.....	478	2	.....	24	.....	.....
Gila.....	148	1	23	.....	2	.....	202	.....	.....	140	.....	.....
Graham.....	1,470	95	6,306	.....	3,845	61	11,830	67	.....	236	.....	359
Greenlee.....	1,286	386	208	139	223	80	1,607	128	20	144	6	82
Maricopa.....	1,481	1,192	15,123	1,767	12,121	15,515	57,360	2,957	145	2,430	124	3,962
Mohave.....	47	.....	22	42	55	.....	480	55	.....	93	.....	.....
Navajo.....	310	494	24	273	6	5	1,785	112	.....	257	147	43
Pima.....	510	.....	825	.....	57	208	1,586	267	180	2,112	.....	650
Pinal.....	425	2	6,107	115	2,419	1,204	6,339	141	228	1,950	.....	171
Santa Cruz.....	199	.....	.....	.....	3	.....	181	207	8	1,005	.....	152
Yavapai.....	1,050	291	13	119	395	313	8,140	290	3	770	486	24
Yuma.....	72	11	452	365	284	2,234	6,749	176	48	305	22	.....

	PRINCIPAL CROPS.											
	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Cantaloupes and muskmelons.	Watermelons.	Potatoes.	Clover and alfalfa seed.	Dry beans.	Cotton.	Grapes.	Apples.	Peaches.	Oranges.
<b>THE STATE.</b>												
Acres harvested.....	3,074	12,245	3,123	807	1,011	4,217	1,295	101,080	14,072	30,749	32,880	32,166
Production.....	7,461	23,183	.....	80,501	137,371	128,193	9,876	56,567	139,690	54,643	149,942	748,764
Value.....dollars..	82,071	347,745	428,855	80,501	93,428	592,053	46,417	19,176,213	8,381	131,143	127,352	195,056
<b>ACRES HARVESTED.</b>												
<b>COUNTIES.</b>												
Apache.....	216	99	46	60	40	.....	81	.....	.....	626	139	.....
Cochise.....	226	2,979	37	106	84	.....	406	.....	2,538	2,645	4,720	.....
Cocconino.....	183	.....	1	26	406	.....	1	.....	.....	770	488	.....
Gila.....	26	25	.....	2	.....	.....	5	.....	16	389	592	.....
Graham.....	74	113	4	20	16	.....	45	469	183	4,740	1,081	.....
Greenlee.....	79	121	11	20	24	.....	59	.....	.....	1,579	1,981	.....
Maricopa.....	1,482	5,092	2,846	402	87	1,231	52	72,296	9,910	5,928	13,092	32,152
Mohave.....	43	57	.....	.....	2	.....	3	.....	.....	527	441	.....
Navajo.....	191	45	2	6	64	18	12	.....	.....	175	20	.....
Pima.....	265	462	8	66	21	200	242	755	274	178	4,862	.....
Pinal.....	.....	1,743	167	32	5	.....	59	1,321	.....	4,950	2,071	20
Santa Cruz.....	23	295	.....	.....	.....	.....	260	.....	.....	.....	.....	.....
Yavapai.....	225	198	.....	16	261	.....	60	.....	108	8,217	3,016	.....
Yuma.....	31	1,016	1	51	1	2,768	10	26,239	634	25	407	24

1 Bushels.      2 Tons.      3 Number of vines.      4 Number of trees.      5 Bales.      6 Pounds.      7 Boxes.

## CALIFORNIA.

	PRINCIPAL CROPS.												
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Kafir, milo, etc.	Rough rice.	Clover and alfalfa seed.	Dry beans.	Dry peas.	Sugar-beet seed.	Flower and vegetable seeds.
<b>THE STATE.</b>													
Acres harvested.....	56,658	9,359	85,245	48,330	128,812	2,546	124,092	130,367	2,319	148,379	1,504	503	3,234
Production.....	1,904,828	260,878	1,630,603	1,717,649	3,299,308	20,294	3,253,711	6,926,313	9,702	2,459,350	24,850	138,000	2,056,510
Value.....dollars..	3,340,208	266,878	3,583,942	1,671,432	5,276,893	54,194	5,531,809	20,432,627	203,742	11,558,944	88,218	96,600	2,056,510
<b>ACRES HARVESTED.</b>													
<b>COUNTIES.</b>													
Alameda.....	6	.....	.....	.....	.....	.....	.....	.....	.....	10	.....	.....	.....
Alpine.....	.....	21	184	.....	10	.....	.....	.....	.....	.....	.....	.....	.....
Amador.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Butte.....	113	377	1,464	109	991	.....	107	24,007	.....	1,293	48	.....	.....
Calaveras.....	32	.....	.....	1	.....	.....	21	.....	.....	27	.....	.....	.....

1 Bushels.      2 Pounds.



AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

CALIFORNIA—Continued.

COUNTIES—continued.	ACRES HARVESTED.												
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Kafir, millo, etc.	Rough rice.	Clover and alfalfa seed.	Dry beans.	Dry peas.	Sugar-beet seed.	Flower and vegetable seeds.
Colusa.....	944		331		431		199	44,842	20	110			
Contra Costa.....	6,117	76	119		1,390				15	4,936			20
Eldorado.....	17		1				1			1			
Fresno.....	2,148	289	6,600	1,657	15,763	15	4,107	60	282	118	2		
Glenn.....	219	30	789	33	4,373	20	1,966	38,803					
Humboldt.....	13			1	10								
Imperial.....	2,682	388	18,370	6,296	17,221	20	62,392		429	2	1		
Inyo.....	1,499	175	242	800	159				36	14			
Kern.....	1,999	464	8,816	10,907	10,051	12	11,842	708	138	96			1
Kings.....	1,980	237	12,578	15,621	10,535	525	5,132		57				
Lassen.....		637	1,304	3,434	474	197			263				
Los Angeles.....	2,908	185	682	275	1,259	20	1,490		48	24,620	4		11
Madera.....	509	15	238		3,151	8	1,650	275		140			
Mendocino.....					9								
Merced.....	1,529	176	1,093	299	6,540	276	3,356	437	10	3,238	5		
Modoc.....	3	89	1,520	1,291	780	449			147	5			
Mono.....	4	30	1	52	70					1			
Monterey.....	8	10	1,450	1,793	1,928					2,081	121	503	
Napa.....	25	22	27		48								
Nevada.....	29	2				2	8			3			
Orange.....	964	147			260		25			11,020	194		30
Placer.....			6		2		13	396					
Plumas.....		430	158	375	5	280							
Riverside.....	721	43	962	68	3,748	4	3,834	7	355	400	70		8
Sacramento.....	1,082	262	1,645	62	2,718		158	100	7	7,285	352		776
San Benito.....	9		70	80	133								
San Bernardino.....	700	155	201		3,412	13	3,069		30	260	214		319
San Diego.....	357	29	47	174	35	4	116			1,170	2		
San Joaquin.....	24,473	232	2,538	860	18,217	164	2,355	45		15,597			1,391
San Luis Obispo.....	32		100	205		5				63			35
San Mateo.....		29	1	20	23								
Santa Barbara.....	2			40						373			419
Santa Clara.....	430	6	30		1,039					1,271			110
Santa Cruz.....	2									5			
Shasta.....	177	18	318	72	169	5	27	257		73	3		
Sierra.....		125		37	25	10							
Siskiyou.....	108	580	395	1,381	727	1			50	27			
Solano.....	1,146	473	130	257	644			113		2,311	200		
Sonoma.....	5	11								13			
Stanislaus.....	1,574	2,832	8,501	221	942	848	11,030	1,246	157	15,506	55		24
Butter.....	212	208	349	173	3,166	20	390	7,112	38	852	186		
Tehama.....	32	98	4,555	67	5,556		692	150	5	308	3		
Trinity.....	43	26	20	38	8					18	2		
Tulare.....	1,720	326	8,561	1,565	9,513	148	10,498	22	20	110			2
Tuolumne.....	22	4	5	4						8			
Ventura.....	25				30		20			52,626	42		
Yolo.....	133	30	719	307	2,731		40	9,511	202	1,158			88
Yuba.....	161	13	122		366		536	2,277		330			

THE STATE.	PRINCIPAL CROPS.												
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Root crops for forage.	Potatoes.
Acres harvested.....	2,919	38,785	4,982	556,656	15,863	3,055	145,337	85,063	16,244	5,069	7,418	634	29,698
Production.....	1 4,936	1 54,806	1 6,396	1 1,967,529	1 22,676	1 3,728	1 199,432	1 96,722	1 119,291	1 12,946	1 14,667	1 5,712	1 4,502,697
Value..... dollars..	93,784	1,013,911	118,326	44,269,402	396,830	74,520	4,656,652	1,354,108	1,133,264	181,244	220,005	84,248	10,355,973

COUNTIES.	ACRES HARVESTED.												
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Root crops for forage.	Potatoes.
Alameda.....		25		1,686		50	795						
Alpine.....	146	372	184	414				95			1		
Amador.....		5		110	45		143	21	20	6			23
Butte.....	20		5	2,807	14	60	1,664	28	132	28	56	3	15
Calaveras.....		85	75	972	182	2	405	207		5			70
Colusa.....		40		2,594		90	615	43		17			
Contra Costa.....				2,117	52		1,559	100					5,951
Eldorado.....	4	85	92	264	176	35	444	116	3	1			23
Fresno.....	4			89,838	408	142	11,044	122	2,090	281	655		69
Glenn.....	140	8		11,793	193	85	787		219	13	66		23

1 Tons.

2 Bushels.

# IRRIGATION.

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**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

**CALIFORNIA—Continued.**

COUNTIES—continued.	ACRES HARVESTED.												
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Root crops for forage.	Potatoes.
Humboldt.....		4		146	44		36		17			7	
Imperial.....	45		170	46,053	377	281	6,931	20	1,222	949	1,951		6
Inyo.....	143	718	150	6,944	263	2	91	777	409	20	110		124
Kern.....			12	28,461	197	72	8,645	41	694	190	697		521
Kings.....			79	24,911	77	5	6,604		461	270	2		17
Lake.....		65		151			17					1	12
Lassen.....	135	2,152	2,610	10,553	190		967	22,790	50			8	
Los Angeles.....	4	4	95	21,774	284	353	15,983	54	2,359	1,132	526	297	7,504
Madera.....				10,850	37	23	2,066		34	82	192		46
Marin.....							10						
Mendocino.....				976	51		40	15				1	3
Merced.....				66,102	113	147	5,234	4,441	1,625	142	163	2	231
Modoc.....	516	19,484	129	8,429	2,562	57	1,668	28,855					72
Mono.....	60	840	181	1,461			52	493		7			
Monterey.....				14,775	12	5	2,779			8	4	23	
Napa.....				369			194		28				10
Nevada.....	2	122	229	468	533		84	131	25	78	14	4	83
Orange.....	6		32	2,553	136	192	7,771	36	217	98	55	24	174
Placer.....		10	32	514	11	2	674	7		8	3	1	7
Plumas.....	130	3,315	75	591	265		163	5,484				1	54
Riverside.....	8	70	2	15,430	202	39	10,080	1	462	348	1,116	45	261
Sacramento.....			1	7,481	55	49	3,269	35	164	70	25	11	848
San Benito.....			17	3,423			867	41	80			72	
San Bernardino.....	86			10,325	738	149	7,706		1,184	280	254	3	990
San Diego.....			2	3,583	56	787	2,620	2	453	109	21	31	207
San Joaquin.....		44	1	30,655	77	145	6,596	496	403	44	102	2	11,069
San Luis Obispo.....				2,759		5	191		22	28			17
San Mateo.....				259			846						237
Santa Barbara.....				1,670		4	678		150				16
Santa Clara.....	34	1	61	6,773	301	56	4,211	1	259	23		51	162
Santa Cruz.....				268			53		4			1	8
Shasta.....	541	3,851	132	4,956	2,008	90	837	7,856	85	82	42	21	121
Sierra.....		830	36	563	318		158	6,356					20
Siskiyou.....	599	5,560	110	16,837	4,637		2,308	6,418	16	19		2	155
Solano.....				6,479	5		344				8		76
Sonoma.....				318		1	2						
Stanislaus.....	70	50	12	55,732	298		9,120	49	1,820	120	178	6	142
Sutter.....		25	27	3,115	80	15	1,374		94	8	4	2	1
Tehama.....		119	9	3,773	338	51	2,330	24	19	25	106		25
Trinity.....	177	850	46	1,847	85	2	373		82			3	53
Tulare.....		5		40,046	215	10	9,892	140	1,287	477	986	6	78
Tuolumne.....	15		37	384	11		148	78		9			34
Ventura.....				1,846		17	1,320		17			5	2
Yolo.....			28	6,759	89		1,272		131	30	44	3	
Yuba.....	35	47	212	816	158	25	1,287	178		73	32	1	24

THE STATE.	PRINCIPAL CROPS.										
	Sweet potatoes and yams.	Cabbages.	Cantaloupes and melons.	Celery.	Cucumbers.	Beans (green).	Peas (green).	Lettuce.	Onions.	Corn (sweet).	Tomatoes.
Acres harvested.....	5,858	3,279	18,800	2,605	477	1,564	2,268	4,266	5,801	2,219	16,997
Production..... bushels.....	659,734										
Value..... dollars.....	1,517,398	547,205	2,753,155	721,521	87,701	292,953	387,070	1,190,363	2,009,151	197,015	2,121,514

COUNTIES.	ACRES HARVESTED.											
	Sweet potatoes and yams.	Cabbages.	Cantaloupes and melons.	Celery.	Cucumbers.	Beans (green).	Peas (green).	Lettuce.	Onions.	Corn (sweet).	Tomatoes.	
Alameda.....		4			3	16	5	5	4	5	149	577
Amador.....	1	1	1				1			1	3	3
Butte.....	3	5	4		5	2	5		2	3	13	22
Calaveras.....		4	1		1	2	5	4	2	6	5	3
Colusa.....		1						1				
Contra Costa.....		1		1,014		2	1		3	263	1	113
Eldorado.....	2	1	1				3				1	1
Fresno.....	43	4	25		3	8	17	1	6	11	3	65
Glenn.....		2	21							1	3	6
Humboldt.....					1		1		1	1	1	
Imperial.....	7	2	5,734			10		285	1,230	20	8	316
Inyo.....			2					1		1	6	1
Kern.....	27	21	179	10		19	12	11	12	21	54	151
Kings.....	13	2	5			62	3	2		1	1	4
Los Angeles.....	1,035	1,931	1,375	335	215	753	671	2,603	196	1,361	5,277	

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

CALIFORNIA—Continued.

COUNTIES—continued.	ACRES HARVESTED.										
	Sweet potatoes and yams.	Cabbages.	Cantaloupes and muskmelons.	Celery.	Cucumbers.	Beans (green).	Peas (green).	Lettuce.	Onions.	Corn (sweet).	Tomatoes.
Madera.....	2		354							9	
Marin.....		3		1		2	3	5	2	6	2
Mendocino.....									1		
Merced.....	2,710	1	435	1			1	1	9	1	32
Monterey.....		14		2	1	1		33	6	4	2
Nevada.....		1	2							7	4
Orange.....	300	429	22	104	27	74	77	20	8	55	1,099
Placer.....		1	1							1	17
Plumas.....		9							1		
Riverside.....	110		68		2	24	10	2	664	16	942
Sacramento.....	4	69	16	143	10	26	26	102	44	60	473
San Benito.....		1				1		1	1	1	467
San Bernardino.....	190	45	30	2	1	4	5	6	14	50	453
San Diego.....	133	84	85	22	45	279	527	71	13	126	839
San Joaquin.....		50	246	880	9	43	5	15	4,285	27	858
San Luis Obispo.....		7	2	1	1	2	2	6	2	6	4
San Mateo.....		221		6	2	62	247	36	21	47	277
Santa Barbara.....	6		2			3	15		16		1
Santa Clara.....		23	11	52	17	189	45	26	85	88	4,548
Santa Cruz.....		3	1	2		1	2		1	5	5
Shasta.....	6	1	5	1	2	4			1	7	8
Sierra.....		1									
Siskiyou.....		1				1					
Solano.....		164	6	1	1	3	2	3	5	17	165
Sonoma.....		10	1	1	1	5	2	14	7	12	94
Stanislaus.....	1,234	49	5,120	3	3	8	290	5	58	10	353
Sutter.....	5	6	5	2	1	4	4	8	3	3	18
Tehama.....		6				2				2	3
Trinity.....		1	1							1	
Tulare.....	27	8	20	5	2	7		3	2	4	16
Tuolumne.....		3	4		1	4	1	1	2	10	5
Ventura.....		88	2	1	11	2	5		4	4	58
Yolo.....		5	5	1	4	7	3	41	8	4	839
Yuba.....		2	2	1			1	2	1	2	6

THE STATE.	PRINCIPAL CROPS.										
	Watermelons.	Asparagus.	Cauliflower.	Peppers (green).	Pumpkins.	Spinach.	Sugar beets grown for sugar.	Cotton.	Broom corn.	Hops.	Strawberries.
Acres harvested.....	3,979	9,626	2,362	4,255	544	887	55,720	83,963	883	2,172	1,465
Production.....							1,422,427	44,681	351,700	3,691,623	5,143,533
Value.....dollars.	327,028	1,653,081	437,888	632,101	18,753	128,516	5,491,551	8,891,519	28,136	1,919,644	1,028,707

COUNTIES.	ACRES HARVESTED.										
	Watermelons.	Asparagus.	Cauliflower.	Peppers (green).	Pumpkins.	Spinach.	Sugar beets grown for sugar.	Cotton.	Broom corn.	Hops.	Strawberries.
Alameda.....							844				7
Butte.....	14				45						1
Calaveras.....	2	1	1					40	769		
Colusa.....	20										
Contra Costa.....		960									
Eldorado.....											1
Fresno.....	34	2	3	7		2		5,484			13
Glenn.....	24										5
Imperial.....	346	100				19		54,688	13		1
Inyo.....	8										
Kern.....	70				5			1,191	15		8
Kings.....	13	1			29	80	80	450	11		2
Lake.....											645
Los Angeles.....	887	138	1,983	207	105	190	16,923				3
Madera.....	169				8			39			
Marin.....			1							134	
Mendocino.....									1		3
Merced.....	249				2						2
Modoc.....											
Monterey.....							13,474				
Napa.....											1
Nevada.....											4
Orange.....	76	7	32	3,911	35		13,553				4
Placer.....											9
Riverside.....	146	22		6	15	119	544	22,060	40		1
Sacramento.....	17	6,759	24	2	3	233				941	522
San Benito.....					5						4
San Bernardino.....	114	14	20		34		877		4		4
San Diego.....	78	8	22	81			212				3
San Francisco.....							1,796				

<sup>1</sup> Tons.

<sup>2</sup> Bales.

<sup>3</sup> Pounds.

<sup>4</sup> Quarts.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

**CALIFORNIA—Continued.**

COUNTIES—continued.	ACRES HARVESTED.									
	Water-melons.	Asparagus.	Cauliflower.	Peppers (green).	Pumpkins.	Spinach.	Sugar beets grown for sugar.	Cotton.	Broom-corn.	Hops.
San Joaquin.....	147	62	7	32	167	91		5		
San Luis Obispo.....		1	1				1,663			1
San Mateo.....	2		230	3		6				5
Santa Barbara.....	1		1				3,209			171
Santa Clara.....	2	1	19	2	5	50				21
Santa Cruz.....										14
Shasta.....	9			1	1					1
Siskiyou.....										
Solano.....		1,553								
Sonoma.....			13			50				
Stanislaus.....	1,537	1		1	51			2	4	
Sutter.....	2		1		10		880			
Tehama.....	1									
Trinity.....	1									2
Tulare.....	26			1	24			9	21	1
Tuolumne.....	1									10
Ventura.....	3	1					1,365			
Yolo.....	4		4	1			120			
Yuba.....	1								348	749

THE STATE.	PRINCIPAL CROPS.									
	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.	Apricots.	Quinces.	Oranges.	Lemons.
Acres harvested.....	173,217,234	804,683	5,662,259	1,017,060	3,841,678	224,569	1,630,763	12,403	8,675,956	2,299,716
Production.....	1,128,175,200	1,335,057	10,318,362	1,783,951	6,542,548	326,449	2,608,136	18,315	18,725,602	5,776,149
Value.....dollars.....	36,101,606	2,066,338	19,088,970	3,211,112	14,066,478	1,305,796	5,216,272	36,630	58,049,366	16,750,832

COUNTIES.	ACRES HARVESTED.									
	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.	Apricots.	Quinces.	Oranges.	Lemons.
Alameda.....		2	402	756	7,455	6,171	14,072			
Amador.....	8,000	251	1,544	112	1,067	53				
Butte.....	5,017	3,521	95,888		82,565			7	67,244	1,959
Calaveras.....	10,887	3,812	1,970	592	629	103	644		20	7
Colusa.....		11	32	18	2,703				18	
Contra Costa.....	65	95	8,568	15,257	9,519	2,363	18		32	2
Eldorado.....		12,678	40,329	91,627	21,666	961	12	6	25	
Fresno.....	51,883,387	54,755	1,713,499	11,288	94,141	405	138,822	594	114,431	13,579
Glenn.....	4,804	1,175	6,254	955	14,491	304	3,928	9	10,359	815
Humboldt.....	186	283	230	72	110	79				
Imperial.....	65,697	129	430	466	124	73	1,030	21	1,635	299
Inyo.....	2,522	16,188	5,892	3,277	414	212				
Kern.....	250,457	9,700	21,257	40,811	18,480	691	19,737	58	50,806	958
Kings.....	931,528	4,184	217,009	4,624	34,137	90	58,337		24	6
Lake.....		100	30		300					
Lassen.....		373	84	24	36	8				
Los Angeles.....	92,872	95,854	209,330	173,433	38,699	8,385	72,941	1,735	2,209,046	753,104
Madera.....	2,180,823	1,466	93,982	850	2,535	29	13,441	18	1,142	14
Marin.....		124	42	112	29					
Mendocino.....		638	110	1,932	625	9				
Merced.....	831,821	1,192	173,483	4,014	5,447	101	6,456	425	2,371	109
Modoc.....		4,647	797	262	333	343				
Mono.....		587	47	55	43	28				
Monterey.....	10	28,662	1,577	2,908	5,922	196	8,566		5	8
Napa.....		3,512	770	3,107	31,755	3,223	1			
Nevada.....	20	5,881	6,132		3,501			8	294	8
Orange.....	12,166	17,484	16,031	2,830	4,006	19	46,016	33	1,275,248	437,370
Placer.....	248,033	26,281	653,654	176,181	608,301	38,324	431	5,622	16,971	414
Riverside.....	102,337	80,135	152,693	23,765	43,712	10,697	283,247	35	929,624	309,867
Sacramento.....	3,931,111	7,958	107,356	175,678	132,710	19,746	2,361	260	22,456	1,529
San Benito.....	1,055	4,068	23,213	15,391	79,448	7,589	60,365		13	2
San Bernardino.....	1,470,497	240,167	424,579	17,998	8,441	6,729	102,422	24	2,236,541	286,140
San Diego.....	175,257	3,750	48,825	4,413	2,984	737	6,611	46	65,537	200,994
San Joaquin.....	4,889,665	4,481	232,842	13,537	71,804	55,145	13,899	2,221	1,971	39
San Luis Obispo.....		1,945	629	771	161	132	66	1	38	626
San Mateo.....		111	20	29	40	25				
Santa Barbara.....		243	84	25	27	11	18		2,648	49,908
Santa Clara.....	103,160	55,651	158,574	175,242	1,884,132	91,996	624,078	854	1,379	379
Santa Cruz.....					14	8				1
Shasta.....		5,397	14,560	34,863	2,376	19,073	324	200	8	67

<sup>1</sup> Number of vines of bearing age.

<sup>2</sup> Number of trees of bearing age.

<sup>3</sup> Pounds.

<sup>4</sup> Bushels.

<sup>5</sup> Boxes.

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

CALIFORNIA—Continued.

COUNTIES—continued.	ACRES HARVESTED.									
	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.	Apricots.	Quinces.	Oranges.	Lemons.
Sierra.....		65		15		7				
Siskiyou.....	15	7,417	2,171	551	1,068	519	14			
Solano.....		59	26,478	1,965	4,971	8,800	19,431		432	5
Sonoma.....				1,783	37,531	35			600	1
Stanislaus.....	530,310	5,887	197,535	2,787	6,491	5,587	18,943	25	3,435	63
Sutter.....	1,184,095	5,838	430,201	9,504	121,455	2,648	2,157	16	1,307	63
Tehama.....		9,764	58,820	12,593	38,881	957	1,616		505	1
Trinity.....	110	842	250	142	328	70	1			
Tulare.....	4,238,152	42,795	455,902	9,306	385,687	4,071	28,374	74	1,564,276	73,302
Tuolumne.....	38,920	23,024	7,111	1,109	532	174	24	2	11	
Ventura.....		1,184	2,872	178	117	14	57,342	1	99,125	168,111
Yolo.....	16,798	167	15,803	3,170	27,752	6,347	25,069		261	15
Yuba.....		977	12,030	3,163	5,206	45	54		68	17

THE STATE.	PRINCIPAL CROPS.								
	Grapefruit (pomeloes).	Figs.	Alligator pears (avocados).	Dates.	Olives.	Japanese persimmons.	Pomegranates.	Almonds.	Walnuts (Persian or English).
Acres harvested.....	1 193,819	1 246,884	1 10,674	1 14,406	1 536,543	1 5,510	1 14,710	1 464,071	1 616,372
Production.....	2 393,923	2 10,074,552	4 7,294	2 118,311	2 12,284,784	2 9,500	2 560,061	2 3,190,813	2 30,210,494
Value.....dollars..	787,846	1,007,455	58,352	23,662	981,181	28,000	26,405	797,703	9,063,148

COUNTIES.	ACRES HARVESTED.									
	Grapefruit (pomeloes).	Figs.	Alligator pears (avocados).	Dates.	Olives.	Japanese persimmons.	Pomegranates.	Almonds.	Walnuts (Persian or English).	
Alameda.....									265	
Amador.....					2					
Butte.....	1,115	5,794	5		74,109			20,302	1,545	
Calaveras.....	2	67			2			17	70	
Colusa.....		2							45	
Contra Costa.....		15			8			2,495	1,847	
Eldorado.....		13			1,000				65	
Fresno.....	421	111,472			21,542	445	2,363	2,686	1,918	
Glenn.....	161	4,970			1,725			45,053	190	
Humboldt.....		24						6	436	
Imperial.....	16,306	1,607		1,498	256		11	13	400	
Inyo.....									8	
Kern.....	1,481	1,359			472		1	7,395	53	
Kings.....	1	174			4		2	80	56	
Los Angeles.....	24,798	13,542	6,762		183,046	1,167	24	7,353	303,883	
Madera.....	2	6,338			15,895		55	2,974	926	
Mendocino.....								1	8	
Merced.....	1	23,813	100		7,531		41	14,922	210	
Monterey.....	1	7						2,044	30	
Napa.....		2						3	116	
Nevada.....	5	66						21	336	
Orange.....	3,714	2,394	1,362		2,013	1,135	500	26	177,539	
Placer.....	465	828			14,149	2,644	10	57	13	
Riverside.....	25,268	3,303	17	12,908	28,862	4		52,436	20,589	
Sacramento.....	3,178	2,273			40,123	27	74	74,769	2,478	
San Benito.....		1						17	15	
San Bernardino.....	71,489	2,116	1,375		19,228	21	8	3,311	21,139	
San Diego.....	4,206	2,143	15		28,297	47		669	678	
San Joaquin.....		1,515			10,245		55	66,653	5,885	
San Luis Obispo.....	3	2						22	1,849	
Santa Barbara.....	255	49	250		1,500				12,255	
Santa Clara.....	42	479	2		135	3		12,915	26,364	
Santa Cruz.....									10	
Shasta.....		321	650		6,665			16	143	
Siskiyou.....								2	7	
Solano.....	4	104			225			13,525		
Sonoma.....	2	80			200				10	
Stanislaus.....	22	7,657			853			41,446	1,063	
Sutter.....	18	5,553			618		1,000	55,761	2,298	
Tehama.....	2	609			4,737			1,923	17	
Trinity.....		5						3	7	
Tulare.....	39,693	41,140			121,346	17	10,560	12,360	1,875	
Tuolumne.....		164						31	303	
Ventura.....	1,165	102	136		1,300		6	405	26,049	
Yolo.....	5	1,535			453			22,347	142	
Yuba.....		276			2			12	229	

1 Number of trees of bearing age.

2 Boxes.

3 Pounds.

4 Crates.

5 Bushels.



# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

## COLORADO.

THE STATE.	PRINCIPAL CROPS.										
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Dry beans.	Dry peas.	Potatoes.	Sugar beets grown for sugar.
Acres harvested.....	52,617	97,618	112,548	139,214	58,125	2,757	5,949	10,627	24,841	50,631	137,329
Production.....	1,316,478	3,037,305	2,577,277	2,994,897	11,383,619	134,217	121,363	1,120,629	1,265,449	17,475,618	1,409,560
Value.....dollars..	1,843,069	2,885,440	5,309,191	6,169,438	1,798,575	49,615	491,349	410,139	663,623	16,446,360	14,800,380
<b>COUNTIES.</b>											
Adams.....	596	1,522	5,110	6,627	338	25	49	606	3,942		
Alamosa.....	706	2,601	44	1,490	848	2	94	327	1,806	1,856	5
Arapahoe.....	85	670	2,141	1,555	518	10	6	6	152	875	
Archuleta.....	28	603	35	156	101	9	10	23			
Baca.....	2,302	1,375	10,796	291	1,171	52	279	101			5,716
Bent.....	313	531	3,639	8,974	888	8	2	2,177	93	4,779	
Boulder.....	6	2,186	6	2,125	1,096	8	2	653			
Chaffee.....	8	8	11								
Cheyenne.....	14	4,125	230	6,496	9,505	11	3,081	460	8,073	2,294	
Clear Creek.....	43	2,396	985	4,927	2,678	138	326	8,436	189		
Conejos.....	3,807	1,738	532	1,590	1,815	7	2	135	29	3,761	
Costilla.....	96	1,281	75	490	379	34	1	13	47		
Crowley.....	2,758	4,024	1,036	4,452	460	30	40	38	7	2,898	2,602
Custer.....	30	59	52	199	6	10			8		
Delta.....	840	211	505	203	50	45			6		
Denver.....	6	2,418	202	701	303	14			1,299		
Dolores.....	1,300	197	310	236	79	10			32	16	41
Douglas.....	14	18	88		6	10			13		
Eagle.....	2,444	859	849	412	284	22	11	34	18	9	
El Paso.....	456	3,041	380	6,051	681	36	78	33	2,636	1	
Elbert.....	480	480	103	28	115	8					
Fremont.....	571	28	95	217	6	1			292		
Garfield.....	486	962	223	698	1,253	77	11	171	128	18	
Gunnison.....	88	2	46	110	42	39			29	566	
Hinsdale.....	957	1,652	4,774	5,239	963	110			262		
Huerfano.....	10	50									
Jackson.....	65	5,051	490	10,142	1,355	31	119	14	2	431	
Jefferson.....	339	3,069	7,613	8,919	2,390	11			50	210	501
Kit Carson.....	319	1,796	833	1,403	462	12			1,127	15	
La Plata.....	1,469	2,387	9,723	1,719	1,548	169			10	99	10,973
Lincoln.....	45	2,756	2,379	2,556	549	11	1,343	180	44	1,408	2,620
Logan.....	3	864	61	407	143	61				5	
Mesa.....	3	276	2,545		880	9			6	52	
Mineral.....	2,196	5,336	3,026	9,646	494	46	278	132		6,698	
Monte Vista.....	4,901	2,339	3,172	1,334	2,161	263			190	607	19,441
Montrose.....	4,479	3,194	6,414	550	634	38	205	1,659	14	27	11,864
Morgan.....	784	198	787		46				2	153	
Ouray.....	100				8					49	
Park.....	1,265	21	598		204	30				700	
Pitkin.....	1,070	11,657	407		1,294	343			18	5	6,368
Prowers.....	7,672	1,675	2,222	1,732	939	109	84	1,029		19	3,676
Pueblo.....	10	1,425	722	736	56		80			44	
Rio Blanco.....	4	8,602	265	9,584	4,636	38			61	2,656	12,203
Rio Grande.....	918	522	331		459	30				39	
Routt.....	57	5,275	260	3,535	2,689	16			2	859	2,093
Saguache.....	21	705	130	609	340						
San Miguel.....	312	320	805	1,059	305	97				426	3,987
Sedgwick.....	120	4	3		75	52					
Summit.....	70	318	351	278	19	20				8	
Teller.....	180	3,823	10,397	29,206	471	190	10				1,459
Washington.....	115	10	100		11,843	499	85	4,461	536	11,880	54,143
Weld.....					60				28		
Yuma.....											

THE STATE.	PRINCIPAL CROPS.											
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Root crops for forage.
Acres harvested.....	33,588	106,664	3,095	659,912	46,110	9,368	26,630	290,663	19,015	14,547	12,123	633
Production.....tons..	46,568	188,616	4,893	1,568,038	60,585	14,194	38,250	230,333	119,656	34,234	24,349	4,255
Value.....dollars..	977,938	4,149,552	83,181	29,008,703	969,360	212,910	688,600	4,905,810	1,196,560	445,042	316,537	55,815

<sup>1</sup> Bushels.

<sup>2</sup> Tons.

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES AND ACRES HARVESTED, BY COUNTIES—Continued.

COLORADO—Continued.

COUNTIES.	ACRES HARVESTED.											
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Root crops for forage.
Adams.....		26	36	13,539	88		214	190	539	146	40	33
Alamosa.....	10		38	15,799	320	330		18,134	48		25	
Arapahoe.....	15	33	7	6,883	73	38	141	25	511	245	55	40
Archuleta.....	191	4,843		3,595	341	13	323	876		2	5	
Baca.....				756							53	
Bent.....			28	22,392	100	12	81	382	515	235	1,583	19
Boulder.....	22	289		8,301	75		88	545	539	52	15	36
Chaffee.....	1,561	1,898	13	5,685	179	118	256	1,769	43	3		6
Cheyenne.....				200								
Clear Creek.....	80	155		11			28			10		
Conejos.....		88	392	13,164	11,727	2,518	2,997	7,020		4		
Costilla.....	73	62	193	4,791	106	259	1,017	4,435	26			
Crowley.....				15,236	108		58	45	1,167	381	825	3
Custer.....	131	891	41	2,142	9,398	50	254	599		172	5	
Delta.....	295		79	30,061	249	8	1,102	212	549	396		50
Denver.....		45		623			9		67			
Dolores.....	80	20	50	370			114	60				
Douglas.....	18	437		2,922			103		100	40	1	
Eagle.....	1,202	4,037	10	5,629	4,522		1,107	356		1		5
El Paso.....	85	866		5,424	98	15	309	2,834	233	283	114	
Eibert.....		178		789			32	102	25	32	4	
Fremont.....	128	1,239	5	7,044	405	9	533	608	187	1,466	22	41
Garfield.....	824	619		31,202	3,099	8	877	153	66	222	22	12
Gilpin.....		25				26	35	62				
Grand.....	1,401	13,444	118	300	330		285	11,497				
Gunnison.....	1,739	10,885	23	1,928	2,638	22	659	24,274				12
Hinsdale.....	24	1,192	1	46			120	1,184				
Huerfano.....	649	1,279	6	14,331	1,496	146	107	1,069	22	87	60	
Jackson.....	3,782	5,881		2,091			60	71,265				
Jefferson.....	118	687	16	15,532	205	41	543	107	400	1,687	5	86
Kiowa.....				822	20				50		30	
Kit Carson.....				235				340	60		40	
La Plata.....	946	1,229	54	24,846	371	129	978	609	152	80	15	5
Lake.....	110	214	7		295		137	3,218				10
Larimer.....	191	519	107	39,854	77	195	586	8,420	1,300	100	2	42
Las Animas.....	3,764	177	300	20,640	632	12	721	2,251	139	169	490	
Lincoln.....				44							10	
Logan.....	5	29		14,850	205			1,699	156	604	478	20
Mesa.....	224	595	15	34,057	238	22	1,286	88	542	2,524	557	73
Mineral.....	80	210			110		304	1,907				
Moffat.....	1,534	2,447	1	5,126	1,653	22	701	2,753		2		4
Montezuma.....	553	114	8	20,650	153	6	984	498	140	139	17	3
Montrose.....	481	1,176	143	33,384	24	45	931	194	602	191	20	47
Morgan.....			5	23,506	187		204	610	359	417	735	2
Otero.....			53	24,968	92	78	83	45	2,542	970	1,260	14
Ourray.....	748	5,434	55	1,864	222	16	264	659				1
Park.....	48	45		21	75		701	29,419				2
Pitkin.....	2,421	3,862	2	2,092	28		153	70				
Prowers.....			145	37,612	112	90	266	505	1,662	1,593	4,643	43
Pueblo.....	70	733	85	26,159	238	324	378	1,699	1,362	1,348	701	10
Rio Blanco.....	3,693	859	45	13,597	656	42	923	5,381				
Rio Grande.....	273	2,119	246	9,229	1,063	581	2,304	13,002	194			6
Routt.....	1,947	32,914	292	2,169	759	400	507	1,650				
Saguache.....	1,731	410	440	6,459	572	3,734	969	63,663		5		2
San Miguel.....	1,831	423	35	5,689	16		397	200		95	19	
Sedgwick.....				2,444	58		15	575	19	80	20	
Summit.....	510	4,036	52	47	59		41	1,110				1
Teller.....				42	115		336	819				
Washington.....				1,583				25				42
Weld.....		2		78,850	437	67	760	1,379	4,699	766	126	8
Yuma.....				898			15	100			88	

THE STATE.	PRINCIPAL CROPS.									
	Cabbages.	Cantaloupes.	Cucumbers.	Tomatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Acres harvested.....	2,791	3,530	1,284	1,063	135,688	1,879,087	238,370	97,783	26,582	194,363
Production.....					173,669	1,842,018	460,404	210,944	19,264	101,271
Value.....dollars..	544,640	616,437	198,241	234,779	13,894	3,039,330	851,747	464,077	46,234	229,131

<sup>1</sup> Number of vines of bearing age.

<sup>2</sup> Number of trees of bearing age.

<sup>3</sup> Pounds.

<sup>4</sup> Bushels.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

**COLORADO—Continued.**

COUNTIES.	ACRES HARVESTED.									
	Cabbages.	Cantaloupes.	Cucumbers.	Tomatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Adams.....	670	12	98	102		925			100	20
Alamosa.....	5									
Arapahoe.....	89	5	8	12		3,774	5	2	200	174
Bent.....		12	9	1						
Boulder.....	2			1	80	1,609		4	391	1,754
Chaffee.....	10					8,931		24	219	116
Clear Creek.....	1									
Costilla.....	3					108		11	2	3
Crowley.....	3	1,163	120	134	3,492	18,295	252	14	580	23,372
Custer.....	1									
Delta.....	4	15	1	11						
Douglas.....						253				13
Eagle.....	1		2			50		4	1	5
El Paso.....	2					250				
Fremont.....	19	4	28	65	7,408	177,879	1,553	1,285	3,183	40,685
Garfield.....	3	4	2	4	8,562	63,752	7,390	1,139	2,022	3,709
Gunnison.....	3									
Huerfano.....	8	1	1			1,901		15	9	18
Jefferson.....	816		31	181	320	28,244	41	110	4,458	29,969
La Plata.....	2		2							
Larimer.....	40	13	6	13	150	46,251	92	395	2,752	55,364
Las Animas.....	1	6	1	4						
Mesa.....	11	30	2	507	4,747	412,282	220,557	92,624	3,600	6,318
Moffat.....										
Montezuma.....	1	5		2	552	21,983	3,599	615	1,018	528
Montrose.....	3	1	1	5	1,399	61,811	4,195	1,373	1,549	2,250
Morgan.....	43		10	1		1,022	12	16	1,371	1,580
Otero.....	4	2,231	796	258	6,454	26,560	503	45	2,512	21,886
Ouray.....	1					130	12	3	38	17
Pitkin.....	1					34				
Prowers.....	2	1	1	2		386	38	10	27	26
Pueblo.....	79	22	38	40	2,276	9,645	34	42	1,340	5,630
Rio Blanco.....	2		1	2						
Rio Grande.....	12									
San Miguel.....	3					366	4	39	26	56
Sedgwick.....			4			49	1	12	162	76
Weld.....	1,451	5	124	346		2,532	10	21	1,008	771
Yuma.....						130	101			20

**IDAHO.**

THE STATE.	PRINCIPAL CROPS.										
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Red clover seed.	Other clover and alfalfa seed.	Timothy seed.	Dry beans.	Dry peas.
Acres harvested.....	10,994	42,487	20,306	299,360	19,667	2,414	14,814	8,955	537	10,159	9,443
Production.....bushels.	383,740	1,232,896	360,211	7,364,943	540,749	19,751	57,195	33,442	1,236	185,086	153,017
Value.....dollars.	652,358	1,294,540	738,433	15,098,133	811,124	36,539	1,544,265	789,166	7,459	658,301	719,180

COUNTIES.	ACRES HARVESTED.										
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Red clover seed.	Other clover and alfalfa seed.	Timothy seed.	Dry beans.	Dry peas.
Ada.....	809	2,982	1,809	25,174	1,763	233	4,147	485	500	1	
Adams.....	55	417	100	842	46			2			
Bannock.....	8	2,069	1,047	7,134	835	48	15			22	
Bear Lake.....		1,160	642	2,244	305	25		5			
Bingham.....	30	4,890	1,159	20,371	1,135						
Blaine.....	2	904	307	4,280	331						
Boise.....	8	351	219	377	22	4	14	40			
Bonner.....		83		21	4						10
Bonneville.....	8	4,001	2,180	23,413	316		37	14	23	81	1,283
Boundary.....	41	301	178	209	10	6				1	6
Butte.....	6	1,115	424	4,701	466	21					5
Canyon.....	5,555	3,414	2,011	38,535	3,321	124	2,682	853		31	4
Caribou.....		42		25	4						
Cassia.....	30	1,573	1,573	14,899	836	104	461	408		5	5
Clark.....		15		89							
Custer.....	2	1,799	412	1,136	396			5			
Elmore.....	89	15	51	147	21	2	57				
Franklin.....	4	168	1,141	1,368	70						
Fremont.....		1,664	785	9,782	135						4,729
Gem.....	766	587	482	1,570	579	41	108	48		9	
Gooding.....	328	807	314	9,711	170	519	427	259			
Idaho.....	3		17	12	3						
Jefferson.....	19	3,107	267	12,958	312	5		119		4	1,791
Jerome.....	45	1,577	783	19,483	397	42	378	132		5	

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

IDAHO—Continued.

COUNTIES—continued.	ACRES HARVESTED.										
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Red clover seed.	Other clover and alfalfa seed.	Timothy seed.	Dry beans.	Dry peas.
Lemhi.....		1,706	102	1,297	516	11		10	4	36	335
Lincoln.....	82	1,121	122	6,785	232		25	187		2	
Madison.....											1,250
Minidoka.....	506	1,629	512	5,643	483	119	698	755		38	4
Naz Perce.....			203	140							
Oneida.....		55	75	198	20			150			
Owyhee.....	387	654	14	2,530	934	67	10	136			
Payette.....	717	736	236	4,562	793	791	39	87			
Power.....	22	168	596	894	63	28					5
Twin Falls.....	913	2,779	1,035	77,270	4,070	117	5,508	5,243		9,911	16
Valley.....		22					6		10	3	
Washington.....	559	276	1,510	5,582	1,079	107	2	17		1	

THE STATE.	PRINCIPAL CROPS.									
	Timothy.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Corn cut for forage.
Acres harvested.....	17,686	48,603	14,715	515,301	8,762	53,371	12,402	544	4,453	1,527
Production..... tons..	22,360	62,010	23,743	1,510,380	13,066	53,515	17,056	762	37,908	4,959
Value..... dollars..	648,440	1,612,260	474,860	32,473,170	274,386	1,016,804	469,040	16,002	379,080	54,659

COUNTIES.	ACRES HARVESTED.									
	Timothy.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Corn cut for forage.
Ada.....	388	690	5,612	29,417	231	128	649		1,620	159
Adams.....	570	5,232	103	3,715	413	205	745		24	38
Bannock.....	1,955	4,961	39	25,727	1,009	7,110	534	50	31	3
Bear Lake.....	2,942	2,546	63	8,337	1,583	14,770	436	13		
Bingham.....	450	146	334	37,672	691	1,867	596	17	15	6
Blaine.....	710	645	90	13,980	94	1,663	448			
Boise.....	729	1,630	66	2,745	12	12	85			3
Bonner.....		507		5	7	31	102			
Bonneville.....	245	152	230	25,178	220	659	639	25		28
Boundary.....	838	385	142	39	237	4,782	347	1	14	5
Butte.....	50	200		13,130	20	539	271	10		
Canyon.....	148	148	2,769	48,825	133	78	604	103	1,016	468
Caribou.....	240	405		168	65	202				
Cassia.....	607	1,403	378	35,364	671	4,000	622		35	6
Clark.....				130						
Custer.....	1,761	4,683	9	13,785	342	3,735	850			
Elmore.....	8	160	33	1,600	20	160	71		21	7
Franklin.....	112	59		4,795	27	110	86		30	22
Fremont.....	1,701	1,497	27	10,124	588	1,903	353	139		
Gem.....	3	321	366	10,483	211	79	300		407	145
Gooding.....	28	35	382	28,485	47	90	213		233	60
Idaho.....	96	261	33	1,191		48	219			2
Jefferson.....	135	197	60	17,440	68	613	1,122	10		2
Jerome.....		10	326	22,017			170	30	49	18
Lemhi.....	1,364	18,188	301	12,195	1,103	3,771	544	30	7	2
Lincoln.....		95	109	19,805	39		167			1
Minidoka.....	200	33	544	22,997	17		411		21	31
Naz Perce.....			6	561			167	20		35
Oneida.....	99	35		2,903	50	353	12			
Owyhee.....	471	2,911	85	22,114	478	3,804	299		23	124
Payette.....	20	127	83	12,280	36	150	253		110	176
Power.....	7	65		5,420	20	1,359	285	41		1
Shoshone.....							5			
Twin Falls.....	1,563	343	2,457	51,701	94	1,002	571	52	368	109
Valley.....	165	241		11	220		40			
Washington.....	68	292	68	11,002	26	98	1,181	3	429	78

THE STATE.	PRINCIPAL CROPS.							
	Potatoes.	Sugar beets grown for sugar.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Acres harvested.....	32,044	32,270	10,809	832,307	71,890	20,290	273,303	31,136
Production..... tons..	5,409,108	222,128	104,166	1,211,790	138,442	15,455	291,495	19,799
Value..... dollars..	11,429,582	2,332,344	7,291	2,120,633	249,196	34,001	641,259	68,203

<sup>1</sup> Number of vines of bearing age.

<sup>2</sup> Number of trees of bearing age.

<sup>3</sup> Bushels.

<sup>4</sup> Tons.

<sup>5</sup> Pounds.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

I D A H O—Continued.

COUNTIES.	ACRES HARVESTED.							
	Potatoes.	Sugar beets grown for sugar.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Ada.....	400		634	201,166	5,247	3,229	180,929	11,010
Adams.....	31		191	113,455	19,806	4,456	548	416
Bannock.....	964	2,343						
Bear Lake.....	174			2,315		198	341	19
Bingham.....	7,168	9,760		62,560	31	1,183	4,129	1,703
Blaine.....	106			1,393		197	119	137
Boise.....				548	103	37	44	59
Bonner.....	3							
Bonneville.....	7,640	1,720						
Boundary.....	123			54,487	350	917	758	571
Butte.....	165							
Canyon.....	2,336	1	5,922	121,554	10,238	1,708	25,954	5,102
Cassia.....	3,178	3,098		4,419	644	439	1,512	426
Clark.....	15							
Clearwater.....	7							
Custer.....	111							
Elmore.....	41			53,426	2,284	452	13,889	267
Franklin.....	182	1,518		1,195	28	16	50	10
Fremont.....	346	488		2,976		72	285	128
Gem.....	84		845	40,452	15,155	1,431	21,943	3,188
Gooding.....	145							
Idaho.....	19		50	842	59	42	84	52
Jefferson.....	2,349	2,444		10,058		376	798	577
Jerome.....	276	537		16,855	857	627	822	867
Lemhi.....	227			4,919	21	338	608	365
Lincoln.....	178			1,636	48	146	917	148
Madison.....		2,268						
Minidoka.....	1,217	3,412	6	10,948	230	532	1,183	895
Nez Perce.....	24			200	5		7	18
Oseida.....	9	347		30			10	1
Owyhee.....	125		5	7,450	637	414	1,178	202
Payette.....	263							
Power.....	85	15		1,345	33	95	71	52
Shoshone.....	9							
Twin Falls.....	3,010	4,323	3,155	95,198	13,825	3,190	9,283	4,240
Valley.....	1							
Washington.....	53		1	42,892	2,309	195	7,883	636

K A N S A S.

THE STATE.	PRINCIPAL CROPS.											
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Alfalfa.	Wild, salt, or prairie grasses.	Silage crops.	Corn out for forage.	Kafir, sorghum, etc., for forage.	Kafir, milo, feterita, durra.	Sugar beets grown for sugar.
Acres harvested.....	238	1,238	4,029	234	1,370	14,962	615	491	136	1,238	2,050	851
Production.....	1 4,090	1 24,022	1 45,340	1 2,592	1 18,483	2 30,397	2 1,148	2 2,668	2 500	2 3,033	2 36,835	2 4,036
Value.....dollars..	5,930	19,218	97,934	5,599	19,407	531,948	14,325	21,344	4,000	30,330	49,727	42,399
COUNTIES.	ACRES HARVESTED.											
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Alfalfa.	Wild, salt, or prairie grasses.	Silage crops.	Corn out for forage.	Kafir, sorghum, etc., for forage.	Kafir, milo, feterita, durra.	Sugar beets grown for sugar.
Barber.....						80						
Barton.....	7				5	7						
Cheyenne.....	45					255	350	10	1			
Cowley.....						20			30			
Finney.....	48	1,073			1,223	9,760	200	261	145	1,036	1,709	821
Ford.....		10	3,328	118		30						
Gray.....					6	355		10		30	15	
Greenwood.....	35	63	36			197						
Hamilton.....			25		10	1,813				158	3	
Hodgeman.....			100									
Kearny.....	19	12	170	116	78	248				14	293	30
Nemaha.....						14						
Pawnee.....	30	77	250		15	1,225						
Pottawatomie.....						19		210	10			
Reno.....						9						
Republic.....						5						
Scott.....	24	3	120		20	872					26	
Sherman.....						45						
Thomas.....					5							
Wallace.....	30											
Wichita.....						7		50			4	

<sup>1</sup> Bushels.

<sup>2</sup> Tons.



AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

MONTANA.

THE STATE.	PRINCIPAL CROPS.											
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Dry beans.	Dry peas.	Flaxseed.	Sugar-beet seed.	Potatoes.
Acres harvested.....	2,436	45,153	39,396	121,804	10,286	1,370	3,330	1,022	12,070	3,740	965	4,903
Production..... bushels..	34,132	1,183,068	831,668	1,551,685	185,866	6,826	8,824	14,578	143,042	22,534	508,385	568,008
Value..... dollars..	58,024	1,183,068	792,687	3,708,527	278,799	11,263	211,776	61,219	443,430	100,276	305,031	1,234,819
COUNTIES.	ACRES HARVESTED.											
Beaverhead.....		3,230	248	1,628	873				74			97
Big Horn.....	120	1,490	926	3,262	116		238	1			573	70
Blaine.....	17	761	147	1,855	34	18	840			520		133
Broadwater.....		232		453	75							1
Carbon.....	260	2,828	1,226	14,428	416		667	298	10			322
Carter.....												7
Cascade.....	5	459	495	1,572	47		111			25		125
Custer.....	288	598	11	218	15	37	7	4				108
Dawson.....												6
Deer Lodge.....		676	123	283	5	28						299
Fergus.....	98	292	989	1,556	106	82	2		1			90
Flathead.....	12	435	1,014	1,938	182	80						64
Gallatin.....	45	5,765	4,406	12,462	2,569	12		120	3,737			231
Glacier.....				260						201		4
Hill.....		20		249								23
Jefferson.....	8	646	76	978	84	15	3	2	30			165
Lewis and Clark.....		1,023	601	1,651	30					5		673
Lincoln.....		183	113	674	73							272
Madison.....	2	4,078	1,179	6,576	538	9	21	1	1,575			540
Meagher.....		755	534	153	140	50						30
Mineral.....												1
Missoula.....	61	2,809	8,747	6,861	250	109	6	11	207			186
Musselshell.....		25		20			15					13
Park.....		1,245	943	2,874	531	5	6		1,585			139
Phillips.....	8	496	435	1,707	28	161	2			141		43
Pondera.....		2,998	438	23,882	974	416	305			2,416		109
Powell.....		1,410	2,938	1,652	99	43	30		27			358
Prairie.....												2
Ravalli.....	80	5,238	820	8,583	1,914	71	3	59	4,657			
Richland.....	95	579		2,730	145	68	97	9		141		
Roosevelt.....		14		199			100			155		
Rosebud.....	10	20					314					
Sanders.....	1	212	221	151	8							20
Sheridan.....												2
Silver Bow.....		68		37	4	12						
Stillwater.....	365	1,173	8,930	5,335	93	30	125	174	9			113
Sweet Grass.....		832	249	2,524	99		38		23	6		75
Teton.....		20	5	194	82							3
Treasure.....	687	78	10	164								10
Valley.....		140		563	12							12
Wheatland.....		210	645	245		10				100		1
Yellowstone.....	279	4,136	2,928	14,007	724	29	500	343	40	30	392	556

THE STATE.	PRINCIPAL CROPS.											
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Sugar beets grown for sugar.	Apples.	Cherries.
Acres harvested.....	35,781	91,912	5,576	220,281	39,254	177,385	25,349	770	620	7,686	1,761,904	147,600
Production..... bushels..	35,613	105,845	6,967	408,993	39,523	131,652	18,194	1,184	3,357	67,297	477,796	9,595
Value..... dollars..	1,050,584	3,176,350	205,626	11,247,308	1,047,860	3,068,822	436,656	28,416	40,284	740,267	788,363	39,819
COUNTIES.	ACRES HARVESTED.											
Beaverhead.....	4,470	7,325	9	14,102	8,904	103,621	1,113	27				
Big Horn.....	166	834	125	8,996	716	2,444	915	15		697	62	
Blaine.....	585		192	5,437	495	3,643	638	21	30			
Broadwater.....	15	58		2,515	685		70					
Carbon.....	1,261	5,376	423	15,981	2,063	64	1,450	116	56	666	35,535	874
Carter.....				288	100	65	30					
Cascade.....	345	317	19	7,965	101	1,036	499	80				
Chouteau.....				15		34						
Custer.....		20	14	4,633	195	340	1,408		147	239		
Dawson.....				288		329						
Deer Lodge.....	2,118	903		1,183	237	2,868	72				30	
Fergus.....	1,084	302	105	8,875	714	434	899				20	
Flathead.....	582	1,070	6	1,076	47	220	1,122		36	145	8,244	1,559
Gallatin.....	5,429	6,814	3,313	16,892	2,146	1,839	997	3			524	
Garfield.....				3								

<sup>1</sup> Number of trees of bearing age.

<sup>2</sup> Tons.

<sup>3</sup> Bushels.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1910 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

MONTANA—Continued.

COUNTIES—continued.	ACRES HARVESTED.											
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Sugar beets grown for sugar.	Apples.	Cherries.
Glacier.....				42		50	295					
Granite.....	6											
Hill.....	10	40		435			228		7			
Jefferson.....	508	408		6,126	307	1,531			258			
Lewis and Clark.....	816	1,987	4	9,927	597	2,720	1,008	104				
Lincoln.....	1,076	903	8	456		14	297	2		5,007	83	
McCone.....						90						
Madison.....	1,558	7,890	47	19,554	6,979	10,391	1,388	164		5,720	49	
Meagher.....	3,469	4,050		2,370	3,289	4,847	703	10				
Mineral.....	70	22		67			19					
Missoula.....	2,954	7,640	274	4,241	272	825	1,423	50	18	400	24,059	1,046
Musselshell.....	55	150		2,294		245	119					
Park.....	2,607	8,644	106	13,075		1,148	638			1,280		
Phillips.....				5,382	3,973	11,630	1,313					
Pondera.....	511	319	17	4,011	194	1,324	2,121	3				
Powder River.....				305			5					
Powell.....	576	16,931	1	5,089	246	19,622	642					
Prairie.....				8								
Ravalli.....	2,621	15,016	617	11,072	1,323	1,030	752	83		1,460	666,699	42,802
Richland.....	12	8		3,783	41	69	314		26	13	1,460	343
Roosevelt.....				126			323					
Rosebud.....				138			10					
Sanders.....	179	981	4	348			95				2,637	243
Sheridan.....						50	57					
Silver Bow.....	526	1,605	20	810	20	2,166	239					
Stillwater.....	620	1,433	167	6,684	524	72	745	28	12	625	2,853	14
Sweet Grass.....	1,424	844	1	14,324	547	1,180	1,074	16		375		
Teton.....				333	10	160						
Treasure.....				852	25		12			243		
Valley.....				850	1,845	870	150					
Wheatland.....	220	90	1	3,341	960	743	93	30				
Yellowstone.....	10	82	75	21,069	45	236	1,083	16	162	2,868	7,829	37

NEBRASKA.

THE STATE.	PRINCIPAL CROPS.													
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Alfalfa.	Other tame grasses.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Potatoes.	Sugar beets grown for sugar.
Acres harvested.....	26,798	12,875	15,321	9,748	3,610	1,403	60,476	1,205	942	14,956	1,459	1,392	6,671	42,069
Production.....	626,064	364,033	321,419	155,405	105,958	117,630	135,942	1,506	807	12,797	2,923	3,365	1,720,833	445,521
Value.....dollars.	845,186	273,062	691,050	340,571	116,554	24,682	2,682,898	18,525	11,271	172,760	30,692	32,158	1,729,999	4,677,971
COUNTIES.	ACRES HARVESTED.													
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Alfalfa.	Other tame grasses.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Potatoes.	Sugar beets grown for sugar.
Antelope.....	165											109	39	92
Boone.....							15							
Brown.....													10	
Buffalo.....	323				15		57		1					
Cass.....										10				
Cheyenne.....													7	
Custer.....		25												
Dawes.....										1,080				
Dawson.....	7,921	882	4,885	708	168	47	3,093	16		12	67	458	25	245
Deuel.....	590	10	450	20	50	245	1,289	15		683		7		180
Douglas.....														
Dundy.....	300	84	93		60		1,491			522	51	43	1	
Gage.....													3	
Garden.....	120	108					36							
Hitchcock.....	1,698	92	2,017	15	88	43	1,064	179	23	173	215	241	35	22
Kath.....	2,269		1,056		12	10	922			45	245	19		
Kimball.....	95	25		314	12		229						340	168
Lancaster.....													1	
Lincoln.....	1,304	278	198	491	4	90	2,440	29	11	804	101	232	86	3,664
Madison.....													1	
Morrill.....	4,235	2,990	3,467	1,991	165	350	7,963	212	107	4,624	607	164	984	5,701
Redwillow.....	491	10	10		70		179	4				48		
Saline.....	120													
Scotts Bluff.....	5,679	6,954	3,625	5,313	1,940	504	28,854	601	240	4,809	78	75	3,480	29,993
Seward.....		20												
Souix.....	1,170	1,317	520	998	1,026	178	13,680	149	555	2,090	35	13	1,692	
Valley.....	35						6							

\* Bushels.

\* Tons.

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

NEVADA.

		PRINCIPAL CROPS.												
		Oats.	Winter wheat.	Spring wheat.	Barley.	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Potatoes.
<b>THE STATE.</b>														
Acres harvested.....		2,501	2,921	17,062	5,156	4,229	14,059	487	112,166	29,114	706	5,564	134,369	2,823
Production.....		1 04,873	1 60,220	1 377,248	1 138,793	1 4,855	1 19,351	1 768	1 318,906	1 31,306	1 545	1 6,272	1 122,148	1 410,001
Value.....dollars..		74,604	138,506	867,670	242,888	111,685	445,073	16,896	6,537,573	641,773	9,810	116,032	2,259,701	918,402
<b>COUNTIES.</b>														
Churchill.....		121	325	2,825	92			40	18,565			689	20	73
Clark.....		102	1,068	214	151				1,420		4	75		1
Douglas.....		218	404	2,674	1,395	318	2,742		8,781	2,105		130	658	96
Elko.....		541	168	1,067	273	2,611	6,248	305	12,068	18,486	682	1,000	70,556	187
Esmeralda.....		28	1	190	39				1,077			11		
Eureka.....		50		38	100				1,203	4,065		300	5,961	57
Humboldt.....		168	5	947	35				5,101	1,297		368	25,393	37
Lander.....				111	9				2,593	137		40	6,772	30
Lincoln.....		110	78	16	33	121			1,621	30		65	2,087	
Lyon.....		24	159	3,206	1,065	100			17,720	280		253	635	1,161
Mineral.....				254	111		1,090		3,032	427			1,120	215
Nye.....		52	44	72	189		57	16	2,577	1,164		109	6,451	43
Ormsby.....		6	25	85	45	7	547		378	6	3	6	110	79
Pershing.....		18	60	2,139	787				17,958	306		857	804	33
Storey.....				50					340			5		15
Washoe.....		155	416	2,637	231	8	2,410		11,217	804		1,495	6,501	528
White Pine.....		908	168	537	601	161	550	126	6,339		17	161	7,291	270

<sup>1</sup> Bushels.

<sup>2</sup> Tons.

NEW MEXICO.

		PRINCIPAL CROPS.									
		Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Clover and alfalfa seed.	Kafir, milo, etc.	Dry beans.	Dry peas.	Cotton.
<b>THE STATE.</b>											
Acres harvested.....		38,954	8,880	9,059	22,251	2,889	2,583	2,205	5,630	3,606	7,527
Production.....		1 948,594	1 250,102	1 185,479	1 395,679	1 62,070	1 6,354	1 66,693	1 63,269	1 51,202	1 4,077
Value.....dollars..		1,422,891	262,607	370,958	791,358	80,691	127,080	83,354	221,442	128,005	913,248
<b>COUNTIES.</b>											
Bernalillo.....		2,077	178	272	1,109	26	8		134	26	
Chaves.....		3,729	975	701	99	344	1,733	112	14		43
Colfax.....			3,382	1,688	4,321	698	126		743	1	
Doña Ana.....		141						40	2		
Dona Ana.....		5,896	239	2,345	1,772	453	27	177	451	5	
Eddy.....		2,182	224	75		219	616	441	57		7,484
Grant.....		2,358	100	141	27			20	91	5	
Gundalupo.....		341	4	31	19				106		
Hidalgo.....		965	171	108	211	12		5	13		
Lea.....		56	60	42					19		
Lincoln.....		899	15	78	79	131		1	28		
Luna.....		743		76		153		1,226	1,121	12	
McKinley.....		855	263	17	374	13			134	1	
Mora.....		15		32							
Otero.....		548	57	318	106	92		166	18		
Rio Arriba.....		1,849	1,118	744	2,066	220			488	770	
San Juan.....		4,102	269	163	535	74	78		108	3	
San Miguel.....		660	206	377	275	11			91	6	
Sandoval.....		2,265	460	108	2,237	70			218	138	
Santa Fe.....		870	43	128	894				186	61	
Sierra.....		1,320	5	383	92	3		14	230	12	
Socorro.....		1,937	51	248	1,001	21		3	271	1	
Taos.....		1,346	756	613	3,484	289			728	2,565	
Valencia.....		2,879	245	408	2,618	60			379		

		PRINCIPAL CROPS.										
		Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.
<b>THE STATE.</b>												
Acres harvested.....		1,766	1,338	821	87,106	4,015	701	6,459	8,513	1,188	3,456	5,748
Production.....	tons.	2,658	2,074	1,581	211,351	5,366	1,011	10,287	6,337	8,409	5,805	10,948
Value.....dollars..		53,160	37,332	25,296	4,861,073	112,476	15,165	200,597	101,392	79,886	69,660	162,720

<sup>1</sup> Bushels.

<sup>2</sup> Bales.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

NEW MEXICO—Continued.

COUNTIES.	ACRES HARVESTED.										
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Annual legumes cut for hay.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Corn cut for forage.	Kafir, sorghum, etc., for forage.
Bernalillo.....			38	3,178	69	477	175	304	81	274	99
Chaves.....	13		13	15,292	80	8	287	27	417	373	1,457
Colfax.....	666	230	247	7,876	868	10	1,736	3,187	175	157	264
De Baca.....				1,019							292
Dona Ana.....			365	11,854	193	2	620	237	214	305	577
Eddy.....				7,885	23		30			207	1,529
Grant.....				1,374	234		15			17	21
Guadalupe.....	3			570			6	3		91	34
Hidalgo.....				441	11		7				18
Lea.....				64	2					129	103
Lincoln.....			3	1,985			161			60	167
Luna.....			10	879	254		23	2,131	58	101	557
McKinley.....				512	32		19			10	
Mora.....				556			38	100			
Otero.....				1,685	127		113		15	41	324
Rio Arriba.....	778	964	15	4,939	899	97	1,182	558		50	2
Roosevelt.....										20	
San Juan.....			4	9,287	80	2	228	15	136	494	82
San Miguel.....	109	16		2,227	75	10	399	22	53	128	30
Sandoval.....	8	13		2,932	47		283	163		462	1
Santa Fe.....	3	10	2	1,931	162	6	113	10	34	140	4
Sierra.....				841	23		33			90	120
Socorro.....	5	6	3	2,656	201	5	110	44		120	1
Taos.....	179	90	20	3,859	551	63	800	992		73	11
Torrance.....											22
Valencia.....	2	4	101	3,323	84	31	80	720		114	33

THE STATE.	PRINCIPAL CROPS.								
	Potatoes.	Peppers (green).	Cantaloupes and muskmelons.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Acres harvested.....	504	400	421	1176,520	321,233	55,464	21,681	9,351	8,204
Production.....	19,650			630,440	487,878	93,140	26,007	11,123	5,876
Value..... dollars..	46,178	58,290	54,590	50,435	780,605	200,251	45,512	23,914	19,978

COUNTIES.	ACRES HARVESTED.									
	Potatoes.	Peppers (green).	Cantaloupes and muskmelons.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.	Kafir, sorghum, etc., for forage.
Bernalillo.....	3	72	17	10,528	10,205	6,482	1,885	1,210	1,538	
Chaves.....	6	2	12	4,561	192,749	24,110	4,401	966	1,829	
Colfax.....					30		1	8	3	
Curry.....					150		200	10	45	175
Dona Ana.....	2	45	346	12,578	12,896	4,866	9,254	1,030	78	
Grant.....		27			120	125	16	10		
Hidalgo.....	30				183	162	55	104	15	
Lea.....				212	629	1,534	59	273	102	
Lincoln.....					15,852	1,175	470	592	266	
Luna.....	22	10	14	273	965	3,270	885	216	30	
McKinley.....	11		2							
Rio Arriba.....	236	85			4,200	865	276	855	623	
San Juan.....	114		18	9,261	47,453	3,526	2,847	1,227	1,699	
San Miguel.....		2	1		1,256	594	158	385	157	
Sandoval.....	2		1	136,567	2,105	2,846	440	718	575	
Santa Fe.....		116	5	1,000	21,354	1,955	546	655	659	
Sierra.....		12	2	25	2,348	1,671	259	531	80	
Socorro.....	13	9	2	310	852	559	170	127	12	
Taos.....	59				3,365	32	40	136	89	
Torrance.....					65	35	2	11	4	
Valencia.....	6	20	1	1,205	4,456	2,555	409	247	260	

<sup>1</sup> Number of vines of bearing age.

<sup>2</sup> Number of trees of bearing age.

<sup>3</sup> Bushels.

<sup>4</sup> Pounds.

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

NORTH DAKOTA.

THE STATE.	PRINCIPAL CROPS.						
	Oats.	Spring wheat.	Barley.	Rye.	Other tame grasses.	Small grains cut for hay.	Wild, salt, or prairie grasses.
Acres harvested.....	2,870	15,713	1,186	2,040	1,028	1,664	779
Production.....	130,555	180,292	110,565	18,673	1453	1,906	301
Value.....dollars.....	24,444	192,701	12,150	12,576	7,474	13,137	4,666
COUNTIES.	ACRES HARVESTED.						
	Oats.	Spring wheat.	Barley.	Rye.	Other tame grasses.	Small grains cut for hay.	Wild, salt, or prairie grasses.
Dunn.....	2,700	15,248	1,176	2,007	1,001	1,608	609
Williams.....	170	365	10	33	27	56	170

<sup>1</sup> Bushels.

<sup>2</sup> Tons.

OREGON.

THE STATE.	PRINCIPAL CROPS.										
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.
Acres harvested.....	1,764	7,980	4,511	21,799	7,602	1,929	5,340	23,377	5,275	102,409	7,094
Production.....	162,167	1,235,637	178,649	1,357,487	1,216,493	118,470	7,066	33,484	9,795	309,206	9,759
Value.....dollars.....	102,576	223,856	165,949	817,598	335,564	38,787	176,650	770,132	200,797	6,493,326	175,662
COUNTIES.	ACRES HARVESTED.										
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.
Baker.....	118	955	281	941	444	140	332	4,227	9	10,097	747
Clackamas.....			5				3	2			
Coos.....	2	9					45	47	8	1	
Crook.....		130	285	458	70	82	100	58	66	4,138	642
Deschutes.....	21	475	8	753	38	210	44	173	462	8,541	57
Douglas.....	4		4				3	20	103	139	54
Grant.....	1	252	57	240	68	37	947	8,210	62	2,805	193
Harney.....		321		176	122	83	104	496	22	1,733	600
Hood River.....	129	184	129	169	25		157	445	867	2,391	78
Jackson.....	297	27	348	92	310	8	471	1,205	306	5,544	920
Jefferson.....								2		120	
Josephine.....	65	21	38	34	99	2	52	619	47	871	701
Klamath.....		2,650	209	5,425	1,236	891	931	3,018	20	14,464	300
Lake.....		144	1,142	2,596	504	97	83	438		353	610
Lane.....		37					14				
Malheur.....	977	663	133	2,291	578	163	70	889	183	17,879	1,394
Marion.....											
Morrow.....	30		38		5					2,439	
Multnomah.....										13	
Polk.....											
Tillamook.....											36
Umatilla.....	99	41	102	1,158	570	120		2	12	21,630	
Union.....	21	481	411	641	370	30	696	1,064	75	2,536	256
Wallowa.....		1,690	1,316	6,627	2,863	65	582	1,172	3,010	6,089	112
Wasco.....									20	20	
Washington.....			5						3		
Wheeler.....							705	1,290		606	395

THE STATE.	PRINCIPAL CROPS.										
	Small grains cut for hay.	Annual legumes cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Potatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Acres harvested.....	23,022	1,523	51,453	1,432	1,880	8,525	177,789	25,953	115,520	21,664	6,656
Production.....	26,695	1,219	49,792	6,578	181,986	110,395	402,912	50,692	141,258	36,930	7,803
Value.....dollars.....	560,595	24,380	796,672	65,780	382,171	6,624	543,931	78,573	226,013	81,246	27,319
COUNTIES.	ACRES HARVESTED.										
	Small grains cut for hay.	Annual legumes cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Potatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Baker.....	832	1	3,560		41						
Clackamas.....					18						
Coos.....	71	10	45	20	3						
Crook.....	2,126		437	250			4				4
Deschutes.....	2,606	264	610	194	733						
Douglas.....	188		3	31	20	18	8,909	365	637	3,637	170
Grant.....	1,040	8	1,183		61						
Harney.....	1,794		15,920								
Hood River.....	604	3	34	21	278		35,282	53	2,408	30	14
Jackson.....	1,172	38	299	44	152	550	47,491	15,326	107,637	587	2,052

<sup>1</sup> Bushels.

<sup>2</sup> Tons.

<sup>3</sup> Number of vines of bearing age.

<sup>4</sup> Number of trees of bearing age.

<sup>5</sup> Pounds.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

**OREGON—Continued.**

COUNTIES—continued.	ACRES HARVESTED.										
	Small grains cut for hay.	Annual legumes cut for hay.	Wild, salt, or prairie grasses.	Silage crops.	Potatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Jefferson.....	32				1						
Josephine.....	326	19	55	29	68						
Klamath.....	5,885	1,181	7,173		203		607	6	8	63	29
Lake.....	900		6,289		4						
Lane.....	48						172	10	18	23	20
Malheur.....	1,652		15,210	313	47	14	1,512	25	11	14	23
Marion.....	37						70	4	32	18	4
Morrow.....	349			11	18						
Multnomah.....											
Polk.....					5						
Tillamook.....	15				4						
Umatilla.....	845			67	93	7,943	80,599	10,092	4,641	17,029	4,126
Union.....	560	4	311	363	45		2,667	72	56	213	198
Wallowa.....	1,937		150	82	73		363		7	50	16
Wasco.....	3				1						
Washington.....				7	2						
Wheeler.....			165		5						

**SOUTH DAKOTA.**

THE STATE.	PRINCIPAL CROPS.												
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Clover and alfalfa seed.	Timothy alone.	Timothy and clover mixed.	Alfalfa.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Potatoes.	Sugar beets grown for sugar.
Acres harvested.....	2,176	3,026	759	10,949	1,026	1,040	539	1,969	38,519	1,708	3,825	413	1,052
Production.....	139,667	171,692	17,335	133,341	117,841	12,358	2,566	1,953	74,193	1,720	3,026	135,065	11,782
Value.....dollars..	51,567	53,769	16,357	297,350	21,409	53,055	3,490	33,201	1,595,150	28,380	39,338	57,662	117,820

COUNTIES.	ACRES HARVESTED.												
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Clover and alfalfa seed.	Timothy alone.	Timothy and clover mixed.	Alfalfa.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Potatoes.	Sugar beets grown for sugar.
Brookings.....												35	
Brown.....				1,220								300	
Butte.....	1,477	2,660	665	8,054	850	526	67	56	24,388	1,423	813	209	1,052
Charles Mix.....		15		80					80		50		
Custer.....	205			114	20	8			2,202		1,340		
Day.....						4							
Fall River.....	86	6	5	409	1	237			449		264		
Hughes.....												1	
Lawrence.....	122	173	10	496	26		172	178	1,422	157	192	166	
McPherson.....	41										35		
Meade.....	137	101	75	237	47				2,517	104	18	1	
Pennington.....	108	71	4	339	52	215	300	1,765	7,461	24	778	86	

<sup>1</sup> Bushels.

<sup>2</sup> Tons.

**TEXAS.**

THE STATE.	PRINCIPAL CROPS.									
	Corn.	Oats.	Winter wheat.	Kafir, milo, etc.	Dry beans.	Rough rice.	Broom corn.	Cotton.	Potatoes.	Sweet potatoes and yams.
Acres harvested.....	38,736	3,494	6,146	6,310	694	164,301	12,199	22,006	553	603
Production.....	11,207,132	153,895	190,535	1,200,459	16,781	15,297,169	5,144,047	8,537	135,317	169,223
Value.....dollars..	1,629,628	43,116	187,407	230,628	29,336	14,832,073	257,202	1,476,901	79,441	106,601

COUNTIES.	ACRES HARVESTED.									
	Corn.	Oats.	Winter wheat.	Kafir, milo, etc.	Dry beans.	Rough rice.	Broom corn.	Cotton.	Potatoes.	Sweet potatoes and yams.
Anderson.....									35	
Atascosa.....	407			12		8			50	48
Bailey.....	210		20	185						
Bexar.....	1,783		112	9		10		342		
Borden.....				27				7		
Bosque.....				3						
Brazoria.....						629				
Brewster.....									3	
Cameron.....	10,917			10		51		686	7,513	424
Chambers.....							19,915			130

<sup>1</sup> Bushels.

<sup>2</sup> Pounds.

<sup>3</sup> Bales.



AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

TEXAS—Continued.

COUNTIES—continued.	ACRES HARVESTED.									
	Corn.	Oats.	Winter wheat.	Kafir, milo, etc.	Dry beans.	Rough rice.	Broom corn.	Cotton.	Potatoes.	Sweet potatoes and yams.
Cherokee.....				610	1			15		
Coke.....						9,604				
Colorado.....	8									
Crockett.....	15									
Dallam.....										
De Witt.....	10							8		4
Deaf Smith.....	132	40	78	3,011						
El Paso.....	3,469	1,962	2,175	446	418				29	241
Fisher.....				27						
Fort Bend.....						230				
Frio.....	201			192	6				7	25
Galveston.....						200				
Gillespie.....	92	40	6	6						
Hale.....	12		944	1,234						
Harris.....						6,638				
Hemphill.....	10	10	10	100			30	10		
Hidalgo.....	14,677		9	3	98		11,419	6,646	54	82
Irion.....	43	2	22					107		
Jackson.....						6,045		37		
Jefferson.....						42,939				
Kerr.....									2	3
Kinney.....	258			100				140		
Lampasas.....		22						4		
Liberty.....						10,410				
Matagorda.....						37,927				
Maverick.....	230		455	5						2
Medina.....	2,545	7						595		3
Menard.....	432	321	911	33				331		16
Nueces.....	6							100		
Orange.....						9,223				
Palo Pinto.....	36									
Presidio.....	465		750	22	90			12		10
Roeves.....	68	86	359	57	8			3,480		
Runnels.....	3	5	2	15			33	682		
Rusk.....									1	
Smith.....		4						11		
Stephens.....								48		
Taylor.....	2									
Tom Green.....	205	832	298	201			1	1,594		40
Travis.....	42									
Uvalde.....	50	14						1		
Val Verde.....	70									2
Victoria.....						100				
Webb.....	88						8	81	5	7
Wharton.....						20,441		110		
Wichita.....	24	17	100					2		1
Zavalla.....	226			29	4		22	45		

THE STATE.	PRINCIPAL CROPS.									
	Alfalfa.	Other tame grasses.	Small grains out for hay.	Wild, salt, or prairie grasses.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Cabbages.	Onions.	Beans (green).	Tomatoes.
Acres harvested.....	19,455	4,612	1,145	690	532	11,817	1,976	942	478	614
Production..... tons..	55,544	8,790	1,244	691	631	26,570				
Value..... dollars..	1,638,543	202,170	29,866	12,734	11,989	504,830	394,883	424,763	74,620	176,800

COUNTIES.	ACRES HARVESTED.									
	Alfalfa.	Other tame grasses.	Small grains out for hay.	Wild, salt, or prairie grasses.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Cabbages.	Onions.	Beans (green).	Tomatoes.
Atascosa.....		12	26	1		98				
Bailey.....	160	4								
Bexar.....		512	51	9	29	237				
Borden.....			2							
Bosque.....		37		46	4	649				
Brewster.....									1	
Caldwell.....						4				
Cameron.....	342	394	3	52	75	1,593	1,254	16	356	409
Childress.....						30				
Coke.....			2:2	32		760				
Collin.....						2				
Crockett.....						3				
Dallam.....				100						
Deaf Smith.....	531	3			102	1,382				
Dimmit.....								56		3

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

TEXAS—Continued.

COUNTIES—continued.	ACRES HARVESTED.									
	Alfalfa.	Other tame grasses.	Small grains cut for hay.	Wild, salt, or prairie grasses.	Corn cut for forage.	Kafir, sorghum, etc., for forage.	Cabbages.	Onions.	Beans (green).	Tomatoes.
El Paso.....	10,044	211	517		109	1,647	14	11	21	157
Floyd.....	112									
Frio.....	8	102				97		309	3	1
Gillespie.....					95	20				
Grayson.....							2			
Hale.....	703	22	2			279	1		1	
Hemphill.....		5				30				
Hidalgo.....	646	1,083		18	29	2,150	692	118	93	34
Irion.....	106	330		3		18				
Jack.....					10	197				
Kinney.....						152				
Lampasas.....				9						
McLennan.....							2	1	1	2
Mastagorda.....		2			15		1		1	
Maverick.....	28	141								
Medina.....	25	27				224				
Menard.....	454	84	61		19	132	5			
Nueces.....						120	4			
Palo Pinto.....						3				
Potter.....		50			30	100				
Presidio.....	31	30	47			312				
Rains.....		14			6					
Reeves.....	4,854	21	26	10	43	376	1		1	
Runnels.....						178				
Sherman.....					12	350				
Smith.....	89									
Terrill.....	7	30								
Throckmorton.....						47				
Tom Green.....	932	807	62			263				
Travis.....	18	20				7				
Uvalde.....	38	200				22				
Val Verde.....		216	11	4	3	1				
Ward.....		35				233				
Washington.....						2				
Webb.....	327	26			5	41				
Wichita.....		60	40	400		28				
Wood.....										8
Zavalla.....		134	85			35		431		

UTAH.

THE STATE.	PRINCIPAL CROPS.								
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Potatoes.	Sugar beets grown for sugar.
Acres harvested.....	9,028	52,695	41,289	91,533	11,884	3,892	9,692	10,758	92,439
Production.....	1 193,560	1 1,560,574	1 545,706	1 1,895,241	1 309,724	1 27,915	1 46,125	1 1,550,386	1 921,415
Value.....dollars..	377,442	1,872,689	1,207,153	4,169,530	526,531	57,226	922,500	3,305,698	9,951,314

COUNTIES.	ACRES HARVESTED.								
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Potatoes.	Sugar beets grown for sugar.
Beaver.....	132	673	281	1,296	290	8	53	107	5
Box Elder.....	113	2,539	6,517	7,153	1,357	238	241	319	13,247
Cache.....	90	2,327	6,322	8,367	566	47	42	699	18,248
Carbon.....	77	373	74	474	26		112	117	136
Daggett.....	1	420	21	133				16	
Davis.....	98	453	1,844	2,526	645	3	2	1,017	5,397
Duchesne.....	586	3,472	1,111	3,877	240	28	1,859	1,054	3
Emery.....	244	4,165	83	4,458	139		1,763	213	3
Garfield.....	14	1,992	57	1,053	98	398		38	
Grand.....	714	75	19	168				36	
Iron.....	596	1,067	201	1,844	272		130	119	
Juab.....	140	364	2,011	796	161	284	226	93	252
Kane.....	832	578	242	197	4	146	60	54	
Millard.....	315	1,309	4,472	2,697	488	1,489	4,062	187	5,885
Morgan.....	3	834	470	2,410	360		91	139	167
Plute.....	8	1,309	7	1,540	35	47	18	109	5
Rich.....		1,377	133	758	258		8	57	
Salt Lake.....	839	1,852	2,599	7,247	975	39	12	1,438	6,957
San Juan.....	617	578	235	211	11		8	26	
Sanpete.....	95	6,198	2,295	12,307	1,436	660	16	480	4,041

1 Bushels.

1 Tons.

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

UTAH—Continued.

COUNTIES—continued.	ACRES HARVESTED.								
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Potatoes.	Sugar beets grown for sugar.
Sevier.....	76	4,856	607	6,689	463	162	3	293	5,629
Summit.....	1	1,394	291	1,225	404	18	.....	190	.....
Tooele.....	105	3,994	3,994	817	680	226	28	120	296
Uintah.....	463	3,264	445	2,120	161	.....	691	100	22
Utah.....	1,619	4,072	4,399	12,408	1,489	23	144	2,136	20,153
Wasatch.....	.....	1,521	114	2,818	189	5	3	155	307
Washington.....	892	1,152	1,126	614	234	5	18	130	.....
Wayne.....	83	1,692	52	1,309	440	1	7	117	.....
Weber.....	276	2,725	1,207	4,016	433	65	45	1,199	11,785

THE STATE.	PRINCIPAL CROPS.										
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Corn cut for forage.	Root crops for forage.
Acres harvested.....	11,972	31,284	2,136	342,635	22,341	67,344	9,320	1,596	3,377	3,837	733
Production..... tons.....	19,200	50,953	3,383	734,746	29,999	78,886	14,985	3,601	27,284	9,557	7,024
Value..... dollars.....	508,800	1,324,778	74,426	18,838,023	629,979	1,498,834	299,700	72,020	272,840	129,020	136,968

COUNTIES.	ACRES HARVESTED.										
	Timothy alone.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Corn cut for forage.	Root crops for forage.
Beaver.....	158	1,384	62	8,105	240	247	55	.....	12	7	2
Box Elder.....	640	610	32	25,132	2,359	4,793	715	140	140	53	65
Cache.....	1,515	2,813	42	16,955	985	1,463	739	28	285	41	240
Carbon.....	15	360	.....	4,139	160	261	47	16	1	46	1
Daggett.....	27	.....	.....	1,774	58	571	18	.....	.....	134	.....
Davis.....	386	325	31	9,019	2,103	358	249	4	570	110	16
Duchesne.....	379	168	635	34,629	405	176	614	10	1	211	21
Emery.....	3	.....	156	14,938	401	321	140	.....	195	.....	10
Garfield.....	581	.....	.....	8,716	643	1,281	631	41	.....	25	9
Grand.....	.....	10	.....	3,298	107	257	48	.....	.....	176	.....
Iron.....	150	298	22	12,932	195	302	181	.....	77	485	103
Juab.....	162	.....	.....	4,981	71	948	255	1	77	70	4
Kane.....	36	.....	.....	2,232	58	724	287	.....	46	674	4
Millard.....	12	.....	28	23,254	1	760	742	.....	2	344	12
Morgan.....	879	1,363	2	1,545	236	1,159	133	95	3	3	10
Piute.....	319	96	44	6,845	240	1,204	120	.....	.....	45	8
Rich.....	310	1,590	.....	3,766	585	25,470	41	47	.....	.....	.....
Salt Lake.....	472	371	140	21,584	333	1,100	402	36	478	207	98
San Juan.....	16	100	.....	7,890	70	107	104	.....	50	180	1
Sanpete.....	638	510	48	27,665	4,062	6,257	1,221	33	67	28	10
Sevier.....	659	598	15	26,335	1,141	2,415	229	8	51	9	4
Summit.....	1,311	9,868	123	1,198	4,592	5,225	135	12	129	12	1
Tooele.....	20	60	.....	5,133	510	1,498	127	.....	10	49	15
Uintah.....	350	251	89	19,235	368	552	523	48	19	56	30
Utah.....	610	544	444	23,711	1,359	5,741	621	145	1,026	441	15
Wasatch.....	843	7,325	127	3,239	204	1,612	315	159	47	.....	10
Washington.....	113	50	10	7,697	92	18	55	8	10	112	.....
Wayne.....	.....	298	25	6,014	335	1,106	293	19	.....	.....	.....
Weber.....	1,368	2,198	51	10,673	428	1,423	360	746	51	319	37

THE STATE.	PRINCIPAL CROPS.							
	Peas (green).	Tomatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Acres harvested.....	2,055	3,428	103,344	594,168	519,350	46,261	55,925	94,612
Production.....	.....	.....	535,897	478,624	484,342	65,861	44,112	107,238
Value..... dollars.....	183,289	483,659	32,148	1,361,923	1,366,947	135,015	77,196	348,524

COUNTIES.	ACRES HARVESTED.							
	Peas (green).	Tomatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Beaver.....	.....	.....	.....	854	179	93	339	66
Box Elder.....	44	128	5,050	79,547	122,577	1,147	6,008	13,949
Cache.....	1	8	143	27,174	6,247	457	1,087	696
Carbon.....	.....	6	89	4,389	2,086	894	537	259
Davis.....	265	1,006	10	38,622	30,799	1,333	1,612	24,314
Duchesne.....	.....	1	53	4,150	519	225	472	275
Emery.....	.....	3	100	26,956	2,548	2,555	1,813	640
Garfield.....	.....	.....	4	118	67	10	.....	.....
Grand.....	.....	1	4	5,359	573	1,335	208	165
Iron.....	.....	.....	.....	2,075	503	242	998	155

<sup>1</sup> Number of vines of bearing age.

<sup>2</sup> Number of trees of bearing age.

<sup>3</sup> Pounds.

<sup>4</sup> Bushels.

# IRRIGATION.

**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

UTAH—Continued.

COUNTIES—continued.	ACRES HARVESTED.							
	Peas (green).	Tomatoes.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.	Cherries.
Juab.....		4	11	11,513	3,781	106	273	132
Kane.....			35	1,731	267	169	291	103
Millard.....		1		5,945	1,579	529	579	49
Morgan.....	655			4,425		561	227	39
Piute.....				1,633	449	86	381	306
Rich.....				1,617		168	147	105
Salt Lake.....	250	216	3,183	86,463	44,809	7,117	7,938	14,325
San Juan.....			7	639	131	398	239	100
Sanpete.....	52			11,432	4,458	427	2,768	499
Sevier.....		2		8,939		1,122	3,660	459
Summit.....	146			59		13	7	4
Tooele.....				4,640	2,022	594	1,521	
Uintah.....		3	4	12,223	968	693	1,991	444
Utah.....	198	525	5,380	192,909	172,566	19,419	14,536	20,772
Wasatch.....	144			4,611	1	0	883	64
Washington.....		15	36,956	7,897	30,839	2,148	2,482	1,181
Wayne.....	1			1,073	798	226	438	74
Weber.....	298	911	42,314	48,124	86,464	4,432	4,495	15,385

## WASHINGTON.

THE STATE.	PRINCIPAL CROPS.												
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Red clover seed.	Hops.	Potatoes.	Sugar beets grown for sugar.	Timothy alone.	Timothy and clover mixed.	Clover alone.
Acres harvested.....	13,263	7,215	8,236	35,694	5,781	544	897	507	8,186	4,635	8,142	8,647	2,254
Production.....	1,487,154	1,337,056	1,154,116	1,923,493	1,193,568	1,5,646	1,3,925	2,870,769	11,526,353	2,40,236	1,15,466	1,13,140	2,4,128
Value.....dollars..	876,877	837,056	324,201	2,013,215	290,352	11,292	117,750	391,846	3,205,341	435,089	463,980	444,430	99,072

COUNTIES.	ACRES HARVESTED.												
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Red clover seed.	Hops.	Potatoes.	Sugar beets grown for sugar.	Timothy alone.	Timothy and clover mixed.	Clover alone.
Adams.....				3,910									
Asotin.....	2					225							
Benton.....	1,389	15	949	680	105				584		77	5	23
Chelan.....	74	4	4	108					147		161	108	23
Clallam.....												10	
Clarke.....													
Columbia.....			1,060									1	6
Douglas.....			60	200	30				10		5		
King.....												18	1
Kitsap.....											5		
Kittitas.....	31	3,916	945	9,686	1,441	76					5,170	5,602	419
Klickitat.....	36	903	161	650	12	7			74		455	1,081	451
Lewis.....		44		10					2			62	
Lincoln.....		5	110	205	30	7					660		
Mason.....													
Okanogan.....	346	78	73	246	52						213	363	102
Pend Oreille.....									5			572	3
Pierce.....									10			2	
Spokane.....	47	72	274						198		41	35	111
Stevens.....	27	103	52	63	1	8			34		464	162	35
Wahkiakum.....	293												
Walla Walla.....		1	265	115	157				241	303		79	
Yakima.....	11,008	2,074	4,283	19,921	3,933	211	894	507	6,506	4,332	890	539	1,066

THE STATE.	PRINCIPAL CROPS.											
	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Silage crops.	Corn cut for forage.	Root crops for forage.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.
Acres harvested.....	148,409	17,014	1,047	11,650	2,645	2,001	628	118,892	4,633,119	455,526	530,834	75,094
Production.....	494,066	35,054	2,075	15,214	23,762	6,046	2,619	1,410,072	15,823,446	1,259,176	1,236,330	1,127,042
Value.....dollars..	11,857,584	735,378	39,425	418,385	261,382	78,698	55,104	112,806	13,697,378	2,707,228	580,118	247,732

<sup>1</sup> Bushels.     
 <sup>2</sup> Pounds.     
 <sup>3</sup> Tons.     
 <sup>4</sup> Number of vines of bearing age.     
 <sup>5</sup> Number of trees of bearing age.

AGRICULTURE.

STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.

WASHINGTON—Continued.

COUNTIES.	ACRES HARVESTED.											
	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Silage crops.	Corn cut for forage.	Root crops for forage.	Grapes.	Apples.	Peaches.	Pears.	Plums and prunes.
Adams.....	148			527		2						
Asotin.....	25											
Benton.....	16,630	11	7	808	294	259	10	38,469	370,732	70,920	65,269	9,633
Chelan.....	7,606	7		472		219	12	4,115	1,214,195	50,761	52,817	8,271
Columbia.....	3			45					35	2		6
Douglas.....	1,028	2		153		16		350	289,838	24,358	8,005	2,240
Ferry.....	40								12			
Franklin.....	5											
Garfield.....	82											
Grant.....								40	19,960	1,565	2,615	24
King.....	145			23		12			12	12	260	15
Kitsap.....				23								
Kittitas.....	12,003	16,095	341	1,420	222		2	79	9,884	359	531	325
Klickitat.....	354	31	130	873	37	49	7	736	29,840	452	261	233
Lewis.....		24		35			5					
Lincoln.....	110								490	1,700	262	284
Mason.....									69	1	8	6
Okanogan.....	12,902	109	298	1,239	334	378	454	1,082	384,425	4,408	3,410	839
Pond Oreille.....		45	15	55					82			10
Pierce.....	4			1					1,302	7	108	257
Spokane.....	693	2		550	72	180	10	3,317	622,158	4,622	9,637	2,026
Stevens.....	1,067	192	5	184	7	33	10		10,656			
Walla Walla.....	8,882	2		372	212	177	70					
Yakima.....	86,682	494	251	4,865	1,467	676	48	70,704	1,679,429	296,364	366,456	50,825

WYOMING.

THE STATE.	PRINCIPAL CROPS.								
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Potatoes.	Sugar beets grown for sugar.
Acres harvested.....	2,738	23,684	2,466	40,470	3,099	541	2,386	4,532	2,714
Production.....	151,839	1,512,262	135,513	1,630,098	158,741	14,415	17,584	1,532,511	23,067
Value.....dollars.	85,534	563,488	76,708	1,361,012	91,049	7,726	144,096	1,251,401	242,204

COUNTIES.	ACRES HARVESTED.								
	Corn.	Oats.	Winter wheat.	Spring wheat.	Barley.	Rye.	Clover and alfalfa seed.	Potatoes.	Sugar beets grown for sugar.
Albany.....		1,100	105	92	176	102		180	
Big Horn.....	80	3,289	192	6,268	192		866	547	40
Carbon.....		1,773	419	265	272	59		129	
Converse.....		43		35	110				
Crook.....								10	
Fremont.....	2	998	58	931	90	4			
Goshen.....	1,991	1,666	229	4,228	246	45		1,699	1,091
Hot Springs.....	9	156	18	43	50	40		68	
Johnson.....						8			
Laramie.....		16	2	15	11	15		27	
Lincoln.....		2,566	246	920	485	60		90	
Natrona.....		10		5				27	
Park.....	44	5,328	275	15,721	343		985	1,345	597
Platte.....	483	1,326	272	3,556	323	107	453	4	271
Sheridan.....	37	1,798	435	6,553	376		48	85	217
Sweetwater.....		1,125		118	39		24	40	
Uinta.....		1,921	180	1,051	303	101		143	
Washakie.....	87	565	40	456	78			131	588
Weston.....	5	5	15	214			10	7	

THE STATE.	PRINCIPAL CROPS.									
	Timothy.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Corn cut for forage.
Acres harvested.....	18,645	25,601	1,633	176,295	50,923	142,750	9,081	778	653	951
Production.....	18,824	32,359	1,811	284,423	47,484	116,168	7,160	1,011	3,787	2,317
Value.....dollars.	489,424	776,616	36,220	6,541,729	1,044,648	2,729,948	150,360	19,209	37,870	34,755

<sup>1</sup> Bushels.

<sup>1</sup> Tons.

## IRRIGATION.

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**STATE TABLE I.—ACRES HARVESTED AND PRODUCTION AND VALUE OF PRINCIPAL CROPS IN 1919 ON IRRIGATED LAND FOR THE STATES, AND ACRES HARVESTED, BY COUNTIES—Continued.**

WYOMING—Continued.

COUNTIES.	ACRES HARVESTED.									
	Timothy.	Timothy and clover mixed.	Clover alone.	Alfalfa.	Other tame grasses.	Wild, salt, or prairie grasses.	Small grains cut for hay.	Annual legumes cut for hay.	Silage crops.	Corn cut for forage.
Albany.....	881	21	10	5,375	3,463	34,748	683		50	1
Big Horn.....	93	504	47	30,771	804	268	1,352	12	68	30
Campbell.....				418		30	50			
Carbon.....	4,665	7,864	65	10,810	7,362	27,301	118	27		1
Converse.....	10	33		1,161		42				
Crook.....				60			30			
Fremont.....	22	63	147	4,471		197	551		9	
Goshen.....	40	15		13,047	389	2,264	595	27	84	186
Hot Springs.....	160	1		8,488	263	80		20	4	12
Laramie.....	41	314		1,559		4,775	40	218	100	48
Lincoln.....	5,866	6,414	72	13,186	20,057	52,511	2,205	99		
Natrona.....				4,653	50	295	195			
Park.....	3,554	631	241	29,330	1,130	690	1,267	28	14	6
Platte.....	22	123	157	25,555	1,963	6,360	393	56	294	637
Sheridan.....	1,873	6,786	29	14,155	2,325	280	709	5	25	28
Sweetwater.....	585	23		1,875	1,011	1,426	146	65		
Uinta.....	833	2,718	795	6,904	12,101	10,686	599	221	5	
Washakie.....		91		1,422			85			
Weston.....			75	3,055	25	797	63			2



STATE TABLE II.—LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT, BY STATE, COUNTY, AND TERMS: 1920.

COUNTY.	Class of enterprise.	Source of water.	Acreage available for settlement.	Price of land, per acre.	Cost of preparing land for irrigation, per acre.	Price of water rights, per acre.	Terms, etc.
<b>ARIZONA.</b>							
Cochise.....	Cooperative.....	San Pedro River.....	800	\$10.00	\$40.00	\$4.00	One-half cash, balance 3 to 5 years, 10 per cent interest.
Cochise.....	Cooperative.....	San Pedro River.....	1,300	10.00	25.00	4.00	No report.
Graham.....	Cooperative.....	Marylla Canyon.....	400	25.00	50.00	14.00	No report.
Graham.....	Cooperative.....	Gila River.....	100	25.00	79.00	2.00	No report.
Graham.....	Individual.....	Wells.....	430			20.00	Government land.
Graham.....	Cooperative.....	Gila River.....	1,000	50.00	30.00	5.00	No report.
Graham.....	Cooperative.....	Oregon Canal.....	200	50.00	100.00	2.00	No report.
Graham.....	Cooperative.....	Gila River.....	1,050			10.00	No report.
Graham.....	Individual.....	Wells.....	125	25.00	30.00		Cash.
Graham.....	Individual.....	Wells.....	102		20.00		No report.
Maricopa.....	Individual.....	Gila River.....	930	50.00			No report.
Maricopa.....	Cooperative.....	Gila River.....	5,000	30.00	60.00	22.00	Cash.
Pima.....	Individual.....	Rillito Creek.....	100	20.00	60.00		8 per cent interest.
Pima.....	Individual.....	Wells.....	147	25.00	50.00		8 per cent annually.
Pima.....	Partnership.....	Wells and Sabino Canyon.....	461	25.00	60.00		8 per cent annually.
Pima.....	Individual.....	Rillito Creek.....	120	150.00	50.00		8 per cent annually.
Pima.....	Individual.....	Wells.....	465	60.00	60.00		8 per cent annually.
Pima.....	Partnership.....	Wells.....	143	30.00	60.00		8 per cent annually.
Pima.....	Partnership.....	Wells.....	120	75.00	60.00		8 per cent annually.
Pima.....	Individual.....	Wells.....	120	60.00	40.00		8 per cent annually.
Pima.....	Individual.....	Wells.....	148	10.00	50.00		No report.
Pima.....	Commercial.....	Santa Cruz River.....	3,000	100.00	40.00	6.00	25 per cent cash, balance 2, 3, and 4 years, 6 per cent interest.
Pima.....	Individual.....	Wells.....	310	60.00	40.00		8 per cent interest.
Pinal.....	Commercial.....	Gila River.....	1,000	40.00	50.00	3.00	One-half cash, balance 8 per cent interest.
Pinal.....	Commercial.....	Gila River.....	6,000	50.00	40.00	3.00	One-half cash, balance 8 per cent interest.
Pinal.....	Individual.....	Wells.....	320	200.00		12.00	One-fourth cash, balance 5 payments, 6 per cent interest.
Pinal.....	Cooperative.....	Gila River.....	400	50.00	40.00	10.00	One-half cash, balance 8 per cent interest.
<b>CALIFORNIA.</b>							
Butte.....	Irrigation district.....	Little Butte Creek.....	4,000	\$80.00	\$75.00	\$4.00	No report.
Butte.....	Cooperative.....	Butte Canal.....	500	200.00	10.00	1.00	No report.
Calaveras.....	Commercial.....	Mokelumne River.....	2,960	40.00	25.00		No report.
Contra Costa.....	Cooperative.....	San Joaquin River.....	8,000				No report.
Fresno.....	Commercial.....	Kings River.....	2,000	117.00	25.00		10 per cent down, 10 per cent annually.
Fresno.....	Commercial.....	San Joaquin River.....	41,667				5 years, 6 per cent interest.
Fresno.....	Commercial.....	San Joaquin River.....	24,000	175.00	40.00	33.00	10 equal payments, 6 per cent interest.
Glenn.....	U. S. Reclamation Serv.....	Stony Creek.....	3,000	150.00	40.00	55.00	5 to 10 years, 7 per cent interest.
Glenn.....	Cooperative.....	Wells.....	300		50.00		No report.
Glenn.....	Cooperative.....	Sacramento River.....	345	125.00	15.00		10 years, 6 per cent interest.
Glenn.....	Partnership.....	Sacramento River.....	1,100	200.00	17.00		3 to 5 years, 6 per cent interest.
Imperial.....	Cooperative.....	Imperial Irrig. Dist.....	1,800	50.00	40.00	10.00	No report.
Inyo.....	Cooperative.....	Bulls Creek.....	1,300	150.00	25.00		One-fourth cash, balance 10 years, 6 per cent interest.
Inyo.....	Cooperative.....	Owens River.....	3,000	50.00	40.00		No report.
Kern.....	Cooperative.....	Canyon Creek.....	524	300.00	25.00	100.00	One-fourth cash, balance 2, 3, and 4 years, 6 per cent interest.
Kings.....	Cooperative.....	Kings River.....	14,000				No report.
Lassen.....	Individual.....	Buckhorn River.....	3,000	30.00	10.00	30.00	6 years, 10 per cent interest.
Los Angeles.....	City.....	Sawpit and Monrovia Canyon.....	250	500.00			Cash.
Los Angeles.....	Cooperative.....	Wells.....	3,500	100.00	150.00		One-fifth cash, one-fifth annually.
Los Angeles.....	Cooperative.....	Dead Mans Canyon.....	1,200	5.00	15.00		No report.
Los Angeles.....	Partnership.....	San Gabriel River.....	300	50.00	15.00		No report.
Los Angeles.....	Commercial.....	Facoma Creek.....	600	500.00	20.00		No report.
Los Angeles.....	Cooperative.....	Wells.....	250	250.00	200.00	100.00	One-third cash, 7 per cent interest.
Merced.....	Commercial.....	Merced River.....	150,000	100.00	40.00	10.00	No report.
Merced.....	Commercial.....	San Joaquin River.....	62,500				5 years, 6 per cent interest.
Mono.....	Cooperative.....	Rush Creek.....	40,000		10.00	1.00	No report.
Riverside.....	Cooperative.....	Wells.....	200	300.00			One-half cash, 7 per cent interest.
Riverside.....	Cooperative.....	Wells.....	2,500	200.00	20.00		One-tenth cash, balance 9 equal payments.
Riverside.....	Cooperative.....	Wells.....	2,310	250.00	25.00		Cash.
Riverside.....	Commercial.....	Whitewater River.....	1,250	325.00	20.00		7 per cent interest.
Riverside.....	Individual.....	Wells.....	1,000	70.00	50.00		One-third cash, 7 per cent interest.
Riverside.....	Cooperative.....	Wells.....	2,000	150.00	100.00	100.00	No report.
Riverside.....	Commercial.....	Edgar Canyon.....	980	100.00	30.00		One-fourth cash, balance 3 years, 6 per cent interest.
Riverside.....	Partnership.....	Springs.....	100	300.00	25.00		Cash.
Riverside.....	Cooperative.....	Wells.....	700	350.00	12.00	15.00	One-fourth down, balance 1 to 5 years, 7 per cent interest.
Sacramento.....	Cooperative.....	Sacramento River.....	9,533	125.00			One-fifth cash, 8 per cent annually, 6 per cent interest.
Sacramento.....	Cooperative.....	American River.....	4,295	150.00			One-fifth cash, 10 years, 6 per cent interest.
Sacramento.....	Cooperative.....	Sacramento River.....	1,208	185.00	3.00		One-fifth cash, 8 per cent annually, 6 per cent interest.
San Benito.....	Partnership.....	Los Veronas.....	1,700	100.00			No report.
San Diego.....	Individual.....	Agua Tilia and Marias Creek.....	1,000				No report.
San Diego.....	Commercial.....	Sweetwater River.....	6,500	300.00		19.00	No report.
Shasta.....	Individual.....	North Fork Cottonwood Creek.....	15,000	35.00	50.00		6 and 8 per cent interest.
Siskiyou.....	Cooperative.....	Big Springs.....	2,300	150.00	60.00	3.00	10 years, 6 per cent interest.
Stanislaus.....	Irrigation district.....	Tuolumne River.....	5,000	150.00	75.00	2.00	One-fourth down, 6 per cent interest.
Stanislaus.....	Commercial.....	San Joaquin River.....	20,833				5 years, 6 per cent interest.

IRRIGATION.

STATE TABLE II.—LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT, BY STATE, COUNTY, AND TERMS: 1920—Continued.

COUNTY.	Class of enterprise.	Source of water.	Acres available for settlement.	Price of land, per acre.	Cost of preparing land for irrigation, per acre.	Price of water rights, per acre.	Terms, etc.
CALIFORNIA—Continued.							
Stanislaus	Cooperative	San Joaquin River	2,000	\$300.00	\$40.00	\$7.00	One-fifth down, 10 payments, 6 per cent interest.
Stanislaus	Irrigation district	Stanislaus River	40,000	75.00	50.00	33.00	No report.
Stanislaus	Irrigation district	Tuolumne River	10,000	200.00	75.00	.....	No report.
Tehama	Commercial	Los Molinos River	2,000	200.00	25.00	.....	One-tenth cash, 15 per cent yearly, 6 per cent interest.
Tehama	Cooperative	Thomas Creek	900	.....	40.00	.....	No report.
Tulare	Irrigation district	Wells	2,700	150.00	35.00	7.00	No report.
Yolo	Commercial	Cache Creek and Clear Lake	20,906	75.00	.....	20.00	No report.
Yuba	Commercial	Dry Creek	4,400	125.00	50.00	.....	5 years, 6 per cent interest.
Yuba	Individual	Feather River	800	150.00	60.00	.....	10 years, 7 per cent interest.
Yuba	Cooperative	Yuba and Feather Rivers	1,520	150.00	50.00	18.00	10 years, 7 per cent interest.

COLORADO.

Alamosa	Cooperative	Rio Grande	8,000	\$20.00	.....	\$3.00	One-fourth cash, 6 per cent interest.
Alamosa	Cooperative	Rio Grande	64,000	25.00	\$15.00	.....	No report.
Bent	Partnership	Dry Creek	5,640	5.00	2.00	.....	No report.
Bent	Cooperative	Arkansas River	1,900	.....	8.00	75.00	No report.
Bent	Partnership	Culebra Creek	4,000	5.00	6.00	.....	No report.
Crowley	Cooperative	Horse Creek	5,000	25.00	10.00	.....	No report.
Delta	U. S. Reclamation Serv.	Gunnison River	1,500	75.00	15.00	100.00	One-half cash, balance 3 to 5 years, 7 per cent interest.
Delta	Cooperative	Cottonwood Creek	1,400	15.00	25.00	50.00	No report.
Delta	Cooperative	Gunnison River	4,000	.....	.....	45.00	No report.
Delta	Partnership	Dirty Gorge	1,440	50.00	15.00	.....	8 per cent interest.
Delta	Cooperative	Gunnison River	700	75.00	20.00	22.00	One-fifth cash, 6 per cent interest.
Dolores	Carey Act	Creeks	20,000	1.25	20.00	25.00	No report.
El Paso	Individual	Turkey Creek	200	.....	.....	.....	No report.
El Paso	Cooperative	Fountain River	2,000	25.00	.....	75.00	One-third cash, balance 3 years, 7 per cent interest.
Elbert	Partnership	Bijou Creek	1,800	50.00	10.00	50.00	No report.
Fremont	Commercial	Beaver Creek	1,200	15.00	10.00	3.00	One-tenth down, 9 payments, 6 per cent interest.
Fremont	Cooperative	Arkansas River	3,350	25.00	90.00	3.00	One-twentieth cash, balance 5 years.
Garfield	Cooperative	West Drude Creek	5,000	10.00	10.00	23.00	No report.
Garfield	Cooperative	White River	1,000	15.00	10.00	115.00	No report.
Grand	Partnership	St. Louis Creek	800	10.00	.....	.....	No report.
Huerfano	Cooperative	Huerfano River	1,500	10.00	25.00	42.00	No report.
Huerfano	Irrigation district	Arapahoe Creek	900	20.00	6.00	.....	No report.
Huerfano	Partnership	South Abeyta	120	75.00	9.00	.....	No report.
Jackson	Individual	Big Grizzly	400	10.00	.....	.....	No report.
Jackson	Individual	Norris Creek	240	25.00	15.00	.....	No report.
Jackson	Cooperative	Wellar Creek	7,000	.....	.....	.....	Homestead lands.
Jackson	Commercial	Michigan River	20,000	.....	.....	.....	Homestead lands.
La Plata	Partnership	Draw	280	.....	.....	.....	No report.
La Plata	Partnership	Spring Hollow	200	.....	.....	.....	No report.
La Plata	Partnership	La Plata River	195	5.00	50.00	.....	No report.
La Plata	Partnership	Florida River	630	15.00	20.00	.....	No report.
La Plata	Partnership	Stevens Creek	100	20.00	100.00	.....	No report.
La Plata	Cooperative	Florida River	5,000	12.00	8.00	30.00	No report.
La Plata	Cooperative	Las Animas River	800	15.00	10.00	7.00	No report.
La Plata	Partnership	La Plata River	202	20.00	20.00	.....	No report.
La Plata	Cooperative	Los Pinos River	500	.....	.....	.....	No report.
Mesa	Cooperative	Kahnah Creek	1,200	10.00	50.00	50.00	No report.
Mesa	Cooperative	Deer and Indian Creeks	4,000	8.00	30.00	.....	No report.
Mesa	U. S. Reclamation Serv.	Grand River	32,500	35.00	20.00	.....	20 years, without interest.
Mesa	Cooperative	Grand River	1,500	15.00	10.00	20.00	No report.
Montezuma	Irrigation district	Dolores River	13,000	25.00	.....	27.00	One-tenth down, 13 annual payments, 8 per cent interest.
Montrose	Cooperative	San Miguel River	2,000	10.00	13.00	30.00	One-fifth down, 15 years, 7 per cent interest.
Montrose	Cooperative	Creeks	8,000	15.00	5.00	50.00	10 years, 8 per cent interest.
Montrose	U. S. Reclamation Serv.	Gunnison River	3,000	75.00	15.00	100.00	One-half cash, balance 3 to 5 years, 8 per cent interest.
Montrose	Cooperative	Cimarron River	500	15.00	20.00	20.00	No report.
Pueblo	Cooperative	Huerfano River	8,000	25.00	.....	10.00	No report.
Pueblo	Cooperative	Huerfano River	17,000	.....	2.00	.....	No report.
Pueblo	Individual	St. Charles River	2,000	.....	5.00	.....	No report.
Pueblo	Partnership	Mustang Creek	1,800	10.00	5.00	.....	No report.
Pueblo	Cooperative	Apishapa River	4,285	25.00	6.00	45.00	Cash.
Pueblo	Partnership	Mustang Creek	2,500	20.00	2.00	.....	No report.
Pueblo	Individual	Saunders Arroyo	1,000	10.00	.....	.....	No report.
Saguache	Cooperative	Saguache Creek	8,000	.....	.....	20.00	No report.
San Miguel	Cooperative	Naturita Creek	3,000	10.00	13.00	30.00	One-fifth down, 15 years, 7 per cent interest.

STATE TABLE II.—LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT BY STATE, COUNTY, AND TERMS: 1920—Continued.

COUNTY.	Class of enterprise.	Source of water.	Acreage available for settlement.	Price of land, per acre.	Cost of preparing land for irrigation, per acre.	Price of water rights, per acre.	Terms, etc.
<b>IDAHO.</b>							
Ada	Cooperative	Indian Creek	800	\$40.00			No report.
Bannock	Carey Act	Port Neuf River, Topons Creek	7,000	50.00	\$20.00	\$35.00	10 equal payments, 6 per cent interest.
Bannock	Partnership	Bear River	9,000		10.00		No report.
Bingham	Carey Act	Snake River	12,688	0.50	35.00	40.00	No report.
Blaine	Partnership	Silver Creek	500	25.00	10.00	50.00	20 years, 7 per cent interest.
Boise	Partnership	Elk Creek	193		50.00		No report.
Cassia	Partnership	Cassia Creek	212	42.00	20.00		8 per cent interest.
Cassia	U. S. Reclamation Serv.	Snake River	154	58.00	6.00	50.00	No report.
Cassia	Irrigation district	Raft River	1,247	15.00	15.00		No report.
Cassia	Partnership	Raft River	540	20.00	15.00		No report.
Cassia	Individual	Six Mile Creek	348	100.00	20.00		No report.
Cassia	Irrigation district	Raft River	680	15.00	15.00		No report.
Clark	Partnership	Birch Creek	3,000		300.00	5.00	No report.
Clark	Partnership	Spring Creek	120				No report.
Custer	Carey Act	Big Lost River	1,350	50.00	15.00	40.00	10 years, 6 per cent interest.
Custer	Irrigation district	Salmon River	125		10.00	23.00	No report.
Elmore	Irrigation district	Snake River	2,000	100.00	15.00	35.00	No report.
Elmore	Irrigation district	Malad River	185	50.00	25.00	65.00	No report.
Gooding	Cooperative	Snake River	32,353		25.00	65.00	10 payments, 6 per cent interest.
Gooding	Cooperative	Dry Creek	1,000	10.00	20.00		No report.
Jefferson	Carey Act	Crystal Lake	15,800	75.00		35.00	10 payments, 10 per cent interest.
Jefferson	Cooperative	Snake River	6,000	75.00	38.00	10.00	10 years, 7 per cent interest.
Jefferson	Partnership	Snake River	425		60.00		No report.
Jerome	Cooperative	Snake River	17,647		25.00	65.00	10 payments, 6 per cent interest.
Lamhi	Carey Act	Timber Creek	3,650	0.50	10.00	14.00	No report.
Lincoln	Carey Act	Big Wood River	26,000	0.50	20.00	42.00	Water, \$10 cash, 12 payments, 6 per cent interest.
Lincoln	Individual	Little Wood River	100	10.00	15.00		No report.
Lincoln	Individual	Little Wood River	150	5.00			No report.
Minidoka	U. S. Reclamation Serv.	Snake River	178	67.00	6.00	50.00	No report.
Owyhee	Individual	Flat Creek	100	50.00	25.00		No report.
Owyhee	Partnership	Deer Creek	280	25.00	25.00	25.00	No report.
Owyhee	Partnership	Deer Creek	245	25.00	25.00		No report.
Owyhee	Individual	Cherry Creek	160	50.00	25.00		No report.
Owyhee	Individual	Deadwood River	100	50.00	25.00		No report.
Owyhee	Irrigation district	Snake River	2,756		25.00	55.00	10 years, bonds, 6 per cent interest.
Owyhee	Partnership	Snake River	140	25.00	35.00		No report.
Owyhee	Irrigation district	Malad River	177	50.00	25.00	65.00	No report.
Payette	Cooperative	Snake River	3,000	75.00		20.00	No report.
Payette	Cooperative	Payette River	1,000			100.00	No report.
Payette	Irrigation district	Payette River	1,356	75.00	15.00	10.00	One-half cash.
Twin Falls	Cooperative	Deep Creek	4,600	1.00	20.00	200.00	No report.
Twin Falls	Individual	Comal Creek	130		35.00		No report.
Twin Falls	Cooperative	Snake River	200	40.00	20.00	55.00	No report.
Twin Falls	Cooperative	Devil Creek	2,500		15.00		No report.
Washington	Irrigation district	Crane Creek	1,500	38.00	30.00	50.00	One-half cash, 8 per cent interest.
<b>MONTANA.</b>							
Beaverhead	Individual	Steel Creek	100				No report.
Beaverhead	Partnership	Willard Creek	500		\$10.00		No report.
Beaverhead	Individual	Red Rock River	1,200	\$40.00	50.00		No report.
Blaine	U. S. Reclamation Serv.	Milk River	46,597	25.00	10.00		20 years, without interest.
Blaine	Individual	Snake Creek	1,000	12.00	10.00		No report.
Broadwater	Partnership	Missouri River	300	25.00	15.00		No report.
Broadwater	Partnership	Missouri River	150	25.00	1.00		No report.
Cascade	U. S. Reclamation Serv.	Sun River	168	35.00		\$36.00	20 years, without interest.
Chouteau	Partnership	Missouri River	150		12.00		No report.
Dawson	U. S. Reclamation Serv.	Yellowstone River	793	20.00	25.00	50.00	20 years, without interest.
Deer Lodge	Partnership	Klondike Creek	560	80.00			No report.
Fergus	Individual	Armella Creek	2,480				No report.
Gallatin	Individual	Madison River	270	30.00			No report.
Gallatin	Cooperative	West Gallatin River	3,000	100.00			One-fourth cash, balance 5 payments, 7 per cent interest.
Jefferson	Cooperative	Pipestons Creek	800		5.00		No report.
Madison	Cooperative	Jefferson River	500		6.00	2.00	No report.
Madison	Individual	Jefferson River	300	25.00	8.00		No report.
Madison	Partnership	Jefferson River	1,300	35.00			No report.
Madison	Cooperative	Ruby River	1,159	15.00	25.00		No report.
Madison	Partnership	Wolf Creek	230				No report.
Mineral	Partnership	Thompson Creek	110	50.00	20.00		No report.
Musselshell	Individual	Musselshell River	435	10.00	25.00		No report.
Musselshell	Partnership	Musselshell River	175	3.00	100.00		No report.
Phillips	U. S. Reclamation Serv.	St. Marys River	34,555	25.00	10.00		20 years, without interest.
Pondera	Carey Act	Birch Creek	7,478	1.00	10.00	60.00	14 payments, 6 per cent interest.
Pondera	Individual	Dupuyer Creek	300	15.00	1.00		No report.
Pondera	Cooperative	Teton River	15,000				No report.
Pondera	Partnership	Sheep Creek	200	15.00			No report.
Pondera	Cooperative	Pondera Coulee	4,220	20.00			Three assessments.
Powell	Individual	Cottonwood Creek	500		10.00		6 years, 8 per cent interest.
Powell	Individual	Deer Lodge River	100				No report.
Richland	U. S. Reclamation Serv.	Yellowstone River	23,535	20.00	25.00	50.00	20 years, without interest.
Rosebud	Partnership	Tongue River	200	25.00	75.00		No report.
Sweet Grass	Carey Act	Sweet Grass Creek	10,000	58.00	10.00	60.00	One-fourth cash, balance to suit, 6 per cent interest.

# IRRIGATION.

STATE TABLE II.—LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT, BY STATE, COUNTY, AND TERMS: 1920—Continued.

COUNTY.	Class of enterprise.	Source of water.	Acreage available for settlement.	Price of land, per acre.	Cost of preparing land for irrigation, per acre.	Price of water rights, per acre.	Terms, etc.
<b>MONTANA—Continued.</b>							
Teton	Cooperative	Teton River	15,000				No report.
Teton	U. S. Reclamation Serv.	Sun River	12,000	\$35.00		\$36.00	20 years, without interest.
Valley	U. S. Reclamation Serv.	St. Marys River	18,848	25.00	\$10.00		20 years, without interest.
Yellowstone	U. S. Reclamation Serv.	Yellowstone River	3,317	4.00		50.00	7 years, without interest.
<b>NEVADA.</b>							
Churchill	U. S. Reclamation Serv.	Truckee River	87,451	\$20.00	\$50.00	\$60.00	20 years, without interest.
Clark	Cooperative	Virgin River	289	50.00	50.00	6.00	No report.
Clark	Partnership	Colorado River	110	50.00	50.00		No report.
Clark	Individual	Well, flowing	115	100.00	25.00		No report.
Clark	Individual	Well, flowing	116	50.00	25.00		No report.
Clark	Partnership	Well, flowing	100	3.00	25.00		No report.
Clark	Partnership	Well, flowing	125	50.00	30.00		No report.
Clark	Cooperative	Virgin River	375	40.00	10.00	10.00	No report.
Douglas	Partnership	West Walker River	19,220	75.00			No report.
Esmoralda	Partnership	Chaotovich Creek	550				No report.
Humboldt	Partnership	Humboldt River	360	30.00	15.00		No report.
Humboldt	Partnership	Pompernicklo River	200				No report.
Humboldt	Partnership	Humboldt River	640	15.00			No report.
Humboldt	Partnership	Rock Creek	564	20.00			No report.
Lincoln	Cooperative	Pahranagat Lake	2,000	100.00	6.00	25.00	One-fourth cash, 5 years, 6 per cent interest.
Lincoln	Cooperative	Ash Springs	300	50.00	10.00	20.00	No report.
Lyon	Individual	Walker River	4,000				No report.
Lyon	Partnership	Walker River	10,490	75.00			No report.
Lyon	Partnership	Walker River	260	75.00	45.00		No report.
Lyon	U. S. Reclamation Serv.	Truckee River	1,787	20.00	50.00	60.00	20 years, without interest.
Nye	Individual	Roose River	300	2.00	15.00		No report.
Nye	Partnership	Hinorgoss River	620		12.00		No report.
Nye	Partnership	Cottonwood and Turney Creeks	400	2.00	40.00		No report.
Ormsby	Partnership	Clear Creek	200	2.00	10.00		No report.
Ormsby	Individual	Clear Creek	180	2.00	40.00		No report.
Ormsby	Cooperative	Carson River	1,000	32.00	60.00		5 years, 6 per cent interest.
Washoe	Commercial	Truckee River	7,000	50.00	10.00	7.00	5 years, 6 per cent interest.
White Pine	Individual	Willow Creek	300	20.00			No report.
<b>NEW MEXICO.</b>							
Bernalillo	Cooperative	Rio Grande	650	\$25.00	\$25.00	\$4.00	No report.
Colfax	Cooperative	Cimarron River	550	15.00	4.00		One-third cash.
Colfax	Commercial	Rayado River	4,979	100.00	5.00		One-fourth cash.
Colfax	Commercial	Eagle Nest Dam	22,200	35.00	27.00	50.00	One-fifth cash, 9 years, 6 per cent interest.
Eddy	Individual	Pecos River	2,000	300.00	100.00		No report.
Eddy	Cooperative	Black River	550	20.00			No report.
Eldorado	Cooperative	Gila River	500	20.00	60.00	100.00	No report.
McKinley	Cooperative	Springs	360	72.00	10.00		No report.
San Juan	Cooperative	Animas River	350	13.00	42.00	75.00	Cash or note, 6 to 8 per cent interest.
San Juan	Cooperative	Animas River	200	25.00		2.00	No report.
San Juan	Partnership	San Juan River	480	20.00	25.00	50.00	Cash or note, 8 per cent interest.
San Juan	Cooperative	San Juan River	1,300	50.00	10.00	10.00	No report.
San Juan	Cooperative	Animas River	900	50.00	25.00	3.00	No report.
San Miguel	Individual	Red River	940	10.00			No report.
Socorro	Cooperative	Rio Grande	300	50.00	30.00	90.00	\$4 per acre per year.
Socorro	Cooperative	Rio Grande	200	200.00	30.00	38.00	No report.
Socorro	Cooperative	Rio Grande	4,140	50.00	15.00		No report.
Taos	Cooperative	Arroyo	4,400	10.00	10.00		No report.
Union	Partnership	Cimarron River	1,500	50.00	60.00		No report.
Valencia	Commercial	Hermosa River	20,000	3.00			No report.
<b>OREGON.</b>							
Baker	Individual	Goose Creek	1,000	\$25.00	\$25.00		No report.
Baker	Commercial	Powder River	1,002	75.00	40.00	\$30.00	30 per cent cash, balance 5 years, 7 per cent interest.
Crook	Carey Act.	Deschutes River	1,278	2.50	30.00	50.00	No report.
Deschutes	Carey Act.	Deschutes River	8,968	2.50	25.00	40.00	One-fifth down.
Deschutes	Carey Act.	Deschutes River	9,709	2.50	30.00	50.00	No report.
Deschutes	Cooperative	Deschutes River	5,000	10.00		26.25	7 per cent interest.
Harnoy	Individual	Riddle Creek	2,000	15.00	70.00		No report.
Hood River	Cooperative	Middle Fork, Hood River	5,000	85.00	150.00		7 per cent interest.
Hood River	Cooperative	Sand Creek	3,700	150.00	150.00	20.00	8 per cent interest.
Hood River	Cooperative	Hood River	1,000	400.00	50.00	30.00	No report.
Hood River	Irrigation district	East Fork, Hood River	4,010	50.00	125.00	22.00	No report.
Hood River	Cooperative	West Fork, Hood River	1,350	90.00	175.00	40.00	One-fourth cash, three years, 7 per cent interest.
Jackson	Cooperative	Rogue River	2,200				No report.
Josephine	Cooperative	Applegate River	394	100.00	75.00		No report.
Klamath	Irrigation district	Lost River	2,000	20.00	30.00	10.00	No report.
Malheur	Irrigation district	Malheur River	10,000	100.00	30.00	70.00	Ten years, 6 per cent interest.
Umatilla	Commercial	Umatilla River	6,000		20.00	40.00	One-tenth cash, ten years, 6 per cent interest.
Wasco	Commercial	Several creeks	34,000	50.00	15.00	60.00	6 per cent interest.

STATE TABLE II.—LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT, BY STATE, COUNTY, AND TERMS: 1920—Continued.

COUNTY.	Class of enterprise.	Source of water.	Acres available for settlement.	Price of land, per acre.	Cost of preparing land for irrigation, per acre.	Price of water rights, per acre.	Terms, etc.
<b>TEXAS.</b>							
Cameron	Irrigation district	Rio Grande	15,000	\$200.00	\$65.00	\$2.00	No report.
Cameron	Irrigation district	Rio Grande	19,000	250.00	50.00		One-third cash, balance 3 years.
Cameron	Partnership	Rio Grande	2,000				No report.
Cameron	Irrigation district	Rio Grande	14,650	150.00	50.00	6.00	One-third cash, balance 5 years, 6 per cent interest.
Dimmit	Partnership	Nueces River	4,650	50.00	40.00		One-half cash, balance 2 years, 10 per cent interest.
Dimmit	Partnership	Wells	200				No report.
Dimmit	Individual	Wells and lake	400	40.00	20.00		One-fourth cash, 5 years, 7 per cent interest.
El Paso	U. S. Reclamation Serv.	Rio Grande	25,000	95.00	65.00	81.00	No report.
Hidalgo	Cooperative	Rio Grande	10,000	300.00	35.00		One-third down, 2 and 3 years, 8 per cent interest.
Hidalgo	Irrigation district	Rio Grande	11,000	400.00	40.00	6.00	Cash.
Hidalgo	Commercial	Rio Grande	8,000	350.00	20.00	75.00	5, 6, and 7 years, 6 per cent interest.
Jefferson	Partnership	Taylor's Bayou	500	40.00	18.00		No report.
Jefferson	Partnership	Pine Island Bayou	1,500	25.00	20.00	8.00	One-fourth cash, 8 per cent interest.
Jefferson	Partnership	Hillebrand Bayou	1,900	50.00	5.00	9.00	One-fourth cash, 3 years, 7 per cent interest.
Jefferson	Partnership	Hillebrand Bayou	1,200	35.00			No report.
Jefferson	Commercial	Pine Island Bayou	6,000	25.00	20.00	8.00	One-fifth cash, balance 4 payments, 7 and 8 per cent interest.
Kinney	Partnership	Rio Grande	1,450				No report.
Liberty	Cooperative	Trinity River	500	20.00	10.00		7 and 8 per cent interest.
Loving	Cooperative	Pecos River	2,600	10.00	25.00		No report.
McMullen	Partnership	Rio River	1,900	100.00	40.00		One-third cash, balance 7 per cent interest.
Matagorda	Partnership	Blue Creek	8,500	50.00	20.00		One-third cash, balance 5 payments, 7 per cent interest.
Matagorda	Partnership	Colorado River	6,675	50.00	2.00		No report.
Matagorda	Cooperative	Tres Palacios Creek	3,400	40.00		100.00	No report.
Matagorda	Commercial	Colorado River	12,000	40.00	6.00		No report.
Matagorda	Commercial	Colorado River	12,000	40.00	6.00	10.00	10 per cent interest.
Matagorda	Commercial	Colorado River	30,000	40.00	6.00	15.00	No report.
Matagorda	Commercial	Colorado River	17,600	40.00	6.00		No report.
Maverick	Cooperative	Rio Grande	1,250	100.00	20.00		One-fifth cash, balance 7 years, 7 per cent interest.
Maverick	Cooperative	Rio Grande	1,500		25.00		No report.
Orange	Individual	Cow Bayou	2,088	30.00	27.00		4 years, 6 to 8 per cent interest.
Orange	Commercial	Adams Bayou	4,000	25.00			No report.
Orange	Cooperative	Adams Bayou	2,500	30.00	30.00		No report.
Pecos	Individual	Cynosta	960	10.00	10.00		One-half cash, balance 2 years, 8 per cent interest.
Pecos	Partnership	Leon Springs	1,500	225.00	25.00	2.00	One-fourth cash, balance 8 years, 6 per cent interest.
Pecos	Commercial	Pecos River	24,400	10.00	16.00	80.00	One-fourth cash, balance 6 years, 6 per cent interest.
Pecos	Individual	Santa Rosa	1,720	25.00	25.00		One-third cash, balance 8 per cent interest.
Presidio	Irrigation district	Rio Grande	300	5.00	5.00	15.00	No report.
Reeves	Cooperative	Pecos River	7,000	50.00	15.00		One-fourth cash, balance 6 to 8 per cent interest.
Reeves	Cooperative	Springs	2,960		17.00		No report.
Val Verde	Cooperative	Rio Grande	2,125		50.00	2.00	No report.
Ward	Irrigation district	Pecos River	14,600	75.00	25.00	2.00	6 to 8 per cent interest.
Ward	Irrigation district	Pecos River	35,000	50.00			Part cash, balance in 5 to 6 years. Interest not shown.
Wharton	Individual	Colorado River	6,000	40.00	20.00		No report.
Wharton	Commercial	Colorado River	25,000	50.00	1.00	10.00	No report.
<b>UTAH.</b>							
Beaver	Cooperative	Beaver River	480	\$10.00	\$10.00	\$1.00	2 years, 6 per cent interest.
Beaver	Cooperative	North Creek	500	12.00	8.00	35.00	No report.
Box Elder	Commercial	Bear River and Lake	12,000	100.00		100.00	One-sixth cash, 6 per cent interest.
Box Elder	Irrigation district	West Fork Grouse Creek	910	25.00	15.00		No report.
Box Elder	Commercial	Bear River	3,000	75.00	10.00	60.00	5 payments, 7 per cent interest.
Carbon	Cooperative	Price River	700		10.00		No report.
Carbon	Cooperative	Price River	10,000	138.00	10.00		8 per cent interest.
Daggett	Cooperative	Sheep Creek	3,750	20.00	15.00	15.00	5 years, 8 per cent interest.
Duchesne	Cooperative	Duchesne River	27,600	25.00	10.00	30.00	10 years, 7 per cent interest.
Duchesne	Cooperative	Green River	3,000	5.00		5.00	No report.
Duchesne	Cooperative	Lake Fork River	200	6.00	15.00	5.00	No report.
Emery	Cooperative	Price River	580		10.00		No report.
Emery	Cooperative	Price River	840	5.00	50.00		No report.
Emery	Cooperative	Muddy Creek	11,000	30.00	10.00		No report.
Emery	Cooperative	Huntington Creek	6,000	63.00	58.00		No report.
Emery	Cooperative	Huntington Creek	700	10.00	15.00		No report.
Grand	Irrigation district	Mill Creek	500	20.00	12.00	37.00	No report.
Millard	Cooperative	Sevier River	15,000	40.00	20.00	100.00	One-fifth cash, balance in 4 to 10 years, 6 to 8 per cent interest.
Millard	Cooperative	Big Spring	700		8.00	175.00	No report.
Millard	Partnership	Pole Canyon	2,000	100.00		20.00	No report.
Millard	Cooperative	Sevier River	300	30.00	10.00	60.00	Cash
Millard	Cooperative	Sevier River	5,000	40.00	10.00	40.00	10 years, 6 per cent interest.
Millard	Cooperative	Sevier River	6,000	80.00	20.00	40.00	One-fifth cash, 5 to 7 years, 6 per cent interest.
Salt Lake	Cooperative	Butterfield Creek	160	50.00	10.00	50.00	No report.
San Juan	Irrigation district	Lake Fork River	1,980	10.00	20.00		Cash.
San Juan	Partnership	Montezuma Creek	1,000			7.00	No report.
San Juan	Cooperative	Springs	1,000		20.00		No report.
Sevier	Cooperative	Sevier River	2,000	22.00			No report.
Sevier	Cooperative	Sevier River	558	2.00	40.00		No report.
Uintah	Cooperative	Uinta River	1,750	10.00	10.00	12.00	Crop payments or 5 annual payments.

# IRRIGATION.

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**STATE TABLE II.—LAND IN IRRIGATION ENTERPRISES REPORTED AS AVAILABLE FOR SETTLEMENT, BY STATE, COUNTY, AND TERMS: 1920—Continued.**

COUNTY.	Class of enterprise.	Source of water.	Acreage available for settlement.	Price of land, per acre.	Cost of preparing land for irrigation, per acre.	Price of water rights, per acre.	Terms, etc.
<b>U T A H—Continued.</b>							
Utah	Cooperative	Summit Creek	2,500	\$25.00	\$15.00	\$50.00	Cash or terms, 8 per cent interest.
Utah	Commercial	Utah Lake	4,000	100.00			No report.
Washington	Cooperative	Santa Clara River	221	12.00	20.00	2.00	No report.
Washington	Cooperative	Virgin River	300	100.00	38.00	10.00	No report.
Washington	Cooperative	Virgin River	150	20.00	45.00	75.00	No report.
Washington	Cooperative	Shoal Creek	2,000	35.00	15.00	25.00	No report.
Washington	Cooperative	Ash Creek	3,000	25.00	15.00	100.00	One-tenth cash, balance 9 years, 8 per cent interest.
Wayne	Cooperative	Fish Creek	100	2.00	25.00	50.00	10 years.
Wayne	Cooperative	Fish Creek	100	2.00	25.00	50.00	10 years.
Wayne	Cooperative	Dirty Devil River	600	2.00	10.00		No report.
<b>WASHINGTON.</b>							
Benton	Commercial	Columbia River	7,500	\$60.00	\$130.00	\$7.00	One-fifth cash, balance one-fifth annually, 7 per cent interest.
Benton	District	Yakima River	6,000	50.00	25.00	2.00	One-fifth cash, balance 5 years, 7 per cent interest.
Benton	U. S. Reclamation Serv.	Yakima River	1,668	60.00	75.00	64.00	Various terms, 8 per cent interest.
Benton	Cooperative	Columbia River	260	100.00			No report.
Chelan	Commercial	Chewawah River	1,400				No report.
Chelan	Commercial	Creeks	2,200	15.00		5.00	No report.
Chelan	Cooperative	Grade Creek	1,200	150.00	25.00	5.00	Various terms.
Chelan	Commercial	Snow Creek	1,000	10.00		3.00	\$100 per acre for $\frac{1}{2}$ miner's inch of water.
Chelan	Cooperative	Chelan Lake	200			150.00	No report.
Challam	Irrigation district	Dungeness River	2,000	35.00	100.00	1.00	Various terms, 6 per cent interest.
Challam	Cooperative	Dungeness River	500	62.00	150.00	14.00	No report.
Douglas	Cooperative	Columbia River	528	50.00		14.00	One-third cash, balance 3 years, 8 per cent interest.
Douglas	Individual	Columbia River	400	75.00	20.00	10.00	No report.
Douglas	Cooperative	Wells	200		100.00	20.00	No report.
Franklin	Irrigation district	Columbia and Snake Rivers	10,500	52.00	50.00	45.00	One-tenth to one-fifth cash, balance 10 years, 6 per cent interest.
Klickitat	Individual	Springs	400	25.00	75.00		No report.
Klickitat	Cooperative	Alderdale Creek	100	200.00	25.00		One-third cash, balance 5 years, 6 per cent interest.
Okanogan	Partnership	Methow River	360	50.00	75.00		No report.
Okanogan	Irrigation district	Twisp Creek	1,500	50.00	15.00	60.00	One-third cash, 3 years, 8 per cent interest.
Okanogan	Partnership	Methow River	150	50.00	100.00		No report.
Okanogan	Cooperative	Okanogan	130	50.00	200.00		No report.
Okanogan	Commercial	Toots Coulee Creek	6,000	40.00	12.00	7.00	10 years, 7 per cent interest.
Spokane	Cooperative	Dear Lake and Loon Lake	1,500			2.00	Various terms.
Spokane	Cooperative	Wall	228	300.00	200.00		One-third cash, 6 per cent interest.
Spokane	Cooperative	Wall	300	500.00	200.00	12.00	No report.
Spokane	Commercial	Spokane River	1,420	119.00	35.00	88.00	5 payments, 7 per cent interest.
Stevens	Partnership	Hunters Creek	615	100.00			No report.
Thurston	Irrigation district	Nisqually River	2,000	100.00	50.00	4.00	One-third cash, 7 per cent interest.
Walla Walla	Partnership	Columbia River	295	100.00	10.00		10 years, 7 per cent interest.
Walla Walla	Partnership	Walls	125	700.00	90.00		No report.
Walla Walla	Irrigation district	Snake River	8,000	100.00	50.00	7.00	No report.
Walla Walla	Irrigation district	Walla Walla River and Columbia River	1,400	100.00	100.00	10.00	No report.
Yakima	U. S. Reclamation Serv.	Yakima River	3,334	60.00	75.00	64.00	Various terms, 6 per cent interest.
<b>WYOMING.</b>							
Albany	Irrigation district	James Lake	1,000		\$12.00	\$35.00	No report.
Big Horn	Cooperative	Shoshone River	3,100			28.00	No report.
Big Horn	Carey Act	Rholl Creek	6,000			60.00	No report.
Big Horn	Cooperative	Greybull River	6,000		8.00	50.00	One-fourth cash, balance 5 years, 7 per cent interest.
Big Horn	Cooperative	Big Horn River	4,800			50.00	No report.
Carbon	Commercial	Platte River	4,500		5.00	35.00	No report.
Fremont	Partnership	Cottonwood River	940			25.00	10 payments, 6 per cent interest.
Fremont	U. S. Reclamation Serv.	Wind River	70,000	\$25.00	25.00		20 years, without interest.
Fremont	Cooperative	Wind River	1,500	35.00	25.00	42.00	No report.
Goahan	U. S. Reclamation Serv.	N. Platte River	14,019	90.00		90.00	20 years, without interest.
Goahan	Carey Act	Horse and Bear Creeks	12,334	25.00	15.00	85.00	Cash or terms, 10 per cent interest.
Goahan	Individual	N. Platte River	1,100		15.00	75.00	No report.
Lincoln	Partnership	La Barge and Muddy Creeks	1,000		6.00		No report.
Lincoln	Partnership	N. and S. Beaver Rivers	213	30.00	1.00		5 years, 10 per cent interest.
Platte	Commercial	Laramie River	16,000	60.00	12.00	60.00	One-fourth cash, 6 per cent interest.
Platte	Commercial	Laramie River	30,000		12.00	65.00	7 years, 6 per cent interest.
Sweetwater	Carey Act	Big Sandy Creek	12,480	40.00	8.00		One-tenth cash, 6 per cent interest.
Sweetwater	Commercial	Boulder Creek	6,000	25.00	10.00	15.00	No report.
Sweetwater	Partnership	Burntfork River	2,000	2.00	10.00		No report.
Uinta	Partnership	Bear River	1,140		25.00	2.00	No report.
Washakie	Cooperative	Big Horn River	3,200			60.00	No report.



STATE TABLE III.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (—) denotes decrease. Per cent not shown when more than 1,000.]

	STATES INCLUDED.	Arizona.	Arkansas.	California.	Colorado.	Idaho.	
1	Number of all farms in 1920.....	1,916,391	9,975	232,604	117,670	59,934	42,106
2	Number of farms irrigated in 1919.....	231,541	6,605	1,166	67,391	28,756	25,283
3	Per cent of all farms.....	12.1	66.2	0.5	57.3	48.0	60.0
4	Number of farms irrigated in 1909.....	162,723	4,841	232	39,352	25,857	16,439
5	Per cent of increase, 1909-1919.....	42.3	36.4	402.6	71.8	11.2	53.8
<b>LAND AND FARM AREA.</b>							
6	Approximate land area.....acres..	1,223,939,120	72,838,400	33,618,000	99,617,280	66,341,120	53,346,560
7	All land in farms.....acres..	505,440,954	5,802,126	17,456,750	29,365,667	24,462,014	8,375,873
8	Improved land in farms.....acres..	214,689,819	712,803	9,210,556	11,878,339	7,744,757	4,511,680
9	Area irrigated in 1919.....acres..	19,191,716	467,565	143,946	4,219,040	3,348,385	2,488,806
10	Per cent of improved land in farms.....	8.9	65.6	1.6	35.5	43.2	55.2
11	Area irrigated in 1909.....acres..	14,433,235	320,051	27,753	2,664,104	2,792,032	1,430,848
12	Per cent of increase, 1909-1919.....	33.0	46.1	418.7	58.4	19.9	73.9
13	Area enterprises were capable of irrigating in 1920.....acres..	26,020,477	627,303	179,013	5,894,466	3,855,348	3,092,810
14	Area enterprises were capable of irrigating in 1910.....acres..	20,285,403	387,655	47,136	3,619,378	3,990,166	2,388,959
15	Per cent of increase, 1910-1920.....	28.3	61.8	279.8	62.9	-3.4	29.5
16	Area included in enterprises in 1920.....acres..	35,890,821	813,153	246,480	7,805,207	5,220,588	3,780,048
17	Area included in enterprises in 1910.....acres..	32,245,404	944,090	52,883	5,490,360	5,917,457	3,549,573
18	Per cent of increase, 1910-1920.....	11.3	-13.9	366.1	42.2	-11.8	6.5
19	Area of irrigated land reported as available for settlement.....acres..	2,257,981	24,341	.....	533,081	274,282	118,334
<b>IRRIGATION WORKS.</b>							
Independent enterprises:							
20	Number, 1920.....	63,298	1,388	944	24,115	6,634	3,620
21	Number, 1910.....	56,858	1,269	810	13,970	9,065	3,092
Main ditches:							
22	Number, 1920.....	51,621	1,295	84	6,040	8,867	4,553
23	Number, 1910.....	46,677	891	217	8,590	8,405	3,209
24	Length, 1920.....miles.....	103,177	1,769	66	14,437	19,022	11,144
25	Length, 1910.....miles.....	88,927	1,727	131	12,620	17,504	7,662
26	Capacity, 1920.....second-feet.....	631,079	11,707	1,205	115,237	119,558	86,273
27	Capacity, 1910.....second-feet.....	618,097	17,200	.....	89,597	148,483	80,458
Laterals:							
28	Number, 1920.....	57,553	1,174	50	9,190	6,185	5,265
29	Number, 1910.....	36,513	313	.....	6,143	5,612	3,359
30	Length, 1920.....miles.....	56,687	1,599	18	12,927	8,571	6,154
31	Length, 1910.....miles.....	39,003	870	.....	8,509	5,006	8,097
Reservoirs:							
32	Number, 1920.....	7,538	340	16	3,030	979	249
33	Number, 1910.....	6,956	402	19	1,583	1,084	243
34	Capacity, 1920.....acre-feet.....	21,246,436	1,510,856	20	1,091,394	2,406,372	3,493,511
35	Capacity, 1910.....acre-feet.....	12,602,924	1,349,938	3	743,269	2,646,593	1,742,308
Flowing wells:							
36	Number, 1920.....	4,606	310	.....	1,415	476	142
37	Number, 1910.....	5,071	214	.....	2,361	313	62
38	Capacity, 1920.....gallons per minute.....	935,057	14,547	.....	287,187	20,139	15,133
39	Capacity, 1910.....gallons per minute.....	1,345,676	9,953	.....	477,343	41,989	7,200
Pumped wells:							
40	Number, 1920.....	32,094	999	1,089	25,401	527	53
41	Number, 1910.....	15,971	470	307	10,724	121	24
42	Capacity, 1920.....gallons per minute.....	16,396,549	1,042,590	1,470,147	10,608,476	210,094	17,749
43	Capacity, 1910.....gallons per minute.....	7,248,699	765,921	268,829	4,119,575	58,564	2,826
Pumping plants:							
44	Number, 1920.....	20,458	744	1,041	21,561	406	143
45	Number, 1910.....	15,803	429	315	9,297	206	58
46	Engine capacity, 1920.....horsepower.....	748,971	22,014	58,332	386,200	8,635	28,364
47	Engine capacity, 1910.....horsepower.....	361,480	37,258	12,440	128,143	7,969	7,065
48	Pump capacity, 1920.....gallons per minute.....	36,275,005	1,048,030	1,654,097	16,773,692	299,726	1,397,681
49	Pump capacity, 1910.....gallons per minute.....	19,355,894	851,873	436,402	5,276,298	296,937	278,569
50	Average lift, 1920.....feet.....	41	44	50	41	23	29
<b>CAPITAL INVESTED.</b>							
51	Capital invested to Jan. 1, 1920.....dollars..	697,667,328	33,498,094	7,183,322	194,896,388	88,302,442	91,501,009
52	Capital invested to July 1, 1910.....dollars..	321,454,008	17,677,966	587,834	72,680,030	56,636,443	40,977,688
53	Per cent of increase, 1910-1920.....	117.0	89.5	.....	168.5	55.9	123.3
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	26.81	53.40	40.13	33.06	22.90	29.59
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	15.85	45.60	12.47	20.05	14.19	17.15
<b>ESTIMATED FINAL COST.</b>							
56	Estimated final cost of existing enterprises in 1920.....dollars..	819,778,005	34,615,064	7,283,522	225,799,123	95,198,423	97,019,717
57	Estimated final cost of existing enterprises in 1910.....dollars..	437,948,825	24,828,868	612,834	84,392,344	76,443,239	58,451,106
58	Per cent of increase, 1910-1920.....	87.2	39.4	.....	167.6	24.5	66.0
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	22.84	42.57	29.55	28.93	18.24	25.97
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	13.58	26.30	11.59	15.37	12.92	16.47
<b>DRAINAGE OF IRRIGATED LAND.</b>							
61	Number of enterprises reporting land drained or needing drainage.....	3,068	31	134	545	420	206
62	Acres included in enterprises reporting land drained or needing drainage.....	8,860,780	852,928	37,574	1,623,330	1,526,311	734,405
63	Acres for which drains have been installed.....	1,519,853	25,173	27,350	319,573	113,899	81,187
64	Additional acres needing drainage.....	1,476,771	71,357	2,821	406,933	220,711	94,934
65	Per cent that acres for which drains have been installed is of total acres included in enterprises reporting drainage.....	17.2	6.6	72.8	19.7	7.5	11.1
66	Per cent that acres for which drains have been installed is of total acres included in irrigation enterprises.....	4.2	3.1	11.1	4.1	2.2	2.1
67	Per cent that acres for which drains have been installed, plus that needing drainage is of total acres included in irrigation enterprises.....	8.3	11.9	12.2	9.3	6.4	4.7

# IRRIGATION.

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**STATE TABLE III.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.]

		Kansas.	Louisiana.	Montana.	Nebraska.	Nevada.	New Mexico.	North Dakota.
1	Number of all farms in 1920.....	165,286	135,463	57,677	124,417	3,163	29,844	77,690
2	Number of farms irrigated in 1919.....	504	6,471	10,807	8,021	2,718	11,390	340
3	Per cent of all farms.....	0.3	4.8	18.7	2.4	85.9	38.2	0.4
4	Number of farms irrigated in 1909.....	1,006	2,690	8,970	1,852	2,406	12,795	69
5	Per cent of increase, 1909-1919.....	-49.9	140.6	20.5	63.1	13.0	-11.0	.....
<b>LAND AND FARM AREA.</b>								
6	Approximate land area.....acres..	52,335,360	29,061,760	83,523,840	49,157,120	70,285,440	78,401,920	44,917,120
7	All land in farms.....acres..	45,425,170	10,019,822	35,070,656	42,225,475	2,357,163	24,408,633	36,214,751
8	Improved land in farms.....acres..	30,600,760	5,626,226	11,007,378	23,109,624	594,741	1,717,224	24,563,178
9	Area irrigated in 1919.....acres..	47,312	454,882	1,681,729	442,690	561,447	538,377	12,072
10	Per cent of improved land in farms.....	0.2	8.1	15.3	1.9	24.4	31.4	(1)
11	Area irrigated in 1909.....acres..	37,479	380,200	1,679,084	255,950	701,833	461,718	10,248
12	Per cent of increase, 1909-1919.....	28.2	19.6	0.2	73.0	-20.0	16.6	17.8
13	Area enterprises were capable of irrigating in 1920.....acres..	67,853	728,742	2,753,498	562,468	704,708	696,119	34,235
14	Area enterprises were capable of irrigating in 1910.....acres..	139,995	553,220	2,205,155	429,225	840,962	644,970	21,917
15	Per cent of increase, 1910-1920.....	-51.5	31.7	24.9	31.0	-16.2	7.9	56.3
16	Area included in enterprises in 1920.....acres..	102,562	851,211	4,329,148	766,768	1,382,036	961,879	57,476
17	Area included in enterprises in 1910.....acres..	161,300	581,965	3,515,602	650,133	1,232,142	1,102,297	33,173
18	Per cent of increase, 1910-1920.....	-36.4	46.3	23.1	12.7	12.2	-12.7	50.6
19	Area of irrigated land reported as available for settlement.....acres..			207,530		139,352	66,479	
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20	Number, 1920.....	209	1,373	6,035	470	1,015	2,391	30
21	Number, 1910.....	716	1,237	5,594	474	1,347	2,786	49
Main ditches:								
22	Number, 1920.....	130	1,298	8,819	513	2,032	2,228	32
23	Number, 1910.....	89	515	6,673	420	994	2,101	47
24	Length, 1920.....miles..	271	1,584	16,411	1,780	3,123	4,469	58
25	Length, 1910.....miles..	274	729	12,990	1,459	1,938	4,664	52
26	Capacity, 1920.....second-feet..	1,667	11,839	94,429	11,665	10,554	23,432	836
27	Capacity, 1910.....second-feet..	2,000		83,840	9,378	17,570	29,646	2,161
Laterals:								
28	Number, 1920.....	374	3,008	10,680	913	2,064	2,158	58
29	Number, 1910.....	39	180	8,307	1,038	1,531	1,280	46
30	Length, 1920.....miles..	147	1,659	6,085	1,545	1,245	1,463	93
31	Length, 1910.....miles..	42	439	5,944	1,269	1,213	1,190	74
Reservoirs:								
32	Number, 1920.....	35	74	468	59	134	328	9
33	Number, 1910.....	42	104	827	44	109	523	22
34	Capacity, 1920.....acre-feet..	391	7,632	1,571,720	197,890	504,428	2,960,718	1,110
35	Capacity, 1910.....acre-feet..	31,024	19,482	580,261	2,098	325,953	454,162	132,187
Flowing wells:								
36	Number, 1920.....	6	9	41		123	556	.....
37	Number, 1910.....	3		15		19	673	.....
38	Capacity, 1920.....gallons per minute..	500	6,255	4,608		21,942	376,222	.....
39	Capacity, 1910.....gallons per minute..	30		22,185		1,302	669,268	.....
Pumped wells:								
40	Number, 1920.....	710	812	22	34	129	461	.....
41	Number, 1910.....	839	606	10	66	6	466	1
42	Capacity, 1920.....gallons per minute..	266,797	1,007,637	11,085	24,701	6,798	265,618	.....
43	Capacity, 1910.....gallons per minute..	73,362	1,108,236	5,263	3,363	1,349	190,690	15
Pumping plants:								
44	Number, 1920.....	198	1,250	253	51	64	472	4
45	Number, 1910.....	698	1,007	125	75	18	413	4
46	Engine capacity, 1920.....horsepower..	6,948	85,028	10,341	959	409	8,488	2,068
47	Engine capacity, 1910.....horsepower..	1,517	57,428	3,511	140	683	14,228	2,038
48	Pump capacity, 1920.....gallons per minute..	297,975	4,968,666	433,231	73,686	85,266	304,789	51,250
49	Pump capacity, 1910.....gallons per minute..	128,276	5,064,173	281,199	5,366	24,285	216,855	182,115
50	Average lift, 1920.....feet..	30	32	20	24	22	40	38
<b>CAPITAL INVESTED.</b>								
51	Capital invested to Jan. 1, 1920.....dollars..	2,067,381	14,063,181	52,143,363	13,909,185	14,754,280	18,210,412	1,857,118
52	Capital invested to July 1, 1910.....dollars..	1,365,503	6,859,166	22,970,958	7,798,310	6,721,924	9,154,897	836,482
53	Per cent of increase, 1910-1920.....	51.4	105.0	127.0	78.4	119.5	93.9	122.0
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	30.47	19.30	18.94	24.73	20.94	26.16	54.25
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	9.75	12.40	10.42	18.17	7.99	14.19	38.17
<b>ESTIMATED FINAL COST.</b>								
56	Estimated final cost of existing enterprises in 1920.....dollars..	2,195,931	14,264,178	70,079,023	18,030,154	22,648,747	20,440,646	2,072,766
57	Estimated final cost of existing enterprises in 1910.....dollars..	1,365,503	6,914,166	32,382,077	9,485,231	12,183,756	11,640,091	836,482
58	Per cent of increase, 1910-1920.....	60.8	106.3	116.4	90.1	85.8	75.6	147.8
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	21.41	16.76	16.19	23.51	16.39	21.25	36.06
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	5.47	11.88	9.21	13.95	9.89	10.56	21.91
<b>DRAINAGE OF IRRIGATED LAND.</b>								
61	Number of enterprises reporting land drained or needing drainage.....	5	406	276	24	58	203	8
62	Acres included in enterprises reporting land drained or needing drainage.....	3,610	283,476	751,274	378,518	537,417	212,353	49,581
63	Acres for which drains have been installed.....	250	167,138	62,872	10,793	84,175	74,783	1,613
64	Additional acres needing drainage.....	1,320	21,202	50,901	26,606	98,249	60,277	659
65	Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	6.9	59.0	8.4	2.9	6.4	35.3	3.3
66	Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises.....	0.2	19.6	1.6	1.4	2.5	7.8	2.8
67	Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises.....	1.5	22.1	2.6	4.9	9.0	14.0	4.0

1 Less than one-tenth of 1 per cent.

STATE TABLE III.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease.]

	Oklahoma.	Oregon.	South Dakota.	Texas.	Utah.	Washington.	Wyoming.
1 Number of all farms in 1920.....	191,968	50,206	74,637	436,033	25,662	66,283	16,748
2 Number of farms irrigated in 1919.....	73	9,154	1,198	14,726	22,218	13,271	6,449
3 Per cent of all farms.....	(1)	18.2	1.6	3.4	86.6	20.0	41.0
4 Number of farms irrigated in 1909.....	137	6,669	500	5,238	19,709	7,664	6,397
5 Per cent of increase, 1909-1919.....	-46.7	37.3	139.6	181.1	12.7	73.2	2.4
<b>LAND AND FARM AREA.</b>							
6 Approximate land area..... acres..	44,424,960	61,188,480	49,195,520	167,634,720	52,597,760	42,775,040	62,430,720
7 All land in farms..... acres..	31,951,934	13,542,318	34,636,491	114,020,621	5,050,410	13,244,720	11,809,351
8 Improved land in farms..... acres..	18,126,321	4,913,851	18,199,250	31,227,503	1,715,390	7,129,343	2,102,006
9 Area irrigated in 1919..... acres..	2,069	966,162	100,682	536,120	1,371,651	529,899	1,207,982
10 Per cent of improved land in farms.....	(1)	20.1	0.6	1.9	80.0	7.4	57.5
11 Area irrigated in 1909..... acres..	4,388	686,129	63,248	451,130	999,410	334,378	1,133,302
12 Per cent of increase, 1909-1919.....	-32.3	43.7	59.2	29.9	37.2	58.5	6.7
13 Area enterprises were capable of irrigating in 1920..... acres..	9,672	1,344,046	150,914	1,150,542	1,700,550	637,151	1,531,039
14 Area enterprises were capable of irrigating in 1910..... acres..	6,397	830,526	128,481	690,991	1,250,246	470,514	1,639,510
15 Per cent of increase, 1910-1920.....	51.2	61.8	17.5	66.5	36.0	35.4	11.7
16 Area included in enterprises in 1920..... acres..	11,742	1,925,987	188,382	1,687,447	2,359,244	836,795	2,564,668
17 Area included in enterprises in 1910..... acres..	8,528	2,527,208	201,625	1,253,173	1,947,625	817,032	2,224,296
18 Per cent of increase, 1910-1920.....	37.7	-23.8	-6.6	34.7	21.1	2.4	15.3
19 Area of irrigated land reported as available for settlement..... acres..		98,809		346,446	189,568	61,738	197,326
<b>IRRIGATION WORKS.</b>							
Independent enterprises:							
20 Number, 1920.....	83	4,710	292	1,371	2,403	2,692	3,564
21 Number, 1910.....	114	3,745	395	2,772	2,472	1,934	5,677
Main ditches:							
22 Number, 1920.....	18	5,252	370	820	2,381	1,873	5,007
23 Number, 1910.....	47	3,582	348	861	2,495	1,600	5,593
24 Length, 1920..... miles.....	38	7,115	653	1,524	6,343	3,851	9,517
25 Length, 1910..... miles.....	54	5,539	631	1,479	5,887	2,594	10,933
26 Capacity, 1920..... second-feet.....	344	28,897	5,427	23,261	29,447	16,242	39,009
27 Capacity, 1910..... second-feet.....	155	39,686	3,598	12,818	25,081	13,178	42,630
Laterals:							
28 Number, 1920.....	72	2,784	632	2,022	4,068	3,179	2,777
29 Number, 1910.....	106	2,518	332	832	1,357	1,180	2,340
30 Length, 1920..... miles.....	19	1,956	605	2,949	5,334	1,764	2,534
31 Length, 1910..... miles.....	31	2,062	625	1,224	1,822	1,298	2,298
Reservoirs:							
32 Number, 1920.....	8	266	119	388	476	205	374
33 Number, 1910.....	11	271	314	309	480	156	414
34 Capacity, 1920..... acre-feet.....	52	1,905,037	212,264	392,999	1,600,505	477,789	2,911,748
35 Capacity, 1910..... acre-feet.....	22	1,024,266	216,205	74,361	583,317	121,543	2,560,937
Flowing wells:							
36 Number, 1920.....	1	65	4	135	1,256	60	7
37 Number, 1910.....		51	42	123	1,138	55	2
38 Capacity, 1920..... gallons per minute.....	100	11,968	2,750	62,364	96,371	14,925	46
39 Capacity, 1910..... gallons per minute.....		3,036	14,382	37,019	42,794	18,926	250
Pumped wells:							
40 Number, 1920.....	19	208	1	901	192	520	16
41 Number, 1910.....	65	92	4	1,912	27	128	3
42 Capacity, 1920..... gallons per minute.....	3,643	47,026	800	538,565	39,059	227,744	8,020
43 Capacity, 1910..... gallons per minute.....	1,791	20,883	24	567,126	4,827	60,220	835
Pumping plants:							
44 Number, 1920.....	22	573	25	1,369	250	975	57
45 Number, 1910.....	68	229	8	2,359	69	391	34
46 Engine capacity, 1920..... horsepower.....	184	13,769	498	80,511	11,392	22,929	1,304
47 Engine capacity, 1910..... horsepower.....	107	3,095	63	69,094	2,143	13,847	705
48 Pump capacity, 1920..... gallons per minute.....	7,668	600,046	23,320	6,825,996	783,588	636,562	39,725
49 Pump capacity, 1910..... gallons per minute.....	4,541	118,514	5,289	5,362,665	315,057	365,411	142,629
50 Average lift, 1920..... feet.....	59	28	21	45	25	60	31
<b>CAPITAL INVESTED.</b>							
51 Capital invested to Jan. 1, 1920..... dollars..	151,325	28,929,151	5,465,248	35,072,739	32,037,351	29,299,011	34,326,328
52 Capital invested to July 1, 1910..... dollars..	47,200	12,760,214	3,043,140	13,487,347	14,023,717	16,219,149	17,700,980
53 Per cent of increase, 1910-1920.....	220.6	126.7	79.6	160.0	123.4	80.6	63.9
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	15.65	21.52	36.21	30.48	18.84	45.98	18.75
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	7.38	15.36	23.69	19.52	11.22	34.47	10.80
<b>ESTIMATED FINAL COST.</b>							
56 Estimated final cost of existing enterprises in 1920..... dollars..	162,775	41,585,742	5,500,748	39,860,871	33,835,641	37,684,591	51,500,288
57 Estimated final cost of existing enterprises in 1910..... dollars..	47,200	39,316,619	3,800,556	14,754,172	17,840,775	22,322,856	20,425,890
58 Per cent of increase, 1910-1920.....	244.9	6.0	44.7	170.2	89.7	68.8	152.1
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	13.86	21.59	29.20	23.62	14.34	45.03	20.08
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	5.83	15.52	13.85	11.77	9.16	27.32	9.13
<b>DRAINAGE OF IRRIGATED LAND.</b>							
61 Number of enterprises reporting land drained or needing drainage.....	3	176	17	166	143	108	144
62 Acreage included in enterprises reporting land drained or needing drainage.....	1,960	347,760	108,129	650,823	503,212	218,763	513,347
63 Acreage for which drains have been installed.....		93,799	2,109	272,437	85,448	79,168	68,086
64 Additional acreage needing drainage.....	1,820	46,115	4,714	154,532	91,976	43,461	75,183
65 Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....		27.0	2.0	41.9	17.0	36.2	13.3
66 Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....		4.9	1.1	16.1	3.6	9.5	2.7
67 Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	15.5	7.3	3.6	25.3	7.5	14.7	5.0

<sup>1</sup> Less than one-tenth of 1 per cent.

# IRRIGATION.

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**STATE TABLE IV.—TOTAL ACREAGE IRRIGATED IN 1919, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES TO 1920, CLASSIFIED BY DATE OF BEGINNING, CHARACTER OF ENTERPRISE, SOURCE OF WATER SUPPLY, AND CHARACTER OF WATER RIGHTS.**

		STATES INCLUDED.	Arizona.	Arkansas.	California.	Colorado.	Idaho.
<b>AREA IRRIGATED, 1919.</b>							
<b>Total.....</b>		<b>19,191,718</b>	<b>467,565</b>	<b>143,946</b>	<b>4,219,040</b>	<b>3,943,885</b>	<b>2,483,806</b>
<b>Date of beginning:</b>							
1	Before 1860.....	299,784	332		108,200	37,742	631
2	1860-1869.....	1,282,705	720		85,455	634,865	48,536
3	1870-1879.....	2,598,414	55,327		1,039,852	647,771	144,031
4	1880-1889.....	4,043,391	41,358		347,635	1,155,083	755,533
5	1890-1899.....	2,538,913	19,975	1,640	404,133	294,493	383,053
6	1900-1904.....	2,211,749	10,944	470	458,261	210,673	619,677
7	1905-1909.....	2,549,927	260,639	11,840	290,086	215,729	354,143
8	1910-1914.....	1,538,644	18,692	49,100	649,875	80,674	90,870
9	1915-1919.....	1,165,560	42,595	64,474	541,500	19,885	60,355
10	Not reported.....	972,629	16,983	16,422	202,963	51,465	31,677
<b>Character of enterprise:</b>							
11	Individual and partnership.....	6,848,807	80,511	140,471	1,502,870	1,014,412	513,350
12	Cooperative.....	6,581,400	114,482	1,075	1,215,696	1,789,385	938,421
13	Irrigation district.....	1,822,887	300		577,168	248,409	355,965
14	Carey Act.....	623,929				2,430	283,833
15	Commercial.....	1,822,001	14,500	2,400	873,499	212,138	6,503
16	U. S. Reclamation Service.....	1,254,569	245,814		36,622	71,145	263,759
17	U. S. Indian Service.....	284,551	8,733		697	4,266	36,775
18	State.....	5,620			2,936	80	10
19	City.....	40,146	200		6,213	5,825	160
20	Other and mixed.....	7,236	25		3,064		
21	Not reported.....	570			275	265	
<b>Source of water supply:</b>							
22	Streams, gravity.....	14,527,060	189,782	120	2,564,445	3,028,787	2,274,959
23	Streams, pumped.....	1,226,510	6,671	6,009	295,673	12,747	107,181
24	Streams, pumped and gravity.....	199,595			60,278	9,430	1,870
25	Wells, pumped.....	1,263,098	39,694	135,260	826,846	10,114	414
26	Wells, flowing.....	65,856	1,558		17,653	4,191	1,131
27	Wells, pumped and flowing.....	35,685	558		23,561	85	
28	Lakes, pumped.....	35,730	5	450	4,168	871	4,912
29	Lakes, gravity.....	100,646			48,084	2,367	2,492
30	Springs.....	198,008	2,578		27,698	10,856	33,337
31	Stored storm water.....	98,373	510	40	20,351	16,909	2,590
32	City water.....	930			515	11	
33	Sewage.....	2,578	135		1,385	195	80
34	Streams, gravity, and pumped wells.....	344,713	217,709	250	87,897	16,258	357
35	Streams, gravity, and flowing wells.....	82,665	525		4,255	67,880	1,927
36	Other mixed.....	996,621	7,690	1,817	228,424	165,825	54,601
37	Other and not reported.....	13,148			7,807	1,359	2,955
<b>Character of water rights:</b>							
38	Appropriation and use.....	2,521,682	226,846	(1)	479,361	114,616	130,774
39	Notice filed and posted.....	2,705,636	97,130		704,608	209,262	233,937
40	Adjudicated by court.....	7,159,954	84,978		982,157	2,918,333	1,104,607
41	Permit from state.....	1,960,924	10		80,484		490,979
42	Certificate or license from state.....	1,288,124			25,484		338,958
43	Riparian rights.....	370,896			240,512		18,329
44	Underground.....	1,067,606	41,624		863,613	14,558	1,834
45	Other and mixed.....	494,564	525		396,703	12,275	55,595
46	Not reported.....	1,562,330	16,452	143,946	446,118	79,291	109,033
<b>CAPITAL INVESTED, 1920.</b>							
<b>Total.....</b>		<b>\$697,657,323</b>	<b>\$35,498,094</b>	<b>\$7,183,322</b>	<b>\$194,886,388</b>	<b>\$98,302,442</b>	<b>\$91,501,009</b>
<b>Date of beginning:</b>							
47	Before 1860.....	9,527,597	2,058		6,802,109	265,660	3,137
48	1860-1869.....	24,130,038	9,770		2,589,615	14,410,037	881,963
49	1870-1879.....	37,722,304	1,881,284		16,475,201	8,150,179	1,024,629
50	1880-1889.....	76,427,344	921,806		19,046,449	17,150,419	13,791,700
51	1890-1899.....	77,443,017	645,369	93,111	31,330,191	7,043,688	9,088,738
52	1900-1904.....	95,749,105	487,719	25,026	19,106,303	14,101,894	25,892,006
53	1905-1909.....	183,980,169	20,951,874	459,542	15,252,972	14,192,932	34,081,217
54	1910-1914.....	102,507,009	3,778,003	2,276,584	41,765,878	11,479,877	3,795,869
55	1915-1919.....	67,613,693	4,419,044	3,302,492	32,996,398	550,890	2,227,426
56	Not reported.....	22,557,052	451,187	1,026,567	9,521,261	956,866	714,324
<b>Character of enterprise:</b>							
57	Individual and partnership.....	154,634,169	5,598,625	7,073,297	57,616,716	11,599,883	5,747,004
58	Cooperative.....	183,041,500	3,171,406	60,013	48,899,448	42,911,035	36,576,664
59	Irrigation district.....	88,573,514	100,000		33,985,301	16,269,026	11,954,046
60	Carey Act.....	32,680,685				1,205,988	17,772,500
61	Commercial.....	85,735,470	3,693,400	50,012	44,996,723	5,711,887	698,179
62	U. S. Reclamation Service.....	129,509,819	20,277,619		2,398,220	10,253,231	17,804,839
63	U. S. Indian Service.....	14,851,236	585,029		55,556	220,979	632,387
64	State.....	344,174			224,909	8,994	1,000
65	City.....	2,936,678	71,500		1,401,320	117,685	14,300
66	Other.....	5,310,399			5,277,490		
67	Not reported.....	39,674	215		30,705	8,754	
<b>Source of water supply:</b>							
68	Streams, gravity.....	489,570,623	11,587,884	3,874	78,139,147	68,852,489	81,823,379
69	Streams, pumped.....	59,343,298	321,852	96,450	10,267,581	2,490,000	5,108,012
70	Streams, pumped and gravity.....	9,512,907			3,084,038	397,392	168,200
71	Wells, pumped.....	76,787,251	3,417,339	7,028,773	54,057,185	875,277	24,935
72	Wells, flowing.....	2,945,059	115,936		807,353	55,251	83,652
73	Wells, pumped and flowing.....	2,498,673	54,700		1,776,156	5,300	
74	Lakes, pumped.....	3,274,601	400	9,500	90,081	27,530	544,681
75	Lakes, gravity.....	2,906,612			674,320	84,935	276,837
76	Springs.....	5,793,988	271,358		1,298,308	188,920	960,189
77	Stored storm water.....	15,075,592	11,600	1,500	6,593,659	1,467,459	246,257
78	City water.....	219,783			61,055	97	
79	Sewage.....	174,444	63,408		59,959	1,646	200
80	Streams, gravity, and pumped wells.....	28,347,835	17,092,890	8,500	10,001,650	190,454	59,700
81	Streams, gravity, and flowing wells.....	2,963,194	27,600		1,264,830	1,033,078	39,150
82	Other mixed.....	48,467,251	333,227	34,725	19,906,271	13,084,359	2,181,887
83	Other and not reported.....	876,213			805,116	47,356	12,730

1 1919 acreage in Arkansas not classified by character of water rights.

STATE TABLE IV.—ACREAGE IRRIGATED IN 1919, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES TO 1920, CLASSIFIED BY DATE OF BEGINNING, CHARACTER OF ENTERPRISE, SOURCE OF WATER SUPPLY, AND CHARACTER OF WATER RIGHTS—Continued.

	Kansas.	Louisiana.	Montana.	Nebraska.	Nevada.	New Mexico.	North Dakota.
<b>AREA IRRIGATED, 1919.</b>							
Total.....	47,312	454,882	1,681,729	442,680	541,447	538,377	12,072
<b>Date of beginning:</b>							
1 Before 1860.....			4,586	30	4,782	28,062	
2 1860-1869.....			110,225		171,317	28,597	
3 1870-1879.....	80	40	114,804	1,090	124,723	33,720	
4 1880-1889.....	15,413	2,050	470,529	104,100	83,562	71,909	1,595
5 1890-1899.....	13,226	151,983	361,563	191,229	9,081	55,223	458
6 1900-1904.....		50,263	148,075	21,580	60,897	27,312	655
7 1905-1909.....	3,617	34,631	272,239	98,704	18,770	71,848	8,786
8 1910-1914.....	3,719	89,919	59,280	19,788	24,633	89,720	285
9 1915-1919.....	7,109	126,831	38,556	2,746	13,937	60,919	330
10 Not reported.....	4,148	29,165	101,872	3,423	49,545	79,067	683
<b>Character of enterprise:</b>							
11 Individual and partnership.....	14,546	259,673	976,615	68,140	355,901	151,351	3,306
12 Cooperative.....	32,516	10,635	893,257	55,403	69,877	264,610	
13 Irrigation district.....			35,153	206,206	60,000	15,008	
14 Carey Act.....			54,771				
15 Commercial.....	150	184,574	34,115	25,235	5,990	19,871	
16 U. S. Reclamation Service.....			88,291	87,558	44,324	77,678	8,766
17 U. S. Indian Service.....			98,887		6,321	9,072	
18 State.....	100		20		12	77	
19 City.....			320		22	600	
20 Other and mixed.....			300	43		110	
21 Not reported.....							
<b>Source of water supply:</b>							
22 Streams, gravity.....	30,807	10,226	1,515,212	425,567	466,812	432,478	9,030
23 Streams, pumped.....	730	248,306	15,743	1,115	2,647	1,890	2,469
24 Streams, pumped and gravity.....	600	12,620	19,672	850	720		
25 Wells, pumped.....	18,235	154,304	139	546	255	15,709	
26 Wells, flowing.....		196	212		811	30,030	
27 Wells, pumped and flowing.....	50	1,075			65	6,556	
28 Lakes, pumped.....		6,966	79				
29 Lakes, gravity.....		3,285	16,653		445	1,945	
30 Springs.....			14,945	2,050	21,937	10,791	
31 Stored storm water.....		84	3,280	1,200	17,348	6,448	508
32 City water.....			15	7	14	40	
33 Sewage.....			245	120	88		
34 Streams, gravity, and pumped wells.....	1,540	10,045	155	115	4,957	1,341	
35 Streams, gravity, and flowing wells.....			6,068		82	685	
36 Other mixed.....	350	7,835	89,070	1,120	45,176	29,787	65
37 Other and not reported.....			41			677	
<b>Character of water rights:</b>							
38 Appropriation and use.....	26,435	(*)	229,887	42,141	200,556	152,746	6,348
39 Notice filed and posted.....	4,218		866,305	16,517	52,027	54,358	2,328
40 Adjudicated by court.....	458		701,015	9,280	181,175	91,807	
41 Permit from state.....			595	234,806	106,857	103,459	2,936
42 Certificate or license from state.....				117,960	6,666	20,096	
43 Riparian rights.....	30		5,500	618		400	
44 Underground.....	13,480		482	546	1,244	52,325	
45 Other and mixed.....	938		8,561	13	1,705	8	
46 Not reported.....	1,753	454,882	69,384	20,809	31,217	63,180	460
<b>CAPITAL INVESTED, 1920.</b>							
Total.....	\$2,067,881	\$14,063,181	\$52,143,363	\$13,908,185	\$14,754,280	\$18,210,412	\$1,857,118
<b>Date of beginning:</b>							
47 Before 1860.....			55,527	500	55,645	268,876	
48 1860-1869.....			1,323,315		2,400,682	384,754	
49 1870-1879.....	736	1,000	2,063,841	21,583	1,599,890	482,843	
50 1880-1889.....	1,058,982	24,800	5,085,794	1,659,094	1,026,933	2,568,298	18,000
51 1890-1899.....	88,719	5,487,222	7,045,284	2,075,677	134,494	1,262,916	17,669
52 1900-1904.....		1,347,322	3,005,519	321,927	8,149,026	1,122,232	37,714
53 1905-1909.....	200,085	1,171,166	26,592,158	8,685,843	244,493	4,692,515	1,777,570
54 1910-1914.....	176,288	1,502,682	2,756,019	444,144	576,638	4,594,735	2,000
55 1915-1919.....	407,876	3,848,822	3,631,564	180,314	234,932	2,021,448	11,207
56 Not reported.....	134,697	680,167	1,584,344	520,103	331,547	811,795	2,958
<b>Character of enterprise:</b>							
57 Individual and partnership.....	775,095	7,943,252	15,543,287	1,146,227	4,014,570	5,589,372	81,698
58 Cooperative.....	1,289,737	161,638	6,692,877	547,104	1,019,047	3,558,863	
59 Irrigation district.....			1,708,851	2,811,474	1,246,611	914,479	
60 Carey Act.....			4,834,407			1,877,842	
61 Commercial.....	1,549	5,958,271	676,535	726,560	240,559	262,713	
62 U. S. Reclamation Service.....			14,381,318	8,674,250	7,953,537	5,020,230	1,775,425
63 U. S. Indian Service.....			8,193,390		178,536	691,194	
64 State.....	1,000		100		1,000	18,544	
65 City.....			105,538		420	276,299	
66 Other.....			7,060	3,570		876	
67 Not reported.....							
<b>Source of water supply:</b>							
68 Streams, gravity.....	1,184,674	318,394	47,016,339	13,619,775	12,493,231	13,524,889	1,299,651
69 Streams, pumped.....	22,142	7,338,954	900,216	39,581	119,900	36,520	652,007
70 Streams, pumped and gravity.....	50,000	172,000	1,612,316	18,700	8,000		
71 Wells, pumped.....	741,583	5,366,948	16,285	23,250	19,900	925,003	
72 Wells, flowing.....		5,000	10,007		50,575	1,220,519	
73 Wells, pumped and flowing.....	4,000	22,500			5,500	388,165	
74 Lakes, pumped.....		350,960	8,250				
75 Lakes, gravity.....	1,000	112,740	271,700	100,300	234,851	18,750	
76 Springs.....			247,094	24,497	568,000	257,179	
77 Stored storm water.....		1,500	298,392	40,429	164,350	686,047	4,660
78 City water.....				1,000	300	1,000	
79 Sewage.....			6,724	313			
80 Streams, gravity, and pumped wells.....	80,532	247,595	3,000	5,035	181,887	175,000	
81 Streams, gravity, and flowing wells.....			493,900	6,902	3,400	14,000	
82 Other mixed.....	13,450	120,050	1,318,598	29,403	903,766	953,740	500
83 Other and not reported.....			1,382			4,600	

\* Dakota territory.  
 \* Acreage in Louisiana not classified by character of water rights.

# IRRIGATION.

**STATE TABLE IV.—ACREAGE IRRIGATED IN 1919, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES TO 1920, CLASSIFIED BY DATE OF BEGINNING, CHARACTER OF ENTERPRISE, SOURCE OF WATER SUPPLY, AND CHARACTER OF WATER RIGHTS—Continued.**

	Oklahoma.	Oregon.	South Dakota.	Texas.	Utah.	Washington.	Wyoming.
<b>AREA IRRIGATED, 1919.</b>							
<b>Total.....</b>	<b>2,969</b>	<b>368,162</b>	<b>100,682</b>	<b>586,120</b>	<b>1,371,651</b>	<b>528,899</b>	<b>1,207,938</b>
<b>Date of beginning:</b>							
1 Before 1860.....		8,206			106,182	461	320
2 1860-1869.....		46,917			144,957	798	9,288
3 1870-1879.....		90,950	11,302	23,008	201,840	22,650	77,228
4 1880-1889.....		198,653	11,441	13,073	300,415	65,791	406,196
5 1890-1899.....	2,392	123,043	2,965	45,411	113,356	126,359	229,300
6 1900-1904.....	108	123,648	58,570	134,832	81,407	42,534	163,543
7 1905-1909.....	55	142,756	8,027	181,770	250,048	175,383	169,976
8 1910-1914.....	298	91,425	5,633	141,116	67,466	30,663	55,288
9 1915-1919.....	36	62,458	1,126	84,656	44,939	24,466	18,642
10 Not reported.....	80	98,106	718	32,256	61,061	40,794	68,201
<b>Character of enterprise:</b>							
11 Individual and partnership.....	969	590,626	31,664	110,680	166,887	142,215	724,620
12 Cooperative.....	2,000	180,037	10,030	103,378	1,014,649	93,192	286,702
13 Irrigation district.....		92,081		88,571	21,143	79,918	22,935
14 Carey Act.....		30,665			16,000		36,230
15 Commercial.....		27,338	2,280	262,892	70,911	21,705	57,600
16 U. S. Reclamation Service.....		54,981	56,638	20,284	29,285	122,869	53,555
17 U. S. Indian Service.....		4,000	20		25,270	69,510	22,000
18 State.....				55		200	2,120
19 City.....		330		250	24,206		2,020
20 Other and mixed.....		104			3,300	280	
21 Not reported.....							
<b>Source of water supply:</b>							
22 Streams, gravity.....	2,522	786,354	92,491	73,982	1,105,691	352,199	1,155,596
23 Streams, pumped.....	188	64,576	869	421,538	10,389	26,244	1,525
24 Streams, pumped and gravity.....		253		350	50	62,702	
25 Wells, pumped.....	107	1,993		39,482	7,308	17,504	147
26 Wells, flowing.....	18	72	130	3,256	4,808	1,071	19
27 Wells, pumped and flowing.....		340		597	1,178	1,490	
28 Lakes, pumped.....		1,620			11,400	4,662	
29 Lakes, gravity.....		5,750	170		15,218	8,442	335
30 Springs.....	6	9,584	326	8,688	41,510	7,806	5,955
31 Stored storm water.....		3,763	2,312	11,572	977	129	10,862
32 City water.....	3	258			25	42	
33 Sewage.....		10		200			
34 Streams, gravity and pumped wells.....		105	500	454	125	2,415	400
35 Streams, gravity and flowing wells.....		200	20	45	637	441	
36 Other mixed.....	125	111,137	3,864	24,170	173,495	19,027	33,043
37 Other and not reported.....		147			40	62	60
<b>Character of water rights:</b>							
38 Appropriation and use.....	35	149,523	1,774	69,334	469,944	196,700	25,662
39 Notice filed and posted.....	216	150,332	62,054	105,009	171,955	169,831	60,792
40 Adjudicated by court.....	2,200	293,913	7,651	2,755	581,080	56,309	162,186
41 Permit from state.....	310	131,540	17,500	229,753	56,061	39,608	466,026
42 Certificate or license from state.....		217,228	8,612	11,898	66,778	17,400	467,038
43 Riparian rights.....	80	14,277	1,599	72,396		17,095	
44 Underground.....	120	3,235	130	44,649	8,631	20,859	276
45 Other and mixed.....	3	12,159	190	594	4,077	561	667
46 Not reported.....	6	14,955	1,172	49,672	13,125	11,530	35,345
<b>CAPITAL INVESTED, 1920.</b>							
<b>Total.....</b>	<b>\$151,325</b>	<b>\$28,929,151</b>	<b>\$5,465,948</b>	<b>\$35,072,739</b>	<b>\$32,037,851</b>	<b>\$29,299,011</b>	<b>\$34,326,328</b>
<b>Date of beginning:</b>							
47 Before 1860.....		151,216			1,883,633	37,086	1,250
48 1860-1869.....		398,603		30,000	1,639,394	16,174	45,731
49 1870-1879.....		1,072,943	261,476	1,108,104	2,495,342	104,885	978,368
50 1880-1889.....		2,321,551	149,465	295,723	4,728,282	1,130,394	5,459,694
51 1890-1899.....	54,378	1,656,228	94,851	987,951	2,333,321	4,883,571	3,109,641
52 1900-1904.....	3,403	4,193,262	4,542,349	4,903,055	507,149	2,907,222	4,844,972
53 1905-1909.....	4,085	10,876,802	221,514	7,762,497	10,322,803	12,527,690	14,962,407
54 1910-1914.....	67,101	2,741,335	106,127	14,010,412	5,113,678	5,697,725	1,621,916
55 1915-1919.....	17,009	4,759,181	68,308	2,747,630	1,893,298	1,993,364	2,337,454
56 Not reported.....	5,349	748,032	25,153	3,227,361	850,451		964,905
<b>Character of enterprise:</b>							
57 Individual and partnership.....	110,658	6,584,362	743,880	8,256,508	2,736,804	4,733,970	8,738,886
58 Cooperative.....	40,667	3,143,698	240,030	3,821,844	20,254,212	3,951,207	6,701,990
59 Irrigation district.....		6,313,753		5,449,142	265,484	6,114,036	1,441,312
60 Carey Act.....		3,231,296			1,323,779		2,434,791
61 Commercial.....		3,281,034	15,058	13,825,409	2,374,991	2,342,028	780,562
62 U. S. Reclamation Service.....		5,956,950	4,464,780	3,673,476	3,667,057	10,444,717	12,863,870
63 U. S. Indian Service.....		230,038	1,500		765,354	1,657,396	1,339,837
64 State.....		16,107		6,802		56,668	15,050
65 City.....		171,063		39,498	728,090		9,930
66 Other.....		823			20,550		
67 Not reported.....							
<b>Source of water supply:</b>							
68 Streams, gravity.....	90,040	20,028,187	5,122,271	5,631,241	26,503,462	19,305,396	33,025,460
69 Streams, pumped.....	4,210	2,807,806	93,340	19,432,010	735,077	2,677,946	99,914
70 Streams, pumped and gravity.....		3,700		60,000	5,100	3,933,461	
71 Wells, pumped.....	47,075	118,306		2,783,260	153,091	1,678,581	10,460
72 Wells, flowing.....	5,000	6,900	5,000	340,538	167,152	117,540	4,630
73 Wells, pumped and flowing.....		2,600		163,657	15,571	58,123	
74 Lakes, pumped.....		26,563			565,030	468,616	
75 Lakes, gravity.....		783,702	2,100		75,281	265,101	4,935
76 Springs.....	1,800	165,946	13,421	316,664	860,214	520,899	66,299
77 Stored storm water.....		124,499	155,121	4,735,276	61,803	5,985	407,065
78 City water.....	1,500	153,650			800	381	
79 Sewage.....		1,500		40,072			
80 Streams, gravity, and pumped wells.....		11,500	3,000	34,680	22,000	243,642	16,770
81 Streams, gravity, and flowing wells.....		1,000	480	5,000	11,822	23,334	
82 Other mixed.....	2,500	4,691,072	65,515	1,304,241	2,828,242		600,705
83 Other and not reported.....		2,200			2,736		100



# ARIZONA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Arizona collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison: and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE I.—SUMMARY FOR THE STATE: 1920 AND 1910.

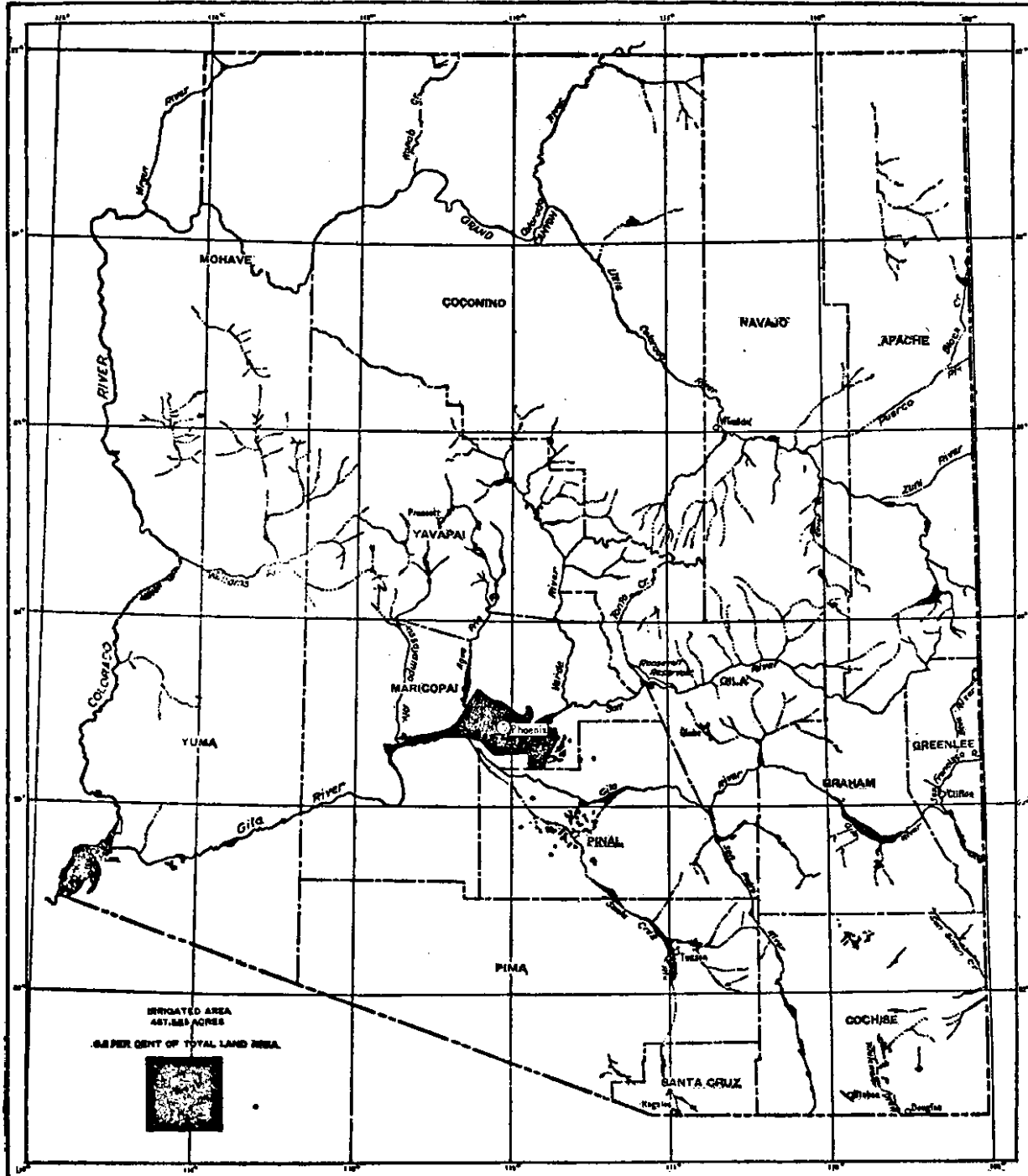
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	9,975	9,227	748	8.1
Approximate land area of the state.....acres..	72,838,400	72,838,400		
All land in farms.....acres..	5,802,126	1,246,613	4,555,513	365.4
Improved land in farms.....acres..	712,803	350,173	362,630	103.6
Number of farms irrigated.....	6,605	4,841	1,764	36.4
Area irrigated.....acres..	467,565	320,051	147,514	46.1
Area enterprises were capable of irrigating.....acres..	627,303	387,655	239,648	61.8
Area included in enterprises.....acres..	813,153	944,090	-130,937	-13.9
Per cent irrigated:				
Number of all farms.....	66.2	52.5	13.7	
Approximate land area of the state.....	0.6	0.4	0.2	
Land in farms.....	8.1	25.7	-17.6	
Improved land in farms.....	65.6	91.4	-25.8	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	159,738	67,604	92,134	136.3
Excess of area included in enterprises over area irrigated.....acres..	185,850	624,039	-438,189	-70.2
Area of irrigated land reported as available for settlement.....acres..	24,341	( <sup>2</sup> )		
Capital invested.....	\$33,498,094	\$17,677,966	\$15,820,128	89.5
Average per acre enterprises were capable of irrigating.....	\$53.40	\$45.60	\$7.80	17.1
Estimated final cost of existing enterprises.....	\$34,615,064	\$24,828,868	\$9,786,196	39.4
Average per acre included in enterprises.....	\$42.57	\$26.30	\$16.27	61.9
Average cost of operation and maintenance per acre.....	\$3.27	\$0.93	\$2.34	251.6
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	1,388	1,269	119	9.4
Number of main ditches.....	1,295	891	404	45.3
Length of main ditches.....miles..	1,769	1,727	42	2.4
Capacity of main ditches.....second-feet..	11,707	17,200	-5,493	-31.9
Number of lateral ditches.....	1,174	313	861	275.1
Length of lateral ditches.....miles..	1,599	870	729	83.8
Number of reservoirs.....	340	402	-62	-15.4
Capacity of reservoirs.....acre-feet..	1,510,856	1,349,938	160,918	11.9
Number of flowing wells.....	310	214	96	44.9
Capacity of flowing wells.....gallons per minute..	14,547	9,953	4,594	46.2
Number of pumped wells.....	999	470	529	112.6
Capacity of pumped wells.....gallons per minute..	1,042,590	765,921	276,669	36.1
Number of pumping plants.....	744	429	315	73.4
Engine capacity.....horsepower..	22,014	37,258	-15,244	-40.9
Pump capacity.....gallons per minute..	1,048,030	851,873	196,157	23.0
Average lift.....feet..	44	( <sup>2</sup> )	44	

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not reported in 1910.

# ARIZONA

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

The whole of the state of Arizona may be classed as arid, although there are small parts of the state where some crops are grown without irrigation.

The central part of the state is mountainous, while the remainder of the state consists of extensive valleys or plateaus broken by isolated ranges of mountains and hills.

In the valley of the Colorado River, in the northwestern part of the state, the normal annual precipitation is about 10 inches, while in the mountains in the central part of the state it varies from 18 to 25 inches. In the northeastern part of the state, on the rolling plateau, the precipitation drops below 10 inches. On the lower Colorado and the Gila Rivers the average annual precipitation is below 5 inches, and to the east of this it increases, being about 7 inches at Phoenix, in the Salt River Valley; about 6 inches at Maricopa, in the Gila River Valley; and about 12 inches at Tucson. It is higher at many points which lie at higher elevations.

Throughout the state the larger part of the precipitation occurs in July, August, and early September, while the driest part of the year is April, May, and June.

Crops are grown without irrigation in the valleys of the Little Colorado, Hassayampa, and Agua Fria Rivers, and at many other points in the state that receive more than the average precipitation, but on the plateaus in northern Arizona and in the extensive valleys in southern Arizona no crops can be grown in this way.

The rainfall varies greatly from year to year, much of it coming in very heavy torrential storms that may do heavy damage by washing out crops, irrigation structures, and bridges.

The heat in the arid valleys is intense, and evaporation is great, making large quantities of water necessary to maintain plant growth.

In 1919 the spring was cold and late, and precipitation for the first six months of the year was below normal, but conditions improved later in the season, and the report of the United States Weather Bureau for Arizona states that "1919 was perhaps the most favorable year on record for both agriculture and live stock," and "crops both in the dry farming sections and under the irrigation projects were rated better than 100 per cent."

**WATER SUPPLY FOR IRRIGATION.**

With the exception of Colorado River all of the streams in Arizona are torrential in character, because of the limited and variable precipitation. Colorado River has its sources in the high, snow-covered moun-

tains in Wyoming and Colorado, and maintains a good summer flow, although it is subject to heavy floods. Throughout its course in northern Arizona this stream flows through the Grand Canyon, and along most of the distance where it forms the boundary between Arizona and Nevada and Arizona and California there is very little land on which its water can be utilized. Near the southwest corner of the state water is diverted for use in both Arizona and California, and up to the present the normal low-water flow has been sufficient to meet the demands of both states. Extension of the areas irrigated will require storage, and plans that will provide for the largest use of the stream are being studied.

The Little Colorado rises in east central Arizona and flows in a northwesterly direction to its junction with Colorado River in the north central part of the state. The stream does not carry a large volume of water at any time, and gets very low or entirely dry at times during the summer. Consequently it is not a dependable source of water for irrigation. Plans for storage have been studied, but no large scheme has been carried out. The northeastern part of the state, north of the Little Colorado, consists of a high, rolling desert with almost no surface water supply.

Southern Arizona is drained by Gila and Salt Rivers. Gila River rises in western New Mexico and flows entirely across southern Arizona. It is a torrential stream, subject to heavy floods, and often entirely dry. It is little used for irrigation because of its uncertain flow. Storage of the flood waters would make it possible to irrigate large areas, and plans for such storage have been made but never carried out.

Salt River rises in east central Arizona and flows westward to its confluence with Gila River, slightly west of the center of the state. Salt River and its tributaries receive most of the drainage from the mountains of central Arizona and supply irrigation water to the Salt River Valley, which contains the largest irrigated area in the state. Like the other streams of the state, Salt River had a very variable flow until storage was provided by the construction of Roosevelt Reservoir. There is opportunity for additional storage on the tributaries.

South of Gila River there are extensive areas almost without surface water, and other valleys having drainage channels that carry water intermittently.

In some of the valleys in the southern part of the state there is a good supply of ground water, which can be made available by pumping. In the Salt River Valley irrigation has raised the ground water level so much that land has been injured. Both open drains and wells have been installed, primarily for the purpose of lowering the ground water, but affording, at the same time, an added supply of water for irrigation.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	6,605	36.4	66.2	467,565	46.1	0.6	8.1	65.6
1910.....	4,841	62.4	62.5	320,051	72.6	0.4	25.7	91.4
1900.....	2,981	177.3	51.3	185,396	181.7	0.3	9.6	72.8
1890.....	1,075	.....	75.4	65,821	.....	0.1	5.1	63.2

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	1,388	813,153	467,565	57.5	627,303
Before 1880.....	10	1,955	332	17.0	660
1860-1869.....	10	2,050	720	35.1	776
1870-1879.....	61	71,788	55,327	77.1	62,077
1880-1889.....	85	78,516	41,358	52.7	55,332
1890-1899.....	78	35,616	19,975	56.1	23,930
1900-1904.....	67	21,966	10,944	49.8	11,270
1905-1909.....	158	348,591	260,639	74.8	285,462
1910-1914.....	226	42,994	18,692	43.5	27,738
1915-1919.....	436	178,826	42,595	23.8	138,571
Not reported.....	207	30,863	16,983	55.0	21,487

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).		Increase. <sup>1</sup>		Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Amount.	Per cent.		
Total.....	467,565	320,051	147,514	46.1	627,303	813,153
Streams, gravity.....	186,782	300,067	-110,285	-36.8	299,122	398,591
Streams, pumped.....	6,671	7,711	-1,040	-13.5	9,397	16,840
Wells, pumped.....	39,694	6,096	33,598	551.1	69,783	99,331
Wells, flowing.....	1,558	1,480	69	4.6	1,902	6,831
Wells, flowing and pumped.....	558	( <sup>2</sup> )	558	.....	799	2,016
Lakes, gravity.....	.....	570	-570	.....	.....	.....
Lakes, pumped.....	5	( <sup>2</sup> )	5	.....	5	130
Springs.....	2,578	3,631	-1,053	-29.0	3,529	6,078
Stored storm water.....	510	487	23	4.7	600	700
Sewage.....	195	( <sup>2</sup> )	195	.....	200	270
Streams, gravity, and pumped wells.....	217,799	( <sup>2</sup> )	217,799	.....	240,640	238,104
Streams, gravity, and flowing wells.....	525	( <sup>2</sup> )	525	.....	645	1,317
Other mixed.....	7,690	( <sup>2</sup> )	7,690	.....	10,690	22,945

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

Arizona, in common with other territory settled by the Spaniards, has many old irrigation enterprises, known as "community ditches" or "public acequias," which are operated in accordance with ancient laws and customs which have not been brought into a

definite code. These laws and customs were continued by the law of 1871, which recognized the "laws and customs of Sonora and the usage of the people of Arizona." Such enterprises are controlled by the water users and are classed as cooperative.

Arizona enacted an irrigation district law in 1912, but almost nothing has been done under that law. The state accepted the conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1912, but nothing has been done under that act.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	467,565	320,051	147,514	46.1
Individual and partnership.....	80,511	61,196	19,315	31.6
Cooperative.....	114,482	101,025	13,457	13.3
Irrigation district.....	300	( <sup>2</sup> )	300	.....
Commercial.....	14,500	80	14,420	.....
U. S. Reclamation Service.....	248,814	138,364	110,450	79.8
U. S. Indian Service.....	8,733	19,386	-10,653	-55.0
City.....	200	( <sup>2</sup> )	200	.....
Other and mixed.....	25	( <sup>2</sup> )	25	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	627,303	387,655	239,648	61.8
Individual and partnership.....	195,331	81,422	113,909	139.9
Cooperative.....	130,903	120,569	10,344	8.6
Irrigation district.....	300	( <sup>2</sup> )	300	.....
Commercial.....	20,000	200	19,800	.....
U. S. Reclamation Service.....	269,691	164,500	105,191	63.9
U. S. Indian Service.....	10,833	20,974	-10,141	-48.4
City.....	220	( <sup>2</sup> )	220	.....
Other and mixed.....	25	( <sup>2</sup> )	25	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	813,153	944,090	-130,937	-13.9
Individual and partnership.....	288,510	175,834	112,676	64.1
Cooperative.....	157,849	360,639	-202,790	-56.2
Irrigation district.....	450	( <sup>2</sup> )	450	.....
Commercial.....	31,000	1,600	29,400	.....
U. S. Reclamation Service.....	314,691	370,000	-55,309	-14.9
U. S. Indian Service.....	20,058	36,017	-15,959	-44.8
City.....	300	( <sup>2</sup> )	300	.....
Other and mixed.....	295	( <sup>2</sup> )	295	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100, or when per cent is more than 1,000.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Arizona relating to water rights are summarized in the following paragraphs:

The bill of rights of the territory of Arizona, approved October 4, 1864, contained the following declaration regarding water rights:

"All streams, lakes, and ponds of water capable of being used for purposes of navigation or irrigation are hereby declared to be public property; and no individual or corporation shall have the right to appropriate them exclusively to their own private use, except under such equitable regulations and restrictions as the legislature shall provide for that purpose."—Art. 22.

The law of 1871 declared all rivers, creeks, and streams of running water to be public and applicable to the purposes of irrigation and mining. This law provided that the appropriator should post a notice at the point of diversion and file a copy of the notice with the county recorder.

A law enacted in 1887 declared that the common law doctrine of riparian rights should not be in force in the territory, and the state constitution, adopted in 1910, contained a similar declaration (Art. 17).

In 1919 the state of Arizona adopted for the first time a comprehensive code of water laws. The code declares that "The water of all natural streams, or flowing in any canyon, ravine or other natural channel, and of springs and lakes, belongs to the public and is subject to beneficial use as herein provided." The office of state water commissioner is created; any party intending to acquire the right to use any water of the state is required to make application to the water commissioner for a permit, and upon an appropriation being perfected in accordance with a permit, the commissioner is to issue a certificate setting forth the rights acquired.

Until the enactment of the water code in 1919 there was no special procedure in the courts for hearing controversies regarding water rights. This code provides that the commissioner, on his own initiative or upon petition of one or more water users from any source, is to take testimony regarding rights to water from the source in question, examine the source of water supply and the works taking water therefrom, make findings of fact and an order defining all rights to water, and submit all testimony and his reports and findings to the superior court of the county in which reside the greatest number of the water users interested. The court reviews the whole record, and after proper hearings issues a decree defining rights. Pending the decision of the court the order of the commissioner is binding.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	467,565	100.0	100.0
Appropriation and use.....	226,846	48.5	76.7
Notice filed and posted.....	97,130	20.8	14.7
Adjudicated by court.....	84,678	18.2	8.4
Permit from state.....	10	(1)	0.2
Riparian rights.....			
Underground.....	41,624	8.9	(2)
Other and mixed.....	625	0.1	(3)
Not reported.....	16,452	3.5	(3)

<sup>1</sup> Less than one-tenth of 1 per cent.  
<sup>2</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	467,565	247,250	89.1	813,153	627,303
Colorado River and tributaries.....	461,694	246,866	87.0	798,530	617,353
Colorado River direct.....	48,326	7,823	517.7	107,311	56,531
Kanab Wash.....	450	700	-35.7	710	610
Virgin River.....	379	820	-53.8	533	612
Williams River.....	1,653	1,266	31.6	3,232	1,809
Little Colorado River and tributaries.....	17,036	11,855	43.7	35,358	21,880
Little Colorado River direct.....	10,260	7,270	41.1	20,821	14,131
Nutriso Creek.....	636	329	98.8	1,224	952
Concho Creek.....	244	168	49.7	500	250
Other tributaries of Little Colorado River.....	5,896	* 4,102	43.7	12,813	6,547
Gila River and tributaries.....	391,417	223,771	74.9	643,480	533,521
Gila River direct.....	76,982	55,973	37.5	203,504	167,642
San Francisco River.....	429	239	79.5	4,148	478
San Pedro River.....	7,773	10,912	-28.8	18,959	10,861
Santa Cruz River.....	33,019	10,806	211.3	76,617	45,115
Salt River and tributaries.....	247,260	140,642	75.8	277,034	268,644
Salt River direct.....	236,826	125,007	88.6	253,603	253,308
Tonto Creek.....	502	1,529	-72.6	2,928	720
Rio Verde.....	6,564	11,502	-42.9	9,978	7,470
Other tributaries of Salt River.....	4,399	* 2,304	89.6	10,525	7,146
Agua Fria River.....	18,824	884		38,699	30,000
Hassayampa River.....	956	1,091	-12.4	3,657	1,773
Other tributaries of Gila River.....	6,174	* 3,424	80.3	20,862	9,010
Other tributaries of Colorado River.....	2,433	* 641	279.6	5,906	2,490
Whitewater Draw and tributaries.....	5,871	384		16,623	9,950

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$33,498,094	89.5	\$53.40	17.1
1910.....	17,677,966	298.3	45.60	90.5
1900.....	4,438,352	854.5	23.94	238.6
1890.....	465,000		7.07	

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$33,498,094	100.0	\$53.40
Before 1860.....	2,058	(1)	3.12
1860-1869.....	9,770	(1)	12.59
1870-1879.....	1,881,284	5.6	30.31
1880-1889.....	921,806	2.8	16.66
1890-1899.....	645,369	1.9	26.97
1900-1909.....	437,719	1.3	38.84
1905-1909.....	20,951,874	62.5	73.40
1910-1914.....	3,778,003	11.3	136.20
1915-1919.....	4,419,044	13.2	31.89
Not reported.....	451,167	1.4	21.00

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$33,498,094	100.0	\$33.40	362,828	\$3.27
Streams, gravity.....	11,537,834	34.6	38.74	111,223	2.27
Streams, pumped.....	521,852	1.6	55.53	6,082	8.12
Streams, pumped and gravity.....					
Wells, pumped.....	3,417,339	10.2	57.16	18,733	13.15
Wells, flowing.....	115,938	0.3	60.95	734	3.64
Wells, flowing and pumped.....	54,700	0.2	68.46	558	13.64
Lakes, pumped.....	400	(*)	80.00	5	10.00
Lakes, gravity.....					
Springs.....	271,358	0.8	77.09	1,525	3.88
Stored storm water.....	11,600	(*)	19.33		
Sewage.....	63,408	0.2	317.04	90	1.89
Streams, gravity, and pumped wells.....	17,092,890	51.0	71.03	216,397	2.70
Streams, gravity, and flowing wells.....	27,500	0.1	42.64	495	2.40
Other mixed.....	333,227	1.0	31.17	6,930	4.99

<sup>1</sup> Based on area irrigated in 1919.    \* Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$33,498,094	\$4,688,298	\$28,809,796	614.5
Colorado River and tributaries.....	33,198,726	4,681,603	28,517,123	609.1
Colorado River direct.....	7,381,891	250,973	7,130,918	96.1
Kanab Wash.....	20,590	4,700	15,890	339.2
Virgin River.....	7,474	3,425	4,049	118.2
Williams River.....	55,504	15,636	39,868	255.0
Little Colorado River and tributaries.....	460,206	265,701	194,505	73.2
Little Colorado River direct.....	148,913	218,900	-71,987	-32.9
Nutriso Creek.....	16,500	2,600	13,900	534.6
Concho Creek.....	49,228	850	48,378	982.5
Other tributaries of Little Colorado River.....	247,565	* 43,351	204,214	471.1
Gila River and tributaries.....	25,165,814	4,131,850	21,033,964	509.1
Gila River direct.....	2,841,626	1,203,882	1,637,744	136.0
San Francisco River.....	15,415	13,586	1,829	13.5
San Pedro River.....	359,153	40,135	319,018	749.9
Santa Cruz River.....	5,168,524	79,685	5,088,839	98.5
Salt River and tributaries.....	14,939,034	2,697,189	12,241,845	453.9
Salt River direct.....	14,339,874	2,404,160	11,935,714	496.5
Tonto Creek.....	9,468	15,085	-5,617	-37.2
Rio Verde.....	209,482	250,813	-41,331	-16.5
Other tributaries of Salt River.....	380,210	* 27,131	353,079	92.9
Agua Fria River.....	1,428,077	20,998	1,407,079	98.6
Hassayampa River.....	51,299	11,160	40,139	359.7
Other tributaries of Gila River.....	362,786	* 65,215	297,571	456.3
Other tributaries of Colorado River.....	107,337	* 9,278	98,059	91.4
Whitewater Draw and tributaries.....	299,368	6,735	292,633	97.8

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000. \* Includes springs and wells.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of most of the other classes shown in the table and a part of its expenditure is properly chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$33,498,094	100.0	362,828	\$3.27
Individual and partnership.....	5,598,625	16.7	43,378	7.53
Cooperative.....	3,171,408	9.5	93,444	2.44
Irrigation district.....	109,000	0.3	300	6.67
Commercial.....	3,693,400	11.0	14,500	4.86
U. S. Reclamation Service.....	20,277,919	60.5	205,064	2.44
U. S. Indian Service.....	585,029	1.8	5,977	2.51
City.....	71,500	0.2	140	1.93
Not reported.....	215	(*)	25	5.00

<sup>1</sup> Based on area irrigated in 1919.    \* Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	31
Acreage included in enterprises reporting land drained or needing drainage.....	382,928
Acreage for which drains have been installed.....	25,173
Additional acreage needing drainage.....	71,357
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	6.6
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	3.1
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	11.9

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-foot.....	4,199	2,967	1,232
Area irrigated in 1919..... acres.....	336,393	258,260	78,133
Average number of acres per second-foot.....	80	87	63
Total quantity of water entering canals, acre-feet.....	1,839,689	1,402,101	437,588
Area irrigated in 1919..... acres.....	358,383	283,376	75,007
Average quantity per acre..... acre-feet.....	5.1	4.9	5.8
Total quantity of water delivered..... acre-feet.....	876,016	690,053	185,963
Area irrigated in 1919..... acres.....	291,637	233,469	58,168
Average quantity per acre..... acre-feet.....	3.0	3.0	3.2



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## IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total</b> .....	248	99	1,295	11,707	1,769	1,174	1,599	340	1,510,856
Before 1860.....	1	4	9	24	7	4	1	4	4
1860-1869.....	5	.....	11	34	11	.....	.....	.....	.....
1870-1879.....	41	.....	76	1,367	255	207	262	21	15,532
1880-1889.....	37	6	104	1,115	211	49	49	28	20,199
1890-1899.....	30	4	83	509	152	68	48	12	164
1900-1904.....	30	7	76	293	125	17	17	19	971
1905-1909.....	31	5	173	4,922	251	466	1,004	49	1,378,642
1910-1914.....	22	29	203	631	211	141	44	68	86,960
1915-1919.....	31	31	430	2,283	424	132	163	112	8,332
Not reported.....	20	5	130	534	122	40	13	27	52

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Number.	Capacity (gallons per minute).
<b>Total</b> .....	104.5	310	14,547	999	1,042,590	744	22,014	1,001	1,048,030
Before 1860.....	0.1	.....	.....	9	6,400	7	147	8	5,900
1860-1869.....	0.1	.....	.....	.....	.....	.....	.....	.....	.....
1870-1879.....	.....	1	.....	1	1,100	1	18	1	1,100
1880-1889.....	11.7	3	30	12	5,980	8	122	11	5,730
1890-1899.....	10.5	8	370	19	11,375	14	550	22	83,575
1900-1904.....	5.9	22	491	26	17,970	19	547	19	20,295
1905-1909.....	10.0	87	4,276	158	111,745	87	1,982	152	119,500
1910-1914.....	8.2	44	2,302	251	428,462	171	3,639	262	397,197
1915-1919.....	55.8	117	5,443	465	411,876	379	14,525	468	367,041
Not reported.....	2.2	28	1,635	58	47,682	58	484	58	47,682

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total</b> .....	248	99	1,295	11,707	1,769	1,174	1,599	340	1,510,856
Individual and partnership.....	200	93	1,180	4,581	1,151	400	209	309	100,625
Cooperative.....	34	5	78	2,390	431	265	390	23	31,424
Irrigation district.....	1	.....	1	.....	.....	.....	.....	.....	.....
Commercial.....	2	.....	4	135	25	70	36	1	300
U. S. Reclamation Service.....	3	1	5	4,355	78	411	977	1	1,367,300
U. S. Indian Service.....	5	.....	42	242	76	22	56	6	11,207
City.....	.....	.....	2	2	3	.....	.....	.....	.....
Not reported.....	3	.....	3	2	1	.....	.....	.....	.....

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Number.	Capacity (gallons per minute).
<b>Total</b> .....	104.5	310	14,547	999	1,042,590	744	22,014	1,001	1,048,030
Individual and partnership.....	97.2	310	14,547	814	591,990	716	18,603	814	559,205
Cooperative.....	0.2	.....	.....	49	321,550	15	1,328	41	282,800
Commercial.....	0.8	.....	.....	83	78,750	8	1,400	88	78,750
U. S. Reclamation Service.....	0.9	.....	.....	48	45,600	2	95	48	45,600
U. S. Indian Service.....	1.3	.....	.....	5	4,700	8	588	10	81,675
City.....	4.1	.....	.....	.....	.....	.....	.....	.....	.....

IRRIGATION—ARIZONA.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	248	99	1,295	11,707	1,769	1,174	1,599	340	1,510,856
Colorado River and tributaries.....	242	48	1,120	11,154	1,648	1,082	1,592	264	1,425,785
Colorado River direct.....	2		6	713	52	174	221		
Kanab Wash.....	1		1	1		4	4	4	258
Virgin River.....		1	10	9	9	9	2		
Williams River.....	5		27	40	34	1	1	1	4
Little Colorado River and tributaries.....	32	14	82	341	156	43	43	45	37,098
Little Colorado River direct.....	19	9	36	208	78	15	22	18	30,823
Nutriso Creek.....	4	1	7	17	8			4	1,050
Concho Creek.....			2	3	2	1	1	2	625
Other tributaries of Little Colorado River.....	9	4	37	113	68	27	20	21	4,600
Gila River and tributaries.....	199	33	950	10,032	1,385	836	1,316	210	1,377,406
Gila River direct.....	27	1	91	2,520	370	219	203	2	210
San Francisco River.....	28	1	38	22	12			2	
San Pedro River.....	30	9	114	270	162	31	15	45	894
Santa Cruz River.....	31	5	237	1,196	260	147	75	26	392
Salt River and tributaries.....	44	8	174	5,084	290	313	911	11	1,367,307
Salt River direct.....	8	1	18	4,447	111	271	896	2	1,367,300
Tonto Creek.....	9	1	34	58	26			1	1
Rio Verde.....	22		75	359	107	29	7	5	1
Other tributaries of Salt River.....	5	1	47	220	46	13	6	3	5
Agua Fria River.....	12	5	108	525	107	105	101	16	24
Hassayampa River.....	1	1	24	46	18			1	180
Other tributaries of Gila River.....	26	8	166	369	166	21	11	107	8,899
Other tributaries of Colorado River.....	3		34	18	12	15	5	4	11,019
Whitewater Draw and tributaries.....	6	51	175	553	121	92	7	76	85,071

DRAINAGE BASIN.	Pipe line, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	104.5	310	14,547	999	1,042,590	744	22,014	1,001	1,048,030	44
Colorado River and tributaries.....	99.4	300	14,044	790	989,803	546	19,611	792	974,063	45
Colorado River direct.....				3	750	7	414	10	80,200	14
Kanab Wash.....	1.3									
Virgin River.....										
Williams River.....	10.1			5	2,015	6	39	8	2,560	20
Little Colorado River and tributaries.....		2		2	1,000	1	1	2	1,000	30
Little Colorado River direct.....		2								
Nutriso Creek.....										
Concho Creek.....										
Other tributaries of Little Colorado River.....				2	1,000	1	1	2	1,000	30
Gila River and tributaries.....	87.9	296	14,044	774	965,338	525	19,087	765	889,573	44
Gila River direct.....	1.0			78	78,531	80	2,332	84	92,581	34
San Francisco River.....	1.4			4	225	11	70	12	5,835	19
San Pedro River.....	5.1	133	5,195	25	11,474	27	285	29	12,949	30
Santa Cruz River.....	35.0			365	576,234	241	8,073	366	528,649	44
Salt River and tributaries.....	4.3	1		132	150,874	75	2,653	124	153,184	68
Salt River direct.....	1.5			72	75,319	14	629	60	75,719	54
Tonto Creek.....				1	500	2	25	2	1,500	16
Rio Verde.....	1.8	1		3		11	96	11	1,070	63
Other tributaries of Salt River.....	1.0			56	75,055	48	1,903	51	74,865	75
Agua Fria River.....	34.3	1		114	120,685	41	4,749	100	68,575	47
Hassayampa River.....	4.1			15	6,420	13	204	13	5,810	35
Other tributaries of Gila River.....	2.7	163	8,849	41	20,895	37	671	37	21,990	49
Other tributaries of Colorado River.....	0.1			6	700	7	70	7	700	20
Whitewater Draw and tributaries.....	5.1	10	503	209	72,787	198	2,403	209	73,967	44

IRRIGATION—ARIZONA.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of in-crease. <sup>1</sup>	Unit.	1919		1909		Per cent of in-crease. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	8,726	89.4	7,797	50.0	10.5	Bu.....	205,909	46.1	171,907	57.6	19.8
2 Winter wheat.....	28,967	93.3	17,901	80.4	79.6	Bu.....	682,332	94.5	358,175	98.7	100.0
3 Spring wheat.....	3,250	53.7				Bu.....	66,378	58.6			
4 Oats.....	4,448	37.5	5,406	92.1	-17.7	Bu.....	136,227	36.1	177,057	93.5	-23.1
5 Barley.....	19,311	91.1	32,268	98.1	-38.6	Bu.....	600,752	91.5	1,001,611	99.3	-40.0
6 Kafir and milo.....	20,316	90.4				Bu.....	609,333	71.7			
<b>Hay and forage:</b>											
7 Alfalfa.....	97,240	88.7	65,369	98.9	48.5	Tons...	323,052	95.7	194,171	99.8	66.4
8 Other tame grasses.....	5,117	53.8	437	20.0		Tons...	9,555	62.0	438	14.7	
9 Annual legumes cut for hay.....	792	69.7	15,266	80.1	-26.5	Tons...	1,081	72.6	24,291	81.8	-36.0
10 Small grains cut for hay.....	10,517	45.5	1,462	15.4	-28.2	Tons...	14,457	48.8	1,756	21.5	-37.6
11 Wild, salt, or prairie grasses.....	1,050	12.6				Tons...	1,096	14.0			
12 Silage crops.....	5,634	77.7				Tons...	30,130	84.1			
13 Corn cut for forage.....	3,110	35.8	( <sup>2</sup> )			Tons...	7,461	52.0	( <sup>2</sup> )		
14 Kafir, sorghum, etc., for forage.....	12,245	42.3	( <sup>2</sup> )			Tons...	23,183	52.6	( <sup>2</sup> )		
<b>Vegetables:</b>											
15 Cantaloupes and muskmelons.....	3,123	94.6									
16 Watermelons.....	807	74.9									
17 Potatoes.....	1,011	40.4	1,011	87.8		Bu.....	37,371	21.4	66,351	68.8	-43.7
<b>Miscellaneous:</b>											
18 Clover and alfalfa seed <sup>3</sup> .....	4,217	87.2	6,355	99.6	-33.6	Bu.....	28,193	90.0	22,264	99.0	26.6
19 Dry beans.....	1,295	13.7	759	33.0	70.6	Bu.....	9,876	12.0	6,863	37.2	43.9
20 Cotton.....	101,080	95.1				Bales	56,667	95.3			
<b>Fruits:</b>											
21 Grapes.....	* 14,072	17.0	( <sup>4</sup> )			Lbs.....	139,690	20.9	( <sup>4</sup> )		
22 Apples.....	* 30,749	43.8	( <sup>4</sup> )			Bu.....	54,643	45.2	( <sup>4</sup> )		
23 Peaches.....	* 32,880	32.3	( <sup>4</sup> )			Bu.....	49,942	36.1	( <sup>4</sup> )		
24 Oranges.....	* 32,196	69.0	( <sup>4</sup> )			Boxes...	48,764	61.2	( <sup>4</sup> )		

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On nonirrigated land.	On irrigated land.			1919		1909		Per cent of in-crease.
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	30.1	17.7	23.9	118.9	135.0	\$401,523	46.1	\$158,993	54.1	152.5
2 Winter wheat.....	Bu.....	22.2	18.2	23.6	101.7	129.7	1,569,364	94.5	398,294	97.1	332.4
3 Spring wheat.....	Bu.....	18.7	16.7	20.4	109.1	122.2	152,669	58.6			
4 Oats.....	Bu.....	31.8	32.6	30.6	96.2	93.9	150,661	36.1	127,003	97.4	23.4
5 Barley.....	Bu.....	30.2	29.0	30.3	100.3	104.5	871,090	91.5	711,251	99.5	22.5
6 Kafir and milo.....	Bu.....	25.3	18.1	30.0	118.6	165.7	914,000	71.7			
<b>Hay and forage:</b>											
7 Alfalfa.....	Tons...	3.08	1.16	3.33	108.1	287.1	7,914,774	95.7	1,880,244	99.1	820.9
8 Other tame grasses.....	Tons...	1.62	1.53	1.87	115.4	140.6	181,545	62.0	5,213	12.2	
9 Annual legumes cut for hay.....	Tons...	1.31	1.18	1.36	103.8	115.3	21,620	72.6	285,166	77.4	26.7
10 Small grains cut for hay.....	Tons...	1.28	1.20	1.39	108.6	115.8	339,740	48.8			
11 Wild, salt, or prairie grasses.....	Tons...	0.93	0.92	1.04	111.8	113.0	15,344	14.0	18,459	16.4	14.0
12 Silage crops.....	Tons...	5.92	4.22	6.41	108.3	151.9	343,235	84.1			
13 Corn cut for forage.....	Tons...	1.65	1.23	2.43	147.3	197.6	82,071	52.0	( <sup>5</sup> )		
14 Kafir, sorghum, etc., for forage.....	Tons...	1.52	1.25	1.89	124.3	151.2	347,745	52.6	( <sup>5</sup> )		
<b>Vegetables:</b>											
15 Cantaloupes and muskmelons.....							428,855	92.1			
16 Watermelons.....							80,501	73.4			
17 Potatoes.....	Bu.....	69.6	91.7	37.0	53.2	40.8	93,428	21.4	74,885	76.0	24.8
<b>Miscellaneous:</b>											
18 Clover and alfalfa seed <sup>3</sup> .....	Bu.....	6.5	5.1	6.7	103.1	131.4	592,053	90.0	156,343	99.8	278.7
19 Dry beans.....	Bu.....	8.7	8.9	7.6	87.4	85.4	46,417	12.0	14,712	32.7	215.5
20 Cotton.....	Bales	0.66	0.54	0.66	100.0	103.7	19,176,213	95.3			
<b>Fruits:</b>											
21 Grapes.....	Lbs.....	* 8.1	* 7.7	* 9.9	122.2	128.6	8,381	20.9	( <sup>6</sup> )		
22 Apples.....	Bu.....	* 1.7	* 1.7	* 1.8	105.9	105.9	131,143	45.2	( <sup>6</sup> )		
23 Peaches.....	Bu.....	* 1.4	* 1.3	* 1.5	107.1	115.4	127,352	36.1	( <sup>6</sup> )		
24 Oranges.....	Boxes...	* 1.7	* 2.1	* 1.5	88.2	71.4	195,056	61.2	( <sup>6</sup> )		

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1909.  
<sup>3</sup> Not including red clover seed.  
<sup>4</sup> Number of vines of bearing age.

<sup>5</sup> Number of trees of bearing age.  
<sup>6</sup> Yield per vine.  
<sup>7</sup> Yield per tree.

IRRIGATION—ARIZONA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	THE STATE.	Apache.	Cochise.	Cocconino.	Gila.	Graham. <sup>1</sup>	Greenlee. <sup>1</sup>
1	Number of all farms in 1920.....	9,975	337	1,251	362	289	262
2	Number of farms irrigated in 1919.....	6,605	191	507	50	117	199
3	Per cent of all farms.....	66.2	53.7	40.5	13.8	40.5	61.3
4	Number of farms irrigated in 1909.....	4,841	184	293	38	251	765
5	Per cent of increase, 1909-1919.....	38.4	-1.6	73.0		-53.4	
<b>LAND AND FARM AREA.</b>							
6	Approximate land area.....acres..	72,838,400	7,282,580	3,948,800	11,918,720	3,007,360	2,963,200
7	All land in farms.....acres..	5,802,128	717,898	998,242	164,669	35,752	165,691
8	Improved land in farms.....acres..	712,803	27,452	120,229	19,827	8,909	38,632
9	Area irrigated in 1919.....acres..	487,565	12,070	12,982	1,479	1,797	32,400
10	Per cent of improved land in farms.....	65.6	44.0	10.8	7.5	20.2	83.9
11	Area irrigated in 1909.....acres..	320,051	8,853	4,900	901	2,778	38,824
12	Per cent of increase, 1909-1919.....	48.1	38.3	184.9	64.2	-35.3	
13	Area enterprises were capable of irrigating in 1920.....acres..	627,303	16,159	19,130	1,902	2,379	24,355
14	Area enterprises were capable of irrigating in 1910.....acres..	387,655	9,330	6,488	1,183	3,272	41,223
15	Per cent of increase, 1910-1920.....	61.8	73.2	194.9	60.8	-37.3	
16	Area included in enterprises in 1920.....acres..	813,153	27,571	33,999	2,040	7,012	41,938
17	Area included in enterprises in 1910.....acres..	944,090	34,807	14,141	3,223	4,233	52,143
18	Per cent of increase, 1910-1920.....	-13.9	-20.8	140.4	-36.7	65.7	
19	Area of irrigated land reported as available for settlement.....acres..	24,341		2,100			3,407
<b>IRRIGATION WORKS.</b>							
<b>Independent enterprises:</b>							
20	Number, 1920.....	1,338	39	328	21	83	100
21	Number, 1910.....	1,269	64	244	20	117	190
<b>Main ditches:</b>							
22	Number, 1920.....	1,295	55	303	26	83	96
23	Number, 1910.....	891	67	71	20	102	124
24	Length, 1920.....miles.....	1,769	97	266	24	93	190
25	Length, 1910.....miles.....	1,727	112	94	17	90	216
26	Capacity, 1920.....second-feet.....	11,707	249	837	49	162	883
27	Capacity, 1910.....second-feet.....	17,200	577	349	49	453	1,075
<b>Laterals:</b>							
28	Number, 1920.....	1,174	24	124	20	3	208
29	Number, 1910.....	313	46	3	25	11	10
30	Length, 1920.....miles.....	1,599	27	23	11	2	181
31	Length, 1910.....miles.....	870	40	2	20	5	14
<b>Reservoirs:</b>							
32	Number, 1920.....	340	36	165	4	2	56
33	Number, 1910.....	402	32	170	11	3	73
34	Capacity, 1920.....acre-feet.....	1,510,856	45,614	86,017	13	1	1,471
35	Capacity, 1910.....acre-feet.....	1,349,938	39,456	68	5,428	1	2,950
<b>Flowing wells:</b>							
36	Number, 1920.....	310		204			95
37	Number, 1910.....	214		90			117
38	Capacity, 1920.....gallons per minute.....	14,547		9,643			4,054
39	Capacity, 1910.....gallons per minute.....	9,953		2,959			6,799
<b>Pumped wells:</b>							
40	Number, 1920.....	999	2	255		18	4
41	Number, 1910.....	470	4	194		10	9
42	Capacity, 1920.....gallons per minute.....	1,042,590	1,000	90,531		5,930	1,880
43	Capacity, 1910.....gallons per minute.....	765,921	65	27,185		2,858	4,002
<b>Pumping plants:</b>							
44	Number, 1920.....	744	1	241	2	19	10
45	Number, 1910.....	428	4	194		11	19
46	Engine capacity, 1920.....horsepower.....	22,014	15	2,909	50	146	104
47	Engine capacity, 1910.....horsepower.....	37,258	7	4,336		43	1,248
48	Pump capacity, 1920.....gallons per minute.....	1,048,030	1,000	94,556	30	5,900	11,030
49	Pump capacity, 1910.....gallons per minute.....	851,873	65	27,185		3,908	8,517
50	Average lift, 1920.....feet.....	44	30	43	22	24	18
<b>CAPITAL INVESTED.</b>							
51	Capital invested to Jan. 1, 1920.....dollars..	33,498,064	275,010	611,833	72,317	59,749	945,403
52	Capital invested to July 1, 1910.....dollars..	17,677,966	234,838	513,333	42,266	38,667	335,971
53	Per cent of increase, 1910-1920.....	89.5	17.1	19.2	71.1	54.5	
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	53.40	17.02	31.09	33.02	25.12	27.52
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	45.60	25.17	79.12	35.73	11.82	8.15
<b>ESTIMATED FINAL COST.</b>							
56	Estimated final cost of existing enterprises in 1920.....dollars..	34,615,064	283,240	635,248	72,317	60,749	995,803
57	Estimated final cost of existing enterprises in 1910.....dollars..	24,828,868	384,838	513,333	42,266	38,667	346,721
58	Per cent of increase, 1910-1920.....	39.4	-26.4	23.7	71.1	57.1	
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	42.57	10.27	18.68	35.45	8.66	23.74
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	28.30	11.06	36.30	13.11	9.13	6.65

<sup>1</sup>Part of Graham County taken to form Greenlee County in 1911.

IRRIGATION—ARIZONA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1920; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.]

	Maricopa.	Mohave.	Navajo.	Pima.	Pinal.	Santa Cruz.	Yavapai.	Yuma.
1 Number of all farms in 1920.....	3,930	130	341	434	293	248	598	630
2 Number of farms irrigated in 1919.....	3,384	59	183	228	213	63	329	559
3 Per cent of all farms.....	86.1	45.4	53.7	52.5	72.7	25.4	55.0	88.7
4 Number of farms irrigated in 1920.....	1,726	44	181	188	570	75	297	229
5 Per cent of increase, 1909-1919.....	96.1	.....	1.1	21.3	-62.6	.....	10.8	144.1
<b>LAND AND FARM AREA.</b>								
6 Approximate land area.....acres..	5,680,240	8,569,600	6,335,360	6,083,200	3,443,200	786,560	5,216,000	6,391,680
7 All land in farms.....acres..	302,396	31,022	1,213,629	413,278	152,643	150,593	874,490	57,440
8 Improved land in farms.....acres..	279,334	6,817	23,753	35,795	41,876	24,929	86,811	40,959
9 Area irrigated in 1919.....acres..	282,130	2,342	5,832	16,883	28,647	2,908	11,566	49,855
10 Per cent of improved land in farms.....	101.0	37.1	24.6	47.2	68.4	10.5	31.4	121.7
11 Area irrigated in 1920.....acres..	199,052	1,688	6,458	10,160	25,431	4,773	8,571	7,662
12 Per cent of increase, 1909-1919.....	41.7	38.7	-9.7	68.2	12.6	-45.4	34.9	550.7
13 Area enterprises were capable of irrigating in 1920.....acres..	394,599	2,672	6,596	25,443	34,706	3,413	13,332	64,481
14 Area enterprises were capable of irrigating in 1910.....acres..	236,061	8,726	8,276	11,876	31,100	4,895	9,538	15,687
15 Per cent of increase, 1910-1920.....	67.2	-69.4	-20.3	114.2	11.6	-30.3	40.3	311.0
16 Area included in enterprises in 1920.....acres..	406,967	3,395	11,956	40,978	65,799	7,162	17,108	128,940
17 Area included in enterprises in 1910.....acres..	455,361	40,624	24,997	24,484	89,400	6,372	16,588	177,217
18 Per cent of increase, 1910-1920.....	-10.0	-61.6	-52.2	67.4	-26.4	4.2	3.1	-27.2
19 Area of irrigated land reported as available for settlement.....acres..	5,930	.....	.....	5,134	7,720	.....	.....	.....
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20 Number, 1920.....	105	63	18	125	167	19	224	27
21 Number, 1910.....	88	57	17	110	77	66	196	23
Main ditches:								
22 Number, 1920.....	85	58	28	107	175	20	169	18
23 Number, 1910.....	64	57	28	53	67	45	176	17
24 Length, 1920.....miles..	305	34	59	129	229	28	159	86
25 Length, 1910.....miles..	433	61	87	70	179	64	211	93
26 Capacity, 1920.....second-feet..	6,371	46	94	449	940	102	492	801
27 Capacity, 1910.....second-feet..	7,468	336	98	698	2,363	170	762	2,622
Laterals:								
28 Number, 1920.....	352	14	14	134	16	.....	66	199
29 Number, 1910.....	29	46	50	9	35	12	24	12
30 Length, 1920.....miles..	1,019	2	14	61	15	.....	11	233
31 Length, 1910.....miles..	525	7	49	4	57	12	9	135
Reservoirs:								
32 Number, 1920.....	5	5	8	18	9	6	23	1
33 Number, 1910.....	17	9	11	27	5	10	31	3
34 Capacity, 1920.....acre-feet..	1,367,305	338	2,410	360	57	51	7,209	10
35 Capacity, 1910.....acre-feet..	1,284,013	3,124	3,428	135	9,961	135	1,235	4
Flowing wells:								
36 Number, 1920.....	.....	.....	2	6	1	.....	2	.....
37 Number, 1910.....	.....	.....	1	.....	.....	.....	6	.....
38 Capacity, 1920.....gallons per minute..	.....	.....	.....	850	500	.....	.....	.....
39 Capacity, 1910.....gallons per minute..	.....	.....	20	.....	.....	.....	175	.....
Pumped wells:								
40 Number, 1920.....	238	11	1	248	136	16	25	30
41 Number, 1910.....	95	3	1	68	25	21	25	15
42 Capacity, 1920.....gallons per minute..	288,339	1,515	.....	456,766	149,099	15,600	5,460	23,345
43 Capacity, 1910.....gallons per minute..	617,790	2,170	700	38,829	48,875	17,242	3,047	3,156
Pumping plants:								
44 Number, 1920.....	95	11	1	136	124	14	36	33
45 Number, 1910.....	55	6	2	62	21	20	21	14
46 Engine capacity, 1920.....horsepower..	7,945	90	.....	3,990	4,940	343	191	1,165
47 Engine capacity, 1910.....horsepower..	26,781	112	25	769	779	345	70	2,743
48 Pump capacity, 1920.....gallons per minute..	243,334	1,790	.....	408,581	149,924	15,200	6,005	102,945
49 Pump capacity, 1910.....gallons per minute..	617,790	10,224	2,020	39,243	48,875	17,242	4,071	73,733
50 Average lift, 1920.....feet..	72	20	.....	38	48	25	37	29
<b>CAPITAL INVESTED.</b>								
51 Capital invested to Jan. 1, 1920.....dollars..	17,491,021	86,612	246,783	4,549,400	891,345	116,050	823,638	7,553,725
52 Capital invested to July 1, 1910.....dollars..	10,759,817	85,948	258,803	427,077	631,934	58,051	219,770	4,071,491
53 Per cent of increase, 1910-1920.....	62.6	0.8	-4.6	965.2	41.1	99.9	138.3	85.5
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	44.33	32.41	37.41	178.81	25.68	34.00	39.13	117.15
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	45.53	9.35	31.27	35.96	20.32	11.86	23.04	259.55
<b>ESTIMATED FINAL COST.</b>								
56 Estimated final cost of existing enterprises in 1920.....dollars..	17,517,921	88,112	264,283	4,595,575	893,345	119,050	655,888	8,355,775
57 Estimated final cost of existing enterprises in 1910.....dollars..	13,418,557	320,248	299,915	427,077	631,934	58,051	224,770	8,122,491
58 Per cent of increase, 1910-1920.....	30.5	-72.5	-11.9	976.1	41.4	105.1	191.8	2.9
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	42.73	25.95	22.10	112.15	13.68	16.62	38.34	64.80
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	29.47	7.88	12.00	17.44	7.07	8.45	13.55	45.83

# ARKANSAS.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Arkansas collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

Rice is the only crop grown under irrigation in Arkansas, with the exception of a few small tracts in other crops, and practically all the rice grown in the state is irrigated. The area harvested in 1919 is reported as 143,211 acres, the quantity of rough rice produced 6,797,126 bushels, and the value \$18,352,240.

TABLE I.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	232,604	214,678	17,926	8.4
Approximate land area of the state.....acres..	33,616,000	33,616,000	—	—
All land in farms.....acres..	17,456,750	17,416,075	40,675	0.2
Improved land in farms.....acres..	9,210,556	8,076,254	1,134,302	14.0
Number of farms irrigated.....	1,166	232	934	402.6
Area irrigated.....acres..	143,946	27,753	116,193	418.7
Area enterprises were capable of irrigating.....acres..	179,013	47,136	131,877	279.8
Area included in enterprises.....acres..	246,480	52,883	193,597	366.1
Per cent irrigated:				
Number of all farms.....	0.5	0.1	0.4	—
Approximate land area of the state.....	0.4	0.1	0.3	—
Land in farms.....	0.8	0.2	0.6	—
Improved land in farms.....	1.6	0.9	1.3	—
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	95,067	19,989	15,684	80.9
Excess of area included in enterprises over area irrigated.....acres..	102,534	25,130	77,404	308.0
Capital invested.....	\$7,183,322	\$587,834	\$6,595,488	—
Average per acre enterprises were capable of irrigating.....	\$40.13	\$12.47	\$27.66	221.8
Estimated final cost of existing enterprises.....	\$7,283,522	\$612,834	\$6,670,688	—
Average per acre included in enterprises.....	\$29.55	\$11.59	\$17.96	155.0
Average cost of operation and maintenance per acre.....	\$13.67	( <sup>2</sup> )	—	—
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	944	310	634	204.5
Number of main ditches.....	84	217	-133	-61.3
Length of main ditches.....miles..	68	131	-63	-48.1
Capacity of main ditches.....second-feet..	1,205	( <sup>3</sup> )	1,205	—
Number of lateral ditches.....	50	( <sup>3</sup> )	50	—
Length of lateral ditches.....miles..	18	( <sup>3</sup> )	18	—
Number of reservoirs.....	16	19	-3	-15.8
Capacity of reservoirs.....acre-feet..	20	3	17	566.7
Number of flowing wells.....	( <sup>3</sup> )	( <sup>3</sup> )	—	—
Capacity of flowing wells.....gallons per minute..	( <sup>3</sup> )	( <sup>3</sup> )	—	—
Number of pumped wells.....	1,089	307	782	254.7
Capacity of pumped wells.....gallons per minute..	1,470,147	268,829	1,201,318	446.9
Number of pumping plants.....	1,041	315	726	230.5
Engine capacity.....horsepower..	58,332	12,440	45,892	368.9
Pump capacity.....gallons per minute..	1,654,097	436,402	1,217,695	279.0
Average lift.....feet..	50	( <sup>3</sup> )	50	—

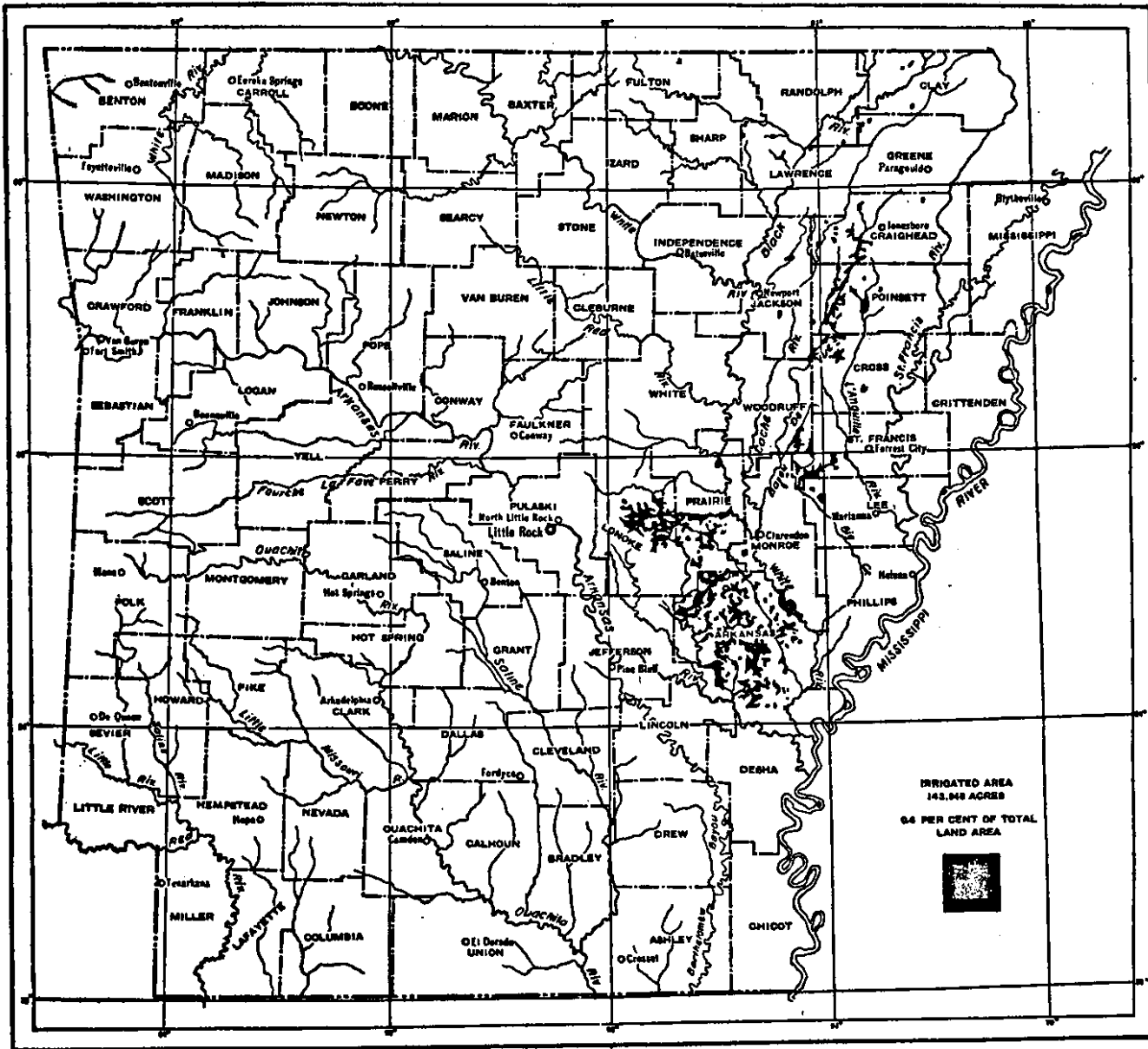
<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Not reported in 1910.

<sup>3</sup> Not reported in 1920.

# ARKANSAS

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.





**CLIMATIC CONDITIONS.**

The rainfall in Arkansas is sufficient for the growing of general crops without irrigation, the annual average being about 47 inches.

The rainfall for the year 1919 was about 7 inches above the normal, and rice was damaged to some extent by rain during harvest.

**WATER SUPPLY FOR IRRIGATION.**

Arkansas is abundantly supplied with streams, but about 94 per cent of the rice is watered from wells, from which the water is pumped. The average lift is about 50 feet, and there seems to be sufficient water for all the land that the farmers care to irrigate.

**FARMS AND ACREAGE IRRIGATED.**

**TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.**

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of increase. <sup>1</sup>	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	1,166	402.6	0.5	143,946	418.7	0.4	0.3	1.6
1910.....	232		0.1	27,753		0.1	0.2	0.3
1900.....	20		(?)	25		(?)	(?)	(?)
1890.....				9		(?)	(?)	(?)

<sup>1</sup> Per cent not shown when base is less than 100.  
<sup>2</sup> Less than one-tenth of 1 per cent.

**TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.**

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	944	246,480	143,946	58.4	179,013
1890-1899.....	3	2,400	1,640	68.3	1,640
1900-1904.....	2	700	470	67.1	650
1905-1909.....	68	19,230	11,840	61.6	14,304
1910-1914.....	335	62,862	49,100	52.9	61,227
1915-1919.....	447	105,369	64,474	60.9	79,108
Not reported.....	89	26,419	16,422	64.6	22,164

**TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.**

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	143,946	27,753	116,193	418.7	179,013	246,480
Streams, gravity.....	120	2,542	-2,422	-95.3	220	220
Streams, pumped.....	6,009	543	5,466		6,555	6,825
Wells, pumped.....	135,260	24,398	110,862	454.4	168,548	235,620
Lakes, pumped.....	450	270	180	66.7	950	950
Stored storm water.....	40	(?)	40		55	55
Streams, gravity, and pumped wells.....	250	(?)	250		300	300
Other mixed.....	1,817	(?)	1,817		2,355	2,510

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not included in classification in 1910.

**ACREAGE, BY CHARACTER OF ENTERPRISE.**

The state of Arkansas has no legislation regarding the organization of enterprises for supplying water for irrigation, and, as shown by Table 5, almost the entire area irrigated is supplied with water by individual or partnership enterprises. With a very few exceptions, each rice grower has his own well and pumping plant.

Neither the Federal Carey Act (act of Aug. 18, 1894) nor the Federal reclamation act (act of June 17, 1902) applies to this state.

The acreage irrigated in 1909 was not reported in this way, but in that year, as in 1919, the irrigated land was practically all supplied with water from private wells.

**TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.**

ITEM.	Total acreage.	CHARACTER OF ENTERPRISE.		
		Individual and partnership.	Cooperative.	Commercial.
Acreage irrigated.....	143,946	140,471	1,075	2,400
Acreage enterprises were capable of irrigating.....	179,013	175,338	1,275	2,400
Acreage included in enterprises.....	246,480	242,330	1,600	2,600

**ACREAGE, BY DRAINAGE BASIN.**

In Table 6 the acreage figures are presented by the drainage basins in which the land lies. The figures for Arkansas have not been presented in this form in the report of any previous census, consequently no comparisons can be made. The rice-growing industry in Arkansas has been developed since 1902, when a special census was taken, for which the results were presented by drainage basins.

**TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919.**

DRAINAGE BASIN.	Area irrigated in 1919 (acres).	Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
Total.....	143,946	246,480	179,013
Red River.....	500	500	500
Ouachita River.....	42	140	105
White River.....	74,918	131,346	95,709
Arkansas River.....	63,521	100,296	76,779
St. Francis River.....	4,965	14,198	5,920

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 7.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1910 AND 1920.**

CENSUS YEAR.	Amount.	AVERAGE PER ACRE.	
		Amount.	Per cent of increase.
1920.....	\$7,183,322	\$40.13	221.8
1910.....	587,834	12.47	

TABLE 8.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$7, 183, 322	100. 0	\$40. 13
1890-1899.....	93, 111	1. 3	56. 78
1900-1904.....	25, 026	0. 3	45. 50
1905-1909.....	459, 542	6. 4	32. 13
1910-1914.....	2, 276, 584	31. 7	37. 18
1915-1919.....	3, 302, 492	46. 0	41. 75
Not reported.....	1, 026, 597	14. 3	43. 28

TABLE 9.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$7, 183, 322	100. 0	\$40. 13	99, 255	\$13. 67
Streams, gravity.....	3, 874	0. 1	17. 61	.....	.....
Streams, pumped.....	96, 450	1. 3	14. 65	3, 309	7. 06
Wells, pumped.....	7, 028, 773	97. 8	41. 70	93, 471	14. 06
Lakes, pumped.....	9, 500	0. 1	10. 00	450	11. 78
Stored storm water.....	1, 500	(*)	27. 27	40	10. 00
Streams, gravity, and pumped wells.....	8, 500	0. 1	28. 33	170	30. 15
Other mixed.....	34, 725	0. 5	14. 75	1, 815	4. 16

<sup>1</sup> Based on area irrigated in 1919.    \* Less than one-tenth of 1 per cent.

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$7, 183, 322	100. 0	99, 255	\$13. 67
Individual and partnership.....	7, 073, 297	98. 5	99, 255	13. 67
Cooperative.....	80, 013	0. 8	.....	.....
Commercial.....	50, 012	0. 7	.....	.....

<sup>1</sup> Based on area irrigated in 1919.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	1920
Total.....	\$7, 183, 322
Red River.....	20, 008
Ouachita River.....	1, 100
White River.....	3, 992, 967
Arkansas River.....	2, 950, 523
St. Francis River.....	218, 727

## DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 12 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 12.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	134
Acreage included in enterprises reporting land drained or needing drainage.....	37, 574
Acreage for which drains have been installed.....	27, 350
Additional acreage needing drainage.....	2, 821
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	72. 8
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	11. 1
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	12. 2

## QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. None of the water used in 1919 was measured, and quantities are probably taken from the rated capacities of the pumps and the time the pumps were operated. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 13.—QUANTITY OF WATER USED IN 1919.

Average volume of water entering canals.....	second-feet..	550
Area irrigated in 1919.....	acres..	12, 685
Average number of acres per second-foot.....	.....	23
Total quantity of water entering canals.....	acre-feet..	50, 859
Area irrigated in 1919.....	acres..	12, 720
Average quantity per acre.....	acre-feet..	4. 0
Total quantity of water delivered.....	acre-feet..	13, 089
Area irrigated in 1919.....	acres..	5, 189
Average quantity per acre.....	acre-feet..	2. 5

IRRIGATION—ARKANSAS.

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IRRIGATION WORKS.

TABLE 14.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPED WELLS.		PUMPING PLANTS.			
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).		Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
Total.....	63	17	84	1,205	68	50	18	16	20	0.4	1,089	1,470,147	1,041	58,332	1,121	1,654,097
1890-1899.....											8	9,400	7	460	8	6,400
1900-1904.....											3	4,200	3	185	8	4,200
1905-1909.....	1	1	9	67	15	1	2				80	106,050	79	4,547	80	144,450
1910-1914.....	18	4	37	210	29	20	10	6			389	499,100	371	20,036	398	591,200
1915-1919.....	49	12	35	916	21	29	6	6		0.4	459	633,655	462	26,744	476	692,005
Not reported.....			2	12	3			1	20		150	217,742	119	6,360	156	215,842

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPED WELLS.		PUMPING PLANTS.			
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).		Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
Total.....	63	17	84	1,205	68	50	18	16	20	0.4	1,089	1,470,147	1,041	58,332	1,121	1,654,097
Individual and partnership.....	63	17	82	1,160	59	50	18	16	20	0.4	1,081	1,455,647	1,031	57,502	1,111	1,620,097
Cooperative.....											8	14,500	8	530	8	14,000
Commercial.....			2	45	9								2	300	2	20,000

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPED WELLS.		PUMPING PLANTS.				
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).		Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).	Average lift (feet).
Total.....	63	17	84	1,205	68	50	18	16	20	0.4	1,089	1,470,147	1,041	58,332	1,121	1,654,097	50
Red River.....											3	1,200	1		3	2,500	35
Ouachita River.....	1		1							0.4							
White River.....	62	14	53	1,067	49	40	11	5			626	820,388	584	30,537	633	858,688	50
Arkansas River.....		3	24	136	19	10	7	11	20		404	575,509	404	25,572	421	714,459	53
St. Francis River.....			1	2							56	73,060	52	2,223	64	78,450	31

IRRIGATION—ARKANSAS.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	THE STATE.	Arkansas.	Clay. <sup>1</sup>	Craighead.	Cross.	Jackson. <sup>1</sup>	Lawrence. <sup>1</sup>	
1	Number of all farms in 1920.....	232,604	2,121	3,335	3,549	2,507	3,227	2,759
2	Number of farms reporting irrigation for rice growing in 1919.....	1,168	609	4	26	40	2	11
3	Per cent of all farms.....	0.5	28.7	0.1	0.7	1.6	0.1	0.4
4	Number of farms reporting irrigation for rice growing in 1909.....	232	102		(*)	(*)		
5	Per cent of increase, 1909-1919.....	402.6	497.1					
<b>LAND AND FARM AREA.</b>								
6	Approximate land area.....acres.	33,616,000	640,000	418,560	439,680	306,160	405,760	378,880
7	All land in farms.....acres.	17,456,750	282,097	215,298	204,899	144,134	221,310	220,054
8	Improved land in farms.....acres.	9,210,658	195,910	156,989	141,469	82,629	129,382	126,953
9	Area irrigated for rice growing in 1919.....acres.	143,948	76,511	345	3,190	3,410	810	889
10	Per cent of improved land in farms.....	1.6	39.1	0.2	2.3	4.1	0.6	0.7
11	Area irrigated for rice growing in 1909.....acres.	27,753	13,250		100	60		
12	Per cent of increase, 1909-1919.....	418.7	477.4					
13	Area enterprises were capable of irrigating in 1920.....acres.	179,013	89,548	905	5,047	4,655	875	2,145
14	Area enterprises were capable of irrigating in 1910.....acres.	47,136	20,240		200	120		
15	Per cent of increase, 1910-1920.....	279.8	342.4					
16	Area included in enterprises in 1920.....acres.	246,480	117,822	1,040	6,869	11,830	900	3,725
17	Area included in enterprises in 1910.....acres.	52,883	22,485		260	120		
18	Per cent of increase, 1910-1920.....	366.1	424.0					
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
19	Number, 1920.....	944	454	4	44	35	2	13
20	Number, 1910.....	310	127		2	1		
<b>Main ditches:</b>								
21	Number, 1920.....	84	17	5	12		1	17
22	Number, 1910.....	217	170		2			
23	Length, 1920.....miles.	69	22	7	6		1	11
24	Length, 1910.....miles.	131	73		2			
25	Capacity, 1920.....second-feet.	1,205	166	15	820		5	89
26	Capacity, 1910.....second-feet.							
<b>Laterals:</b>								
27	Number, 1920.....	50	4					35
28	Number, 1910.....							
29	Length, 1920.....miles.	18	4					9
30	Length, 1910.....miles.							
<b>Reservoirs:</b>								
31	Number, 1920.....	16						2
32	Number, 1910.....	19	7		1			
33	Capacity, 1920.....acre-feet.	20						
34	Capacity, 1910.....acre-feet.	3			1			
<b>Pumped wells:</b>								
35	Number, 1920.....	1,089	496	4	63	41	3	13
36	Number, 1910.....	307	119		2	1		
37	Capacity, 1920.....gallons per minute.	1,470,147	573,524	9,700	66,000	63,650	8,250	26,000
38	Capacity, 1910.....gallons per minute.	268,829	22,835		13,500	1,200		
<b>Pumping plants:</b>								
39	Number, 1920.....	1,041	497	4	51	36	3	13
40	Number, 1910.....	315	128		2	1		
41	Engine capacity, 1920.....horsepower.	58,332	29,299	180	1,987	2,013	220	425
42	Engine capacity, 1910.....horsepower.	12,440	5,288		50	49		
43	Pump capacity, 1920.....gallons per minute.	1,654,097	749,974	9,000	67,500	61,350	5,250	25,200
44	Pump capacity, 1910.....gallons per minute.	436,402	173,305		13,500	1,200		
45	Average lift, 1920.....feet.	50	61	20	30	27	42	20
<b>CAPITAL INVESTED.</b>								
46	Capital invested to Jan 1, 1920.....dollars.	7,183,322	3,492,391	47,414	140,375	174,628	43,000	47,950
47	Capital invested to July 1, 1910.....dollars.	587,834	90,219		5,950	1,500		
48	Per cent of increase, 1910-1920.....							
49	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars.	40.13	39.00	52.39	27.81	37.51	49.14	22.35
50	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars.	12.47	4.46		29.75	12.50		
<b>ESTIMATED FINAL COST.</b>								
51	Estimated final cost of existing enterprises in 1920.....dollars.	7,283,522	3,584,791	47,414	140,375	174,628	43,000	48,450
52	Estimated final cost of existing enterprises in 1910.....dollars.	612,834	115,219		5,950	1,500		
53	Per cent of increase, 1910-1920.....							
54	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars.	29.55	30.26	45.59	20.44	14.76	47.78	13.01
55	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars.	11.59	5.12		22.88	12.50		

<sup>1</sup> No irrigation reported in 1909.

<sup>2</sup> Not shown in report for 1910.

## IRRIGATION—ARKANSAS.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

		Lonoke.	Monroe. <sup>1</sup>	Poinsett.	Prairie.	St. Francis.	Woodruff.	Other counties.
1	Number of all farms in 1920.....	5,596	3,305	2,257	2,413	4,586	2,853	194,096
2	Number of farms reporting irrigation for rice growing in 1919.....	166	3	77	165	26	18	19
3	Per cent of all farms.....	3.0	0.1	3.4	6.8	0.6	0.6	(*)
4	Number of farms reporting irrigation for rice growing in 1909.....	58		16	35	9	5	7
5	Per cent of increase, 1909-1919.....							
<b>LAND AND FARM AREA.</b>								
6	Approximate land area..... acres.....	516,480	335,920	461,440	423,680	401,920	369,280	23,378,240
7	All land in farms..... acres.....	320,088	160,029	127,124	238,994	190,175	163,305	14,979,243
8	Improved land in farms..... acres.....	217,981	101,215	78,191	153,830	133,540	104,386	7,588,191
9	Area irrigated for rice growing in 1919..... acres.....	24,941	1,135	10,310	10,225	6,840	3,838	1,602
10	Per cent of improved land in farms.....	11.4	1.1	13.2	6.6	5.1	3.7	(*)
11	Area irrigated for rice growing in 1909..... acres.....	7,223		978	3,587	1,450	725	380
12	Per cent of increase, 1909-1919.....	245.3		954.2	185.1	371.7	429.4	295.3
13	Area enterprises were capable of irrigating in 1920..... acres.....	30,788	1,565	12,850	13,216	9,355	5,245	2,321
14	Area enterprises were capable of irrigating in 1910..... acres.....	12,651		1,975	6,045	2,720	1,230	1,955
15	Per cent of increase, 1910-1920.....	143.4		550.6	118.6	243.9	328.4	44.3
16	Area included in enterprises in 1920..... acres.....	34,502	2,733	26,578	16,900	10,490	9,915	3,176
17	Area included in enterprises in 1910..... acres.....	14,335		2,920	6,253	2,865	1,340	2,305
18	Per cent of increase, 1910-1920.....	140.7		810.2	170.3	266.1	639.9	57.8
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
19	Number, 1920.....	145	6	107	70	28	30	6
20	Number, 1910.....	88		23	37	14	11	7
<b>Main ditches:</b>								
21	Number, 1920.....	24	2	2		1		3
22	Number, 1910.....	19		4	10	5	4	3
23	Length, 1920..... miles.....	16				3		2
24	Length, 1910..... miles.....	13		20	5	9	3	6
25	Capacity, 1920..... second-feet.....	81	8	5		12		4
26	Capacity, 1910..... second-feet.....							
<b>Laterals:</b>								
27	Number, 1920.....	9	2					
28	Number, 1910.....							
29	Length, 1920..... miles.....	5						
30	Length, 1910..... miles.....							
<b>Reservoirs:</b>								
31	Number, 1920.....	14						
32	Number, 1910.....	8		2				1
33	Capacity, 1920..... acre-feet.....	20						
34	Capacity, 1910..... acre-feet.....	2						
<b>Pumped wells:</b>								
35	Number, 1920.....	149	8	128	79	58	38	9
36	Number, 1910.....	91		24	39	15	12	4
37	Capacity, 1920..... gallons per minute.....	272,850	11,400	198,600	92,415	104,358	59,200	14,200
38	Capacity, 1910..... gallons per minute.....	121,745		19,467	44,077	21,365	14,640	10,000
<b>Pumping plants:</b>								
39	Number, 1920.....	152	7	117	77	46	31	7
40	Number, 1910.....	90		24	38	13	12	7
41	Engine capacity, 1920..... horsepower.....	9,745	330	4,697	4,431	3,175	1,445	385
42	Engine capacity, 1910..... horsepower.....	3,530		561	1,504	615	342	500
43	Pump capacity, 1920..... gallons per minute.....	279,150	11,400	173,850	99,165	98,358	59,900	16,000
44	Pump capacity, 1910..... gallons per minute.....	128,685		21,160	46,977	21,365	14,640	15,570
45	Average lift, 1920..... feet.....	43	73	33	59	33	45	23
<b>CAPITAL INVESTED.</b>								
46	Capital invested to Jan. 1, 1920..... dollars.....	1,272,693	76,674	404,158	787,375	425,414	192,550	78,800
47	Capital invested to July 1, 1910..... dollars.....	230,714		31,600	128,682	51,552	22,715	24,902
48	Per cent of increase, 1910-1920.....	451.6			511.8	725.2	747.7	216.4
49	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars.....	41.34	48.99	31.45	59.57	45.47	36.71	27.93
50	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars.....	18.24		16.00	21.29	18.95	18.47	12.74
<b>ESTIMATED FINAL COST.</b>								
51	Estimated final cost of existing enterprises in 1920..... dollars.....	1,297,493	76,674	404,158	789,375	425,414	192,550	79,309
52	Estimated final cost of existing enterprises in 1910..... dollars.....	230,714		31,600	128,682	51,552	22,715	24,902
53	Per cent of increase, 1910-1920.....	482.4			518.4	725.2	747.7	218.4
54	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....	37.61	28.05	15.21	48.70	40.55	19.42	24.97
55	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....	16.09		10.82	20.58	17.99	18.95	10.80

<sup>1</sup> No irrigation reported in 1909.

\* Less than one-tenth of 1 per cent.

# CALIFORNIA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of California collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	117, 670	88, 197	29, 473	33. 4
Approximate land area of the state.....acres..	99, 617, 280	99, 617, 280		
All land in farms.....acres..	29, 365, 667	27, 931, 444	1, 434, 223	5. 1
Improved land in farms.....acres..	11, 876, 339	11, 389, 894	488, 445	4. 3
Number of farms irrigated.....	67, 391	39, 352	28, 039	71. 3
Area irrigated.....acres..	4, 219, 040	2, 664, 104	1, 554, 936	58. 4
Area enterprises were capable of irrigating.....acres..	5, 894, 466	3, 619, 378	2, 275, 088	62. 9
Area included in enterprises.....acres..	7, 805, 207	5, 490, 360	2, 314, 847	42. 2
Per cent irrigated:				
Number of all farms.....	57. 3	44. 6	12. 7	
Approximate land area of the state.....	4. 2	2. 7	1. 5	
Land in farms.....	14. 4	9. 5	4. 9	
Improved land in farms.....	35. 5	23. 4	12. 1	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	1, 675, 426	955, 274	720, 152	75. 4
Excess of area included in enterprises over area irrigated.....acres..	3, 586, 167	2, 826, 256	759, 911	26. 9
Area of irrigated land reported as available for settlement.....acres..	533, 981	( <sup>2</sup> )		
Capital invested.....	\$194, 886, 388	\$72, 580, 030	\$122, 306, 358	168. 5
Average per acre enterprises were capable of irrigating.....	\$33. 06	\$20. 05	\$13. 01	64. 9
Estimated final cost of existing enterprises.....	\$225, 799, 123	\$84, 392, 344	\$141, 406, 779	167. 6
Average per acre included in enterprises.....	\$28. 93	\$15. 37	\$13. 56	88. 2
Average cost of operation and maintenance per acre.....	\$4. 40	\$1. 54	\$2. 86	185. 7
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	24, 115	13, 970	10, 145	72. 6
Number of main ditches.....	6, 040	8, 590	-2, 550	-29. 7
Length of main ditches.....miles..	14, 437	12, 620	1, 817	14. 4
Capacity of main ditches.....second-feet..	115, 237	89, 597	25, 640	28. 6
Number of lateral ditches.....	9, 190	6, 143	3, 047	49. 6
Length of lateral ditches.....miles..	12, 947	8, 509	4, 438	52. 2
Number of reservoirs.....	3, 030	1, 583	1, 447	91. 4
Capacity of reservoirs.....acre-feet..	1, 091, 394	743, 269	348, 125	46. 8
Number of flowing wells.....	1, 415	2, 361	-946	-40. 1
Capacity of flowing wells.....gallons per minute..	287, 187	477, 343	-190, 156	-39. 8
Number of pumped wells.....	25, 401	10, 724	14, 677	136. 9
Capacity of pumped wells.....gallons per minute..	10, 608, 476	4, 119, 575	6, 488, 901	157. 5
Number of pumping plants.....	21, 561	9, 297	12, 264	131. 9
Engine capacity.....horsepower..	386, 200	128, 143	258, 057	201. 4
Pump capacity.....gallons per minute..	16, 773, 692	5, 276, 298	11, 497, 394	217. 9
Average lift.....feet..	41	( <sup>2</sup> )	41	

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not reported in 1910.





**CLIMATIC CONDITIONS.**

In California both the amount and the seasonal distribution of precipitation have an important influence on the necessity for irrigation. The state has a very wide range in amount of precipitation, the average annual amount reaching about 60 inches in the northwestern part of the state and only 2 or 3 inches in the southeastern part. Throughout the state there is a well-defined wet season during the winter months and an almost entire absence of rainfall in the summer months. The latter condition makes irrigation necessary for the growing of summer crops in some sections where the total precipitation would be sufficient if more evenly distributed throughout the year, while the concentration of the year's precipitation in a short period makes it possible to grow some crops, particularly grain, without irrigation where it would not be possible if the rainfall were distributed through the year.

That part of the state lying north of San Francisco Bay, except a part of the Sacramento Valley, receives more than 20 inches of precipitation annually, and crops are grown both with and without irrigation, while the part of the state south of San Francisco Bay, except in the high mountains, receives less than 20 inches, and irrigation is generally practiced, although some crops are grown without it.

In Sacramento Valley the average annual precipitation is between 15 and 20 inches, but practically all of this occurs in the winter. Grain crops are generally grown without irrigation, and alfalfa, rice, and orchards are irrigated.

In San Joaquin Valley the average annual precipitation is from 5 to 14 inches, and here most crops except grain are generally irrigated; while there are large areas of irrigated grain.

In the southeastern part of the state desert conditions are found, the average annual precipitation being from 2 to 5 inches, and no crops can be grown without irrigation.

Along the coast of southern California the precipitation is from 15 to 20 inches, and crops are quite generally grown both with and without irrigation.

In the Sierra Nevada Mountains the snowfall in the winter is very heavy, and this maintains a good summer flow in most of the streams.

The summer of 1919 was one of the driest on record and in some sections, especially in the San Joaquin Valley, this occasioned a shortage of water for irrigation.

**WATER SUPPLY FOR IRRIGATION.**

In northern California, except the Sacramento Valley, the supply of water available for irrigation is limited, and the area irrigated is small.

In the Sacramento Valley water is taken from the Sacramento and its tributaries, and while there is a

shortage at times there is a very large supply of flood water available for storage.

In the San Joaquin Valley, where the larger part of the irrigated land of the state is located, the water supply comes principally from San Joaquin River and its tributaries from the east which rise in the high Sierras. These rivers carry large volumes of water during the rainy season and in the early summer when the snow in the mountains is melting, but have a low discharge in the summer, so that there is usually a shortage of water in this season. While some storage has been provided, there is opportunity for much more, and efforts are being made to have the owners of existing enterprises combine to build reservoirs and coordinate their canal systems in such a way as to save the flood waters and make the largest use of them. Natural overflow and seepage from irrigation have brought the ground water near the surface in many places, and during recent years many wells have been sunk and water is pumped from them to supplement the supply from streams when they are low. There is opportunity for a large extension of irrigation from this source as well as from the storage of flood waters. In 1919 the water supply in this section was unusually short, and much land usually irrigated was not watered.

In the coast region of southern California there are many short streams rising in the coast range and discharging into the Pacific. In some sections there is little opportunity for storage, and a large part of the water goes unused. In this section, as well as in other parts of the state, there are many wells, both flowing and pumped. The heavy draft on the underground supplies has lowered the ground water to such an extent that many wells that once flowed are now pumped, and the lift in pumped wells has greatly increased. This condition is being remedied to some extent by spreading the flood waters over the gravelly lands where the streams emerge from the mountains, so that some of the water will find its way into the underground supply rather than waste down the stream channels.

Similar work is proposed for the Coachella Valley, in southeastern California, where small areas are watered from wells.

Imperial Valley is supplied from Colorado River. Although the water supply in the river is usually sufficient there is sometimes difficulty in getting the water from the river into the canal because of silting. Plans for storage and for relocating the canal are under discussion. A large area of land in this valley is available for cultivation and a large quantity of water is available for storage. There are other opportunities in California to use water from Colorado River, where it forms the boundary between California and Arizona, and some land has been irrigated. Here, as in the Imperial Valley, the water supply is ample if storage is provided for the surplus flood waters.

Colorado River extends into or borders seven states, and there are conflicting claims as to the use of its waters that are delaying the construction of reservoirs. Attempts are being made to settle these conflicts through a compact between the states. Such a compact has been authorized by Congress.

**FARMS AND ACREAGE IRRIGATED.**

**TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.**

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Num-ber.	Per cent of in-crease.	Per cent of all farms.	Acres.	Per cent of in-crease.	Per cent of total land area.	Per cent of land in farms.	Per cent of im-proved land in farms.
1920.....	67,391	71.3	57.3	4,219,040	58.4	4.2	14.4	35.5
1910.....	39,352	53.3	44.6	2,664,104	84.2	2.7	9.5	23.4
1900.....	25,675	87.0	35.4	1,446,114	44.0	1.5	5.0	12.1
1890.....	18,722	.....	26.6	1,004,233	.....	1.0	4.7	8.2

**TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.**

DATE OF BEGINNING.	Num-ber of enter-prises.	Area included in enter-prises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enter-prises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acre-age in enter-prises.	
Total.....	24,115	7,865,207	4,219,040	54.1	5,894,466
Before 1880.....	258	219,261	108,200	49.3	134,969
1880-1889.....	338	152,858	88,485	57.9	116,015
1870-1879.....	519	1,967,946	1,039,852	53.0	1,573,635
1820-1830.....	641	573,569	347,685	60.6	392,478
1830-1839.....	788	757,611	404,123	53.3	625,592
1900-1904.....	1,105	628,448	456,261	72.6	558,366
1905-1909.....	1,854	498,171	290,085	58.2	359,151
1910-1914.....	6,762	1,356,230	649,875	47.9	928,067
1915-1919.....	7,573	1,220,876	541,500	44.4	849,319
Not reported.....	4,377	435,237	292,963	67.3	356,874

**TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.**

CLASS.	AREA IRRIGATED (ACRES).				Area enter-prises were capable of irrigating in 1920 (acres).	Area included in enter-prises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	4,219,040	2,664,104	1,554,936	58.4	5,894,466	7,805,207
Streams, gravity.....	2,564,445	2,216,757	347,688	15.7	3,627,280	4,499,148
Streams, pumped.....	295,673	29,965	265,708	89.7	490,926	664,287
Streams, pumped and gravity.....	60,278	( <sup>2</sup> )	60,278	.....	62,913	84,768
Wells, pumped.....	826,845	276,595	550,251	198.9	1,068,239	1,488,213
Wells, flowing.....	17,653	74,128	-56,475	-76.2	21,826	34,739
Wells, flowing and pumped.....	23,561	( <sup>2</sup> )	23,561	.....	27,318	57,788
Lakes, gravity.....	48,084	18,896	29,188	202.5	48,321	159,827
Lakes, pumped.....	4,168	3,574	1,594	61.9	4,429	14,067
Springs.....	27,698	31,779	-4,081	-12.8	36,285	56,227
Stored storm water.....	20,351	16,410	3,941	24.0	20,681	38,546
City water.....	515	( <sup>2</sup> )	515	.....	577	887
Sewage.....	1,385	( <sup>2</sup> )	1,385	.....	1,368	2,189
Streams, gravity, and pumped wells.....	87,897	( <sup>2</sup> )	87,897	.....	99,377	127,651
Streams, gravity, and flowing wells.....	4,255	( <sup>2</sup> )	4,255	.....	5,114	5,686
Other mixed.....	228,424	( <sup>2</sup> )	228,424	.....	371,033	580,364
Other and not reported	7,807	( <sup>2</sup> )	7,807	.....	9,549	10,820

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1909.

**ACREAGE, BY CHARACTER OF ENTERPRISE.**

California was the first state to enact an irrigation district law containing the provision for issuing bonds that are a lien on the lands within the districts. The so-called "Wright Act," containing this provision, was enacted in 1887, and has served as a basis for practically all irrigation district legislation in the United States. Many districts were organized under this act, only a few of which, however, have survived to the present time.

Prior to the enactment of the Wright Act there were some districts created by special act, and there was a special law providing for the organization of districts, without the bonding power, in Los Angeles County.

The Wright Act was amended and reenacted in 1897, the new law being known as the "Bridgeford Act." This law has been amended in various particulars by almost every legislature since its passage, but is still in force.

In 1915 there was enacted a law creating a State Irrigation Board, which was empowered to organize "water districts" under state supervision, rather than county supervision, as was done under the older laws, but this law has been declared unconstitutional by the state supreme court.

Many irrigation districts in California have been organized to build irrigation works, and some have taken over works built by other agencies. The lands in the Imperial Valley have been organized into an irrigation district, which controls the diversion works and the main canal, while mutual companies control the distributing canals. This land is reported under "Cooperative" in Table 5.

California accepted the conditions of the Federal Carey Act (act of Aug. 18, 1894) in 1915, providing for a "Carey Act Commission" and for the organization of "state irrigation districts" to reclaim Carey Act lands. However, no land is reported as irrigated under this law.

In 1917 California enacted a "land settlement" law, providing for the building of irrigation works and other improvements, including dwellings, etc., by the state, and the sale of the farms created on long-time and easy terms to settlers. Only one enterprise had advanced far enough to be reported in the Fourteenth Census, and this appears under "State" in Table 5. Other projects have been begun.

Most of the cooperative enterprises reported in Table 5 are mutual water companies supplying water to members only.

Commercial companies in California are subject to control by the state railroad commission as to rates charged and conditions of service.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	4,219,040	2,664,104	1,554,936	58.4
Individual and partnership.....	1,502,870	961,136	541,734	56.4
Cooperative.....	1,215,696	779,020	436,676	56.1
Irrigation district.....	577,168	173,793	403,375	232.1
Commercial.....	878,499	746,265	127,234	17.0
U. S. Reclamation Service.....	26,622	400	26,222	.....
U. S. Indian Service.....	697	3,490	-2,793	-80.0
State.....	2,936	( <sup>2</sup> )	2,936	.....
City.....	6,213	( <sup>2</sup> )	6,213	.....
Other.....	3,064	( <sup>2</sup> )	3,064	.....
Not reported.....	276	( <sup>2</sup> )	276	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	5,894,466	3,619,378	2,275,088	62.9
Individual and partnership.....	1,919,663	1,131,951	787,712	69.6
Cooperative.....	1,705,647	984,570	721,077	73.2
Irrigation district.....	899,786	294,108	605,677	205.9
Commercial.....	1,307,968	1,204,059	103,909	8.6
U. S. Reclamation Service.....	42,805	1,200	41,605	.....
U. S. Indian Service.....	936	3,490	-2,554	-71.7
State.....	4,210	( <sup>2</sup> )	4,210	.....
City.....	9,073	( <sup>2</sup> )	9,073	.....
Other.....	4,054	( <sup>2</sup> )	4,054	.....
Not reported.....	276	( <sup>2</sup> )	276	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	7,805,207	5,490,360	2,314,847	42.2
Individual and partnership.....	2,698,798	1,512,511	1,186,287	78.4
Cooperative.....	2,148,711	1,388,435	760,276	54.8
Irrigation district.....	1,101,220	606,351	494,869	81.6
Commercial.....	1,778,135	1,985,063	-186,928	-9.5
U. S. Reclamation Service.....	47,669	14,200	33,469	235.7
U. S. Indian Service.....	5,252	3,800	1,452	38.2
State.....	6,259	( <sup>2</sup> )	6,259	.....
City.....	10,645	( <sup>2</sup> )	10,645	.....
Other.....	8,168	( <sup>2</sup> )	8,168	.....
Not reported.....	350	( <sup>2</sup> )	350	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of California relating to water rights are summarized in the following paragraphs:

In 1850 California adopted the common law of England, but without specific mention of water rights.

The first legislation in California relating to water rights was the act of 1872. This act provided that rights to water "flowing in a river or stream or down a canyon or ravine may be acquired by appropriation in the manner provided by law"; that the appropriation must be for some useful or beneficial purpose; that as between appropriators the "first in time is the first in right"; and that the appropriator must post a notice at the point of intended diversion and file a copy in the county records. This law was in effect until 1913.

The constitution of the state, adopted in 1879, contained the following section relating to water rights: "The use of all waters now appropriated, or that may hereafter be appropriated, for sale, rental, or distribution is hereby declared to be a public use, and subject to the regulation and control of the state, in the manner to be prescribed by law." (Art. XIV.)

While the constitution and laws provide for rights being acquired by appropriation, the courts of the state have recognized riparian rights under the law of 1850 referred to above. (Lux v. Haggins, 69 Cal., 255.)

In 1913 California adopted a new system of public control of the use of water and attempted to eliminate the conflict between riparian rights and right by appropriation by providing that owners of riparian lands must put water to use in order to retain their rights. The section of the law relating to this point is as follows: "Section 11. All water or the use of water which has never been appropriated, or which has been heretofore appropriated and which has not been in process, from the date of the initial act of appropriation, of being put,

with due diligence in proportion to the magnitude of the work necessary properly to utilize for the purpose of such appropriation such water or the use of water, or which has not been put, or which has ceased to be put to some useful or beneficial purpose, or which may hereafter be appropriated and cease to be put, to the useful or beneficial purpose for which it was appropriated, or which in the future may be appropriated and not be, in the process of being put, from the date of the initial act of the appropriation, to the useful or beneficial purpose for which it was appropriated, with due diligence in proportion to the magnitude of the work necessary properly to utilize for the purpose of such appropriation, such water or the use of water, is hereby declared to be unappropriated. And all waters flowing in any river, stream, canyon, ravine, or other natural channel, excepting so far as such waters have been or are being applied to useful and beneficial purpose upon, or in so far as such waters are or may be reasonably needed for useful, and beneficial purposes upon lands riparian thereto, or otherwise appropriated, is and are hereby declared to be public waters of the state of California and subject to appropriation in accordance with the provisions of the act. If any portion of the waters of any stream shall not be put to a useful or beneficial purpose to or upon lands riparian to such stream for any continuous period of 10 consecutive years after the passage of this act, such non-application shall be deemed to be conclusive presumption that the use of such portions of the waters of such stream is not needed upon said riparian lands for any useful or beneficial purpose; and such portion of the waters of any stream so nonapplied, unless otherwise appropriated for a useful or beneficial purpose, is hereby declared to be in the use of the state and subject to appropriation in accordance with the provisions of this act."

The new law created a water commission, and provided that parties wishing to take water should apply to the water commission for permission to do so, and that the commission should issue licenses on completion of the works in accordance with the permits.

The law of 1913 provided also for the preparation by the commission of findings regarding rights to water, which were to be filed with the courts and were to serve as bases for adjudications of water rights. This part of the law was amended in 1917, changing the procedure and providing that the findings of the commission shall be filed with the courts, and shall be issued as decrees by the courts, after hearings and such changes as the courts may make. After a decree is rendered the commission is to issue to each claimant a certificate setting forth his rights as determined by the court.

An act of 1917 provided that after three years' nonuse of water for the purpose for which it was appropriated or adjudicated "such unused water shall revert to the public and shall be regarded as unappropriated public water."

The portion of the law of 1913 relating to the acquiring of rights is in operation, but the commission is delaying any action for adjudication of rights until the expiration of 10 years from the passage of the act, when rights attaching to riparian lands but not utilized will have expired under the terms of the act.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	4,219,040	100.0	100.0
Appropriation and use.....	479,361	11.4	47.3
Notice filed and posted.....	704,608	16.7	16.6
Adjudicated by court.....	922,157	23.3	28.0
Permit from state.....	80,484	1.9	( <sup>1</sup> )
Certificate or license from state.....	25,484	0.6	( <sup>1</sup> )
Riparian rights.....	240,512	5.7	8.2
Underground.....	863,613	20.5	( <sup>2</sup> )
Other and mixed.....	396,703	9.4	( <sup>2</sup> )
Not reported.....	446,118	10.6	( <sup>2</sup> )

<sup>1</sup> No provision for permits or licenses from state in 1909.

<sup>2</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase.		
Total.....	4,219,040	1,708,720	148.9	7,805,207	5,894,466
Colorado River.....	447,384	10,000	.....	631,015	494,976
Independent streams, northern California.....	139,961	125,779	11.2	259,836	193,255
Carson River.....	4,459	4,663	-4.8	7,027	4,819
Long Valley Creek.....	12,543	4,060	208.9	18,840	15,951
Mono Lake and tributaries.....	4,190	3,818	9.7	70,377	45,760
Susan River.....	31,784	23,533	35.1	86,225	33,313
Walker River.....	39,261	52,975	-25.9	42,295	40,355
Other independent streams.....	47,624	* 36,710	29.7	84,572	53,057
Independent streams, southern California.....	200,818	59,358	238.3	346,831	257,988
Mohave River.....	4,608	540	753.3	21,523	6,510
Owens River.....	144,024	51,902	177.5	200,147	182,748
San Joaquin River.....	20,889	5,040	314.1	34,974	22,263
Whitewater River.....	14,643	( <sup>1</sup> )	.....	37,604	22,282
Other independent streams.....	16,674	* 1,876	788.8	52,583	24,185
Pacific Ocean streams north of San Francisco Bay.....	66,001	56,272	17.3	146,070	85,098
Klamath River.....	62,538	52,709	18.6	122,853	70,275
Russian River.....	3,045	314	869.7	12,475	4,200
Other Pacific Ocean streams north of San Francisco Bay.....	421	* 3,249	-87.0	10,742	10,628
Pacific Ocean streams south of San Francisco Bay.....	543,385	379,519	94.4	831,490	662,847
Pajaro River.....	19,771	14,157	39.7	33,620	25,769
Salinas River.....	48,097	10,604	353.6	60,989	57,456
Santa Maria River.....	9,623	1,544	523.3	22,903	20,460
Santa Ynez River.....	3,491	1,493	133.8	10,082	9,645
Santa Clara River.....	28,270	14,214	98.9	43,205	30,216
Los Angeles River.....	59,072	5,310	.....	82,657	73,606
San Gabriel River.....	127,146	33,766	276.6	161,737	145,022
Santa Ana River.....	185,508	70,492	163.2	281,630	218,735
San Diego River.....	8,812	5,130	71.8	14,039	10,789
Other Pacific Ocean streams south of San Francisco Bay.....	53,595	* 122,809	-56.4	120,628	71,149
Sacramento River and tributaries.....	640,950	206,312	210.7	1,204,769	864,605
Sacramento River direct.....	194,397	10,942	.....	439,189	296,748
Pit River.....	89,984	72,072	24.9	129,984	107,478
Cow Creek.....	6,068	2,321	161.4	12,488	7,446
Cottonwood Creek.....	2,972	1,858	60.0	21,016	4,112
Battle Creek.....	2,960	2,642	12.3	6,590	5,108
Stony Creek.....	23,559	4,110	473.2	45,143	36,191
Feather River.....	142,841	67,111	112.8	186,756	167,463
Yuba River.....	19,473	( <sup>1</sup> )	.....	69,074	23,492
Cache Creek.....	24,541	3,756	553.4	56,498	21,212
American River.....	47,150	10,112	366.3	82,965	52,842
Other tributaries of Sacramento River.....	86,993	* 81,388	177.2	155,356	132,513

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.      <sup>3</sup> Not reported separately in 1902.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902—Continued.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase.		
San Joaquin River and tributaries.....	2,103,694	932,931	125.5	4,294,966	3,248,919
San Joaquin River direct.....	842,261	129,647	395.4	1,083,862	873,300
Kern River.....	200,641	116,189	72.7	432,431	299,685
Tulare Lake.....	70,134	( <sup>2</sup> )	.....	204,660	147,444
Tule River.....	61,223	( <sup>2</sup> )	.....	175,777	109,412
Kaweah River.....	149,932	( <sup>2</sup> )	.....	356,703	299,474
Kings River.....	552,601	596,091	-7.3	1,052,406	895,263
Fresno River.....	12,414	10,729	15.7	30,004	14,016
Merced River.....	65,151	19,636	231.8	222,715	71,709
Tuolumne River.....	165,533	( <sup>2</sup> )	.....	298,418	250,425
Stanislaus River.....	75,359	13,840	444.5	155,453	111,192
Calaveras River.....	13,323	( <sup>2</sup> )	.....	21,598	16,489
Mokelumne River.....	86,848	5,558	563.0	155,430	72,144
Cosumnes River.....	3,259	( <sup>2</sup> )	.....	9,011	6,406
Other tributaries of San Joaquin River.....	55,015	* 41,241	33.4	96,198	81,981
Tributaries of San Francisco Bay, other than Sacramento and San Joaquin Rivers.....	76,947	38,549	99.6	100,730	86,770
Coyote Creek.....	25,092	8,483	195.8	30,979	26,526
Guadalupe River.....	29,248	6,547	346.7	34,549	31,008
Other tributaries of San Francisco Bay.....	22,607	* 23,519	-3.9	35,202	29,245

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not reported separately in 1902.  
<sup>3</sup> Includes springs and wells.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Percent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$194,886,388	168.5	\$33.06	64.9
1910.....	72,580,030	278.4	20.05	51.1
1900.....	19,181,610	47.5	13.27	2.5
1890.....	13,004,817	.....	12.95	.....

TABLE 9.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$194,886,388	100.0	\$33.06	3,714,361	\$4.40
Streams, gravity.....	78,139,147	40.1	21.54	2,275,082	2.06
Streams, pumped.....	16,267,561	8.3	33.83	267,826	5.10
Streams, pumped and gravity.....	3,094,038	1.6	49.02	60,137	1.93
Wells, pumped.....	54,057,185	27.7	50.80	724,593	10.40
Wells, flowing.....	807,353	0.4	36.99	4,341	5.91
Wells, flowing and pumped.....	1,776,156	0.9	65.02	20,426	7.63
Lakes, pumped.....	90,081	( <sup>2</sup> )	20.34	3,733	1.66
Lakes, gravity.....	674,320	0.3	13.96	41,962	0.39
Springs.....	1,298,308	0.7	35.78	21,635	2.21
Stored storm water.....	6,593,659	3.4	222.15	18,963	4.25
City water.....	61,055	( <sup>2</sup> )	69.62	58	24.05
Sewage.....	59,959	( <sup>2</sup> )	42.89	1,286	11.26
Streams, gravity, and pumped wells.....	10,001,650	5.1	100.74	67,770	15.62
Streams, gravity, and flowing wells.....	1,264,530	0.6	247.27	1,860	23.96
Other mixed.....	19,906,271	10.2	53.65	196,856	5.36
Other and not reported.....	805,115	0.4	84.31	7,744	16.12

<sup>1</sup> Based on area irrigated in 1919.      <sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 10.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$194,886,388	100.0	\$33.06
Before 1860.....	6,802,109	3.5	50.40
1860-1869.....	2,689,616	1.3	22.32
1870-1879.....	16,475,201	8.5	10.47
1880-1889.....	19,046,449	9.8	48.53
1890-1899.....	31,330,191	16.1	50.08
1900-1904.....	19,106,308	9.8	34.22
1905-1909.....	15,252,978	7.8	42.47
1910-1914.....	41,765,878	21.4	45.00
1915-1919.....	32,996,398	16.9	38.85
Not reported.....	9,521,261	4.9	26.68

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$194,886,388	\$23,772,157	\$171,114,231	719.8
Colorado River.....	14,838,041	500,000	14,338,041	.....
Independent streams, northern California.....	6,257,200	629,548	5,627,652	898.9
Carson River.....	40,385	22,939	17,446	76.1
Long Valley Creek.....	171,642	16,345	155,297	950.1
Mono Lake and tributaries.....	5,863,858	15,200	5,848,658	.....
Susan River.....	242,426	203,205	39,221	19.3
Walker River.....	87,575	196,445	-158,870	-80.9
Other independent streams.....	401,814	* 175,414	225,900	128.8
Independent streams, southern California.....	12,493,213	1,354,970	11,138,243	.....
Mohave River.....	618,769	114,800	501,969	437.3
Owens River.....	5,785,132	408,875	5,376,257	.....
San Jacinto River.....	2,139,257	775,000	1,364,257	176.0
Whitewater River.....	2,242,944	(*)	2,242,944	.....
Other independent streams.....	1,709,111	* 56,265	1,652,846	.....
Pacific Ocean streams north of San Francisco Bay.....	2,378,513	304,952	2,073,561	690.0
Klamath River.....	1,690,958	281,896	1,409,062	499.9
Russian River.....	162,630	2,463	160,167	.....
Other Pacific Ocean streams north of San Francisco Bay.....	524,925	* 20,593	504,332	.....
Pacific Ocean streams south of San Francisco Bay.....	53,456,601	9,509,767	43,946,834	462.1
Pajaro River.....	1,248,343	168,593	1,079,750	640.4
Salinas River.....	2,670,331	101,960	2,468,371	.....
Santa Maria River.....	573,194	32,380	540,814	.....
Santa Ynez River.....	284,037	33,745	250,292	741.7
Santa Clara River.....	2,211,473	374,161	1,837,312	491.1
Los Angeles River.....	5,508,400	309,611	5,198,789	.....
San Gabriel River.....	12,862,319	772,597	12,089,722	.....
Santa Ana River.....	19,918,550	1,919,531	17,999,019	937.7
San Diego River.....	1,789,124	32,100	1,757,024	.....
Other Pacific Ocean streams south of San Francisco Bay.....	6,490,830	* 5,765,099	725,731	12.6
Sacramento River and tributaries.....	28,833,106	1,882,227	26,950,879	.....
Sacramento River direct.....	11,830,874	49,368	11,781,506	.....
Pit River.....	799,913	274,671	525,242	191.2
Cow Creek.....	126,946	15,246	111,700	732.7
Cottonwood Creek.....	673,601	124,473	549,128	360.8
Battle Creek.....	95,139	34,706	60,433	173.4
Stony Creek.....	1,539,614	42,250	1,497,364	.....
Feather River.....	3,937,360	869,841	3,067,519	352.7
Yuba River.....	2,518,770	(*)	2,518,770	.....
Cacho Creek.....	916,477	28,115	888,362	.....
American River.....	2,890,114	112,753	2,777,366	.....
Other tributaries of Sacramento River.....	3,604,778	* 330,709	3,274,069	990.0
San Joaquin River and tributaries.....	71,694,653	9,103,242	62,591,411	637.6
San Joaquin River direct.....	9,224,164	1,504,233	7,719,931	513.2
Kern River.....	17,573,637	796,340	16,777,297	.....
Tulare Lake.....	3,910,620	(*)	3,910,620	.....
Tule River.....	2,842,495	(*)	2,842,495	.....
Kaweah River.....	6,186,840	(*)	6,186,840	.....
Kings River.....	8,145,446	2,976,638	5,168,808	173.6
Fresno River.....	415,385	400,514	14,871	3.7
Merced River.....	3,812,235	1,542,834	2,269,401	147.1
Tuolumne River.....	7,173,802	(*)	7,173,802	.....
Stanislaus River.....	7,840,436	963,964	6,876,472	709.2
Calaveras River.....	818,995	(*)	818,995	.....
Mokelumne River.....	1,675,137	305,239	1,369,898	448.6
Cosumnes River.....	153,899	(*)	153,899	.....
Other tributaries of San Joaquin River.....	1,921,512	* 608,425	1,313,087	215.8
Tributaries of San Francisco Bay, other than Sacramento and San Joaquin Rivers.....	4,940,061	457,451	4,482,610	913.4
Coyote Creek.....	1,453,138	43,345	1,409,793	.....
Guadalupe River.....	1,833,049	75,795	1,757,254	.....
Other tributaries of San Francisco Bay.....	1,608,874	* 368,311	1,240,563	335.5

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells. \* Not reported separately in 1902.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$194,886,388	100.0	3,714,361	\$4.40
Individual and partnership.....	57,616,716	29.6	1,185,770	6.28
Cooperative.....	48,899,448	25.1	1,074,361	4.46
Irrigation district.....	33,985,301	17.4	566,654	2.42
Commercial.....	44,996,723	23.1	854,574	2.39
U. S. Reclamation Service.....	2,398,220	1.2	25,300	1.56
U. S. Indian Service.....	55,556	(*)	423	4.96
State.....	224,909	0.1	191	17.54
City.....	1,401,320	0.7	4,026	19.52
Other.....	5,277,490	2.7	3,062	6.14
Not reported.....	30,705	(*)	.....	.....

<sup>1</sup> Based on area irrigated in 1919. \* Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	545
Acreage included in enterprises reporting land drained or needing drainage.....	1,623,330
Acreage for which drains have been installed.....	319,573
Additional acreage needing drainage.....	409,933
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	19.7
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	4.1
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	9.8

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-foot.....	29,110	18,190	15,920
Area irrigated in 1919..... acres.....	1,611,038	1,137,205	373,833
Average number of acres per second-foot.....	53	66	23
Total quantity of water entering canals, acre-foot.....	14,793,933	10,581,929	4,212,004
Area irrigated in 1919..... acres.....	2,167,485	1,785,976	381,509
Average quantity per acre..... acre-foot.....	6.8	5.9	11.0
Total quantity of water delivered..... acre-foot.....	3,400,367	1,627,316	1,782,051
Area irrigated in 1919..... acres.....	1,438,699	751,327	687,372
Average quantity per acre..... acre-foot.....	2.4	2.2	2.6

IRRIGATION—CALIFORNIA.

IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2,070	455	6,040	115,237	14,437	9,190	12,947	3,030	1,091,394
Before 1860.....	187	63	839	4,672	2,263	438	730	98	108,552
1860-1869.....	189	23	434	4,103	935	224	136	19	3,635
1870-1879.....	209	20	667	23,774	2,432	1,524	2,855	60	77,015
1880-1889.....	313	62	627	14,073	1,258	437	500	142	107,142
1890-1899.....	296	42	561	14,618	1,538	1,247	1,399	159	110,318
1900-1904.....	100	36	334	17,730	792	504	2,160	163	175,719
1905-1909.....	110	40	321	6,201	438	510	873	236	91,012
1910-1914.....	161	61	1,052	10,404	2,468	1,708	2,490	750	207,616
1915-1919.....	144	75	1,011	11,314	1,170	1,781	1,625	897	202,442
Not reported.....	261	83	694	8,343	1,093	817	179	506	7,943

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	6,885.9	1,415	287,187	25,401	10,608,476	21,561	386,200	24,134	16,773,692
Before 1860.....	61.3	9	1,227	17	8,668	18	311	23	11,813
1860-1869.....	14.3	36	3,926	20	32,959	22	257	22	35,219
1870-1879.....	234.1	48	22,126	58	41,461	53	1,523	62	46,063
1880-1889.....	711.3	107	15,268	257	115,851	202	11,387	301	804,228
1890-1899.....	521.0	120	16,240	744	261,613	468	11,455	578	348,468
1900-1904.....	333.7	183	29,239	1,339	526,339	1,014	20,273	1,153	651,768
1905-1909.....	743.7	128	20,409	2,448	1,064,097	1,885	34,876	2,156	1,251,035
1910-1914.....	2,019.2	261	65,565	8,539	3,608,435	7,180	128,041	8,038	4,688,351
1915-1919.....	1,848.4	180	60,518	8,410	2,605,797	7,568	138,609	8,375	6,808,125
Not reported.....	398.9	343	52,729	3,569	1,343,256	3,151	39,468	3,426	2,148,622

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2,070	455	6,040	115,237	14,437	9,190	12,947	3,030	1,091,394
Individual and partnership.....	1,787	333	5,343	34,298	7,116	4,351	2,641	2,655	549,335
Cooperative.....	153	32	399	32,698	2,547	1,699	3,252	191	57,226
Irrigation district.....	29	18	104	19,426	1,006	1,309	3,381	31	163,000
Commercial.....	91	62	168	26,687	3,659	1,753	8,495	137	245,750
U. S. Reclamation Service.....	4	1	5	787	65	31	155	1	51,000
U. S. Indian Service.....	5	1	10	1,108	17	85	15	2	.....
State.....	1	4	2	38	16	.....	.....	7	293
City.....	.....	2	.....	.....	.....	2	1	11	30
Other.....	.....	3	9	195	11	10	7	5	34,700

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	6,885.9	1,415	287,187	25,401	10,608,476	21,561	386,200	24,134	16,773,692
Individual and partnership.....	3,757.4	1,290	225,709	24,131	9,790,608	20,821	311,505	22,822	14,038,640
Cooperative.....	1,782.3	50	83,964	922	571,860	579	60,990	938	1,438,994
Irrigation district.....	620.0	2	.....	97	83,270	36	13,416	161	513,160
Commercial.....	693.4	56	25,885	185	126,700	94	8,615	153	741,375
U. S. Reclamation Service.....	.....	1	.....	1	400	3	263	4	3,250
U. S. Indian Service.....	12.5	15	1,539	17	2,563	4	120	13	2,548
State.....	11.9	.....	.....	18	3,708	7	161	9	4,860
City.....	20.8	.....	.....	29	26,644	13	1,090	27	28,245
Other.....	1.6	2	100	6	2,720	4	40	6	2,620

IRRIGATION—CALIFORNIA.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total.....</b>	<b>2,070</b>	<b>455</b>	<b>6,040</b>	<b>115,237</b>	<b>14,437</b>	<b>9,190</b>	<b>12,947</b>	<b>3,030</b>	<b>1,091,394</b>
Colorado River.....	8	1	47	6,577	498	494	1,990		
Independent streams, northern California.....	215	22	574	5,145	868	396	172	54	116,574
Carson River.....	15	1	18	52	20	14	1	2	4
Long Valley Creek.....	59	2	102	585	131	90	44	6	857
Mono Lake and tributaries.....	4	2	21	525	26	11	3	3	34,700
Susan River.....	92	3	82	1,861	215	114	45	15	63,949
Walker River.....	7		64	925	161	3	5	5	19,000
Other independent streams.....	87	9	287	1,197	815	164	69	23	7,064
Independent streams, southern California.....	32	18	381	8,724	446	410	988	284	132,308
Mohave River.....	2		21	189	23	9	4	18	27
Owens River.....	6	4	53	1,598	138	5	4	20	26,006
San Jacinto River.....	7	11	32	261	50	28	14	94	106,688
Whitewater River.....	3		12	57	47	15	2	41	60
Other independent streams.....	14	3	263	6,629	188	353	904	111	537
Pacific Ocean streams north of San Francisco Bay.....	469	88	971	5,850	1,083	823	479	84	95,351
Klamath River.....	448	23	925	5,716	1,068	284	113	70	95,064
Russian River.....	9	10	18	23	8	25	864	10	142
Other Pacific Ocean streams north of San Francisco Bay.....	12	5	28	111	17	14	2	4	155
Pacific Ocean streams south of San Francisco Bay.....	197	82	716	9,418	928	1,281	419	925	68,969
Pajaro River.....	29	9	94	278	66	81	29	19	5,995
Salinas River.....	7	4	140	553	117	403	98	21	73
Santa Maria River.....	1	1	18	69	13	25	3	8	36
Santa Ynez River.....	9	8	18	227	10	10	4	16	2,502
Santa Clara River.....	15	3	38	191	49	56	30	30	2,741
Los Angeles River.....	11	3	79	266	81	191	78	164	4,950
San Gabriel River.....	18	1	54	3,940	89	61	47	129	7,168
Santa Ana River.....	39	12	123	2,066	302	139	34	139	3,514
San Diego River.....	4	2	11			5	4	63	18,904
Other Pacific Ocean streams south of San Francisco Bay.....	64	39	143	1,798	201	310	92	336	23,086
Sacramento River and tributaries.....	859	200	1,821	23,514	4,574	1,743	1,955	220	348,485
Sacramento River direct.....	6	3	192	5,803	585	559	693	24	285
Pit River.....	322	68	489	5,160	730	150	78	63	202,877
Cow Creek.....	40		64	367	118	30	23	1	
Cottonwood Creek.....	16	1	41	147	78	19	30	8	6,300
Battle Creek.....	26		71	358	114	17	4		
Stony Creek.....	44	5	63	1,590	81	22	130	4	51,001
Feather River.....	221	52	332	4,399	455	424	130	12	243
Yuba River.....	41	38	136	1,235	481	65	96	32	56,672
CACHE CREEK.....	6	3	20	1,197	87	30	115	4	181
American River.....	51	31	109	1,264	1,498	135	374	53	30,682
Other tributaries of Sacramento River.....	86	9	304	1,994	347	292	282	19	194
San Joaquin River and tributaries.....	269	85	1,452	55,628	5,995	4,394	6,904	1,419	329,522
San Joaquin River direct.....	23	2	176	11,431	1,237	1,203	2,103	120	1,937
Kern River.....	17	11	142	6,273	427	156	140	188	60,469
Tulare Lake.....	26		67	562	101	200	601	671	110,553
Tule River.....	44	2	115	2,465	426	209	155	118	523
Kaweah River.....	19	1	95	5,133	339	271	497	72	2,348
Kings River.....	27	5	128	17,194	822	465	981	67	6,116
Fresno River.....	5		7	314	5	6	107	19	263
Marced River.....	17		159	2,171	476	597	390	9	8,019
Tuolumne River.....	17	15	110	5,834	626	835	907	12	86,007
Stanislaus River.....	12	13	59	1,444	190	142	813	17	42,526
Calaveras River.....	22	6	139	1,224	80	33	12	25	17
Mokelumne River.....	31	25	136	1,568	1,024	62	153	33	678
Cosumnes River.....	6		13	103	55	2	15	2	
Other tributaries of San Joaquin River.....	3	2	126	882	111	213	130	66	10,066
Tributaries of San Francisco Bay, other than Sacramento and San Joaquin Rivers.....	26	9	78	381	45	149	40	44	235
Coyote Creek.....	6		6	24	5			3	1
Guadalupe River.....	8		12	271	21	4	20		
Other tributaries of San Francisco Bay.....	12	9	60	86	19	145	20	41	234



IRRIGATION—CALIFORNIA.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	6,885.9	1,415	287,187	25,401	10,608,476	21,561	388,200	24,134	16,773,692	41
Colorado River.....	0.4			1	900	2	73	2	2,000	42
Independent streams, northern California.....	8.6	75	6,647	30	13,144	27	552	28	28,414	35
Carson River.....	0.5									
Long Valley Creek.....	2.1			1	480	3	9	3	1,180	17
Susan River.....	2.0			1	75	4	34	4	3,460	23
Other independent streams.....	4.0	75	6,647	28	12,589	20	509	21	23,774	37
Independent streams, southern California.....	780.7	368	51,386	1,087	404,122	843	15,093	892	433,667	58
Mohave River.....	28.8	31	4,874	88	45,477	86	2,145	86	45,960	80
Owens River.....	368.5	23	537	9	4,088	12	137	12	4,558	24
San Jacinto River.....	145.0	9	115	236	66,833	183	3,546	203	76,386	73
Whitewater River.....	77.5	242	36,860	325	121,466	235	3,212	247	126,356	41
Other independent streams.....	120.9	68	9,000	429	166,258	327	6,053	344	180,407	57
Pacific Ocean streams north of San Francisco Bay..	82.4	4		107	35,194	186	3,858	190	168,168	22
Klamath River.....	19.1	3		14	4,375	43	2,695	47	111,709	18
Russian River.....	27.2	1		89	30,224	128	1,058	128	51,229	28
Other Pacific Ocean streams north of San Francisco Bay.....	0.1			4	585	15	105	15	5,215	17
Pacific Ocean streams south of San Francisco Bay..	4,041.4	713	164,294	7,068	3,064,724	5,203	129,331	6,071	3,694,090	57
Pajaro River.....	83.2	17	2,000	688	186,255	370	7,083	417	203,845	35
Salinas River.....	169.6	18	3,808	697	422,195	239	10,085	296	424,002	25
Santa Maria River.....	28.9	18	2,700	118	66,393	62	2,934	78	204,534	47
Santa Ynez River.....	28.7	7	1,510	60	16,401	61	1,611	84	199,630	30
Santa Clara River.....	154.0	1	700	136	92,049	125	5,126	161	102,184	67
Los Angeles River.....	528.2	45	24,963	849	443,036	745	16,298	825	458,932	52
San Gabriel River.....	832.9	160	28,363	1,034	557,934	825	25,675	951	579,153	72
Santa Ana River.....	924.5	360	62,693	1,816	1,002,743	1,523	45,345	1,836	1,048,090	61
San Diego River.....	145.2	1	8	533	54,216	319	2,313	374	65,462	56
Other Pacific Ocean streams south of San Francisco Bay.....	1,146.2	91	37,549	1,137	223,502	634	12,951	1,059	408,258	59
Sacramento River and tributaries.....	361.2	36	2,957	3,508	1,473,602	3,430	64,163	3,898	4,184,249	26
Sacramento River direct.....	61.2			514	279,456	655	28,625	807	2,616,658	24
Pit River.....	2.9	14	693	4	395	36	440	36	32,886	18
Cow Creek.....	0.4					11	87	11	8,955	14
Cottonwood Creek.....	0.6					9	100	10	7,585	33
Battle Creek.....	0.3			2	750	3	63	4	3,300	25
Stony Creek.....	17.5			68	40,451	61	759	66	45,959	25
Feather River.....	117.3	9	1,284	945	341,583	728	8,425	828	394,677	22
Yuba River.....	6.2	2	30	8	2,725	9	1,572	11	2,751	35
Catch Creek.....	0.4			144	91,211	75	1,524	76	92,391	24
American River.....	77.8			163	83,694	172	2,358	190	95,838	26
Other tributaries of Sacramento River.....	76.6	11	950	1,760	623,337	1,671	20,210	1,859	683,260	30
San Joaquin River and tributaries.....	1,396.6	145	48,828	11,149	4,911,280	9,973	136,911	10,951	7,400,131	34
San Joaquin River direct.....	184.8	49	15,155	1,531	668,420	1,481	30,086	1,639	1,295,475	25
Kern River.....	83.1	17	13,860	441	219,674	384	6,676	405	223,606	47
Tulare Lake.....	261.9	24	8,253	1,100	434,565	906	12,841	1,069	1,330,434	59
Tule River.....	162.7	2	251	1,146	493,272	974	11,329	1,083	995,319	45
Kaweah River.....	269.7	8	17	2,136	842,065	1,734	21,932	1,930	876,254	41
Kings River.....	239.3	34	10,000	2,547	1,183,710	2,283	25,426	2,397	1,225,007	23
Fresno River.....	6.3	1	200	145	79,255	134	1,520	144	82,738	33
Merced River.....	5.2	1	75	216	120,465	213	2,774	235	157,865	21
Tuolumne River.....	14.4	1	400	63	63,880	66	1,231	69	59,360	33
Stanislaus River.....	41.0			34	26,490	36	1,158	41	73,140	26
Calaveras River.....	29.4	6	220	565	189,181	544	4,358	585	200,337	26
Mokelumne River.....	82.2	2	25	709	356,156	694	8,309	765	451,434	33
Coquille River.....	5.5			117	50,870	111	1,788	131	84,740	28
Other tributaries of San Joaquin River.....	11.1	5	382	399	193,257	413	7,483	458	343,822	28
Tributaries of San Francisco Bay, other than Sacramento and San Joaquin Rivers.....	264.6	74	13,075	2,451	705,510	1,897	36,219	2,102	862,967	55
Coyote Creek.....	60.2	14	3,450	821	246,483	657	12,407	725	312,320	50
Guadalupe River.....	99.3	51	7,700	725	242,912	512	13,480	572	278,221	67
Other tributaries of San Francisco Bay.....	105.1	9	1,925	905	216,115	728	10,332	806	272,446	50

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CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

	CROP.	AREA HARVESTED.				Per cent of increase. <sup>1</sup>	Unit.	QUANTITY HARVESTED.				Per cent of increase. <sup>1</sup>
		1919		1909				1919		1909		
		Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
1	<b>Cereals:</b>											
2	Corn.....	56,958	48.8	17,802	34.8	220.0	Bu....	1,964,828	57.0	491,978	88.6	299.4
3	Oats.....	9,359	6.4	5,903	8.1	58.5	Bu....	266,878	9.0	205,727	5.0	29.7
4	Winter wheat.....	85,245	9.2	22,603	4.7	491.0	Bu....	1,636,508	11.2	408,706	6.6	478.0
5	Spring wheat.....	48,330	29.9				Bu....	717,549	31.8			
6	Barley.....	228,812	18.0	77,785	6.5	65.6	Bu....	8,299,308	15.1	1,844,971	7.0	78.8
7	Rye.....	2,546	13.8	107	1.5		Bu....	29,294	15.8	1,265	1.8	
8	Kafir, milo, etc.....	124,092	73.9	( <sup>2</sup> )			Bu....	8,253,711	80.8	( <sup>2</sup> )		
9	Rough rice.....	130,367	100.0	( <sup>2</sup> )			Bu....	6,926,313	100.0	( <sup>2</sup> )		
10	Mixed crops.....	1,633	59.2	( <sup>2</sup> )			Bu....	58,300	78.5	( <sup>2</sup> )		
11	<b>Other grains and seeds:</b>											
12	Clover and alfalfa seed <sup>3</sup> .....	2,319	18.0	2,570	29.3	-9.8	Bu....	9,702	23.7	5,911	24.5	64.1
13	Dry beans, navy, etc.....	148,379	31.5	11,384	7.2		Bu....	2,459,350	37.5	244,624	7.3	905.4
14	Dry peas (Canada).....	1,504	7.2	290	9.8	418.6	Bu....	24,850	18.6	9,902	17.2	151.0
15	Sugar-beet seed.....	503	71.4	( <sup>2</sup> )			Lbs....	138,000	51.8	( <sup>2</sup> )		
16	Flower and vegetable seed.....	3,234	22.9	( <sup>2</sup> )			Lbs....	2,056,510	87.6	( <sup>2</sup> )		
17	<b>Hay and forage:</b>											
18	Timothy alone.....	2,919	22.5	8,026	58.5	-63.6	Tons..	4,936	25.5	11,236	56.2	-56.1
19	Timothy and clover mixed.....	38,786	74.2	20,880	44.7	85.8	Tons..	54,806	72.8	34,177	46.7	60.4
20	Clover alone.....	4,882	32.1	1,176	13.8	315.1	Tons..	6,396	26.0	2,689	13.2	137.9
21	Alfalfa.....	556,656	77.5	366,692	75.7	51.8	Tons..	1,967,529	81.6	1,280,105	78.1	53.7
22	Other tame grasses.....	15,863	31.8	6,504	7.0	143.9	Tons..	22,676	33.7	10,656	8.7	112.8
23	Annual legumes cut for hay.....	3,055	11.8				Tons..	3,726	12.4			
24	Small grains cut for hay.....	145,337	13.4	101,187	6.3	46.7	Tons..	199,432	15.4	146,018	7.2	39.1
25	Wild, salt, or prairie grasses.....	85,603	48.0	153,672	60.7	-44.3	Tons..	96,722	62.1	189,964	67.6	-49.1
26	Silage crops.....	18,244	55.0				Tons..	119,291	57.4	( <sup>2</sup> )		
27	Corn cut for forage.....	5,069	37.1	( <sup>2</sup> )			Tons..	12,946	51.9	( <sup>2</sup> )		
28	Kafir, sorghum, etc., for forage.....	7,418	51.1	( <sup>2</sup> )			Tons..	14,667	59.8	( <sup>2</sup> )		
29	Root crops for forage.....	634	9.4	( <sup>2</sup> )			Tons..	5,712	4.5	( <sup>2</sup> )		
30	<b>Vegetables:</b>											
31	Potatoes.....	29,698	46.9	32,735	48.4	-9.3	Bu....	4,502,597	54.8	5,180,006	52.7	-13.1
32	Sweet potatoes and yams.....	5,858	76.8	( <sup>2</sup> )			Bu....	659,734	76.1	( <sup>2</sup> )		
33	Cabbages.....	3,270	60.5	( <sup>2</sup> )								
34	Cantaloupes and muskmelons.....	13,800	64.3	( <sup>2</sup> )								
35	Calery.....	2,605	48.7	( <sup>2</sup> )								
36	Cucumbers.....	477	26.7	( <sup>2</sup> )								
37	Beans (green).....	1,564	37.9	( <sup>2</sup> )								
38	Peas (green).....	2,258	27.4	( <sup>2</sup> )								
39	Lettuce.....	4,266	69.7	( <sup>2</sup> )								
40	Onions.....	5,801	68.2	( <sup>2</sup> )								
41	Corn (sweet).....	2,219	42.2	( <sup>2</sup> )								
42	Tomatoes.....	16,997	54.1	( <sup>2</sup> )								
43	Watermelons.....	3,979	54.2	( <sup>2</sup> )								
44	Asparagus.....	9,626	55.2	( <sup>2</sup> )								
45	Cauliflower.....	2,362	64.4	( <sup>2</sup> )								
46	Peppers (green).....	4,255	67.4	( <sup>2</sup> )								
47	Pumpkins.....	544	48.1	( <sup>2</sup> )								
48	Spinach.....	897	36.1	( <sup>2</sup> )								
49	<b>Miscellaneous crops:</b>											
50	Sugar beets grown for sugar.....	55,720	63.1	14,057	18.6	280.2	Tons..	422,427	63.3	171,494	20.3	146.8
51	Cotton.....	83,993	96.2	( <sup>2</sup> )			Bales..	44,681	96.3	( <sup>2</sup> )		
52	Broom corn.....	883	40.5	( <sup>2</sup> )			Lbs....	351,700	44.4	( <sup>2</sup> )		
53	Hops.....	3,172	26.8	( <sup>2</sup> )			Lbs....	3,691,623	29.5	( <sup>2</sup> )		
54	<b>Small fruits:</b>											
55	Strawberries.....	1,465	29.5	( <sup>2</sup> )			Qts..	5,143,533	47.6	( <sup>2</sup> )		
56	<b>Orchard fruits:</b>											
57	Apples.....	4,804,683	25.7	( <sup>2</sup> )			Bu....	1,335,057	17.0	( <sup>2</sup> )		
58	Peaches.....	4,562,259	62.5	( <sup>2</sup> )			Bu....	10,318,362	64.6	( <sup>2</sup> )		
59	Pears.....	4,017,060	44.1	( <sup>2</sup> )			Bu....	1,783,951	46.1	( <sup>2</sup> )		
60	Plums and prunes.....	4,841,678	43.8	( <sup>2</sup> )			Bu....	6,542,548	49.6	( <sup>2</sup> )		
61	Cherries.....	4,234,569	43.3	( <sup>2</sup> )			Bu....	326,449	49.9	( <sup>2</sup> )		
62	Apricots.....	4,630,763	44.2	( <sup>2</sup> )			Bu....	2,608,136	44.1	( <sup>2</sup> )		
63	Quinces.....	4,12,403	48.0	( <sup>2</sup> )			Bu....	18,315	58.8	( <sup>2</sup> )		
64	<b>Grapes:</b>											
65	Grapes.....	4,73,217,234	47.8	74,984			Lbs....	1,128,175,200	54.9	( <sup>2</sup> )		
66	<b>Subtropical fruits:</b>											
67	Oranges.....	4,878,956	84.3	( <sup>2</sup> )			Boxes.	18,725,602	86.6	( <sup>2</sup> )		
68	Lemons.....	4,299,716	79.7	( <sup>2</sup> )			Boxes.	5,776,149	88.2	( <sup>2</sup> )		
69	Grapfruit (pomeloes).....	4,193,819	83.0	( <sup>2</sup> )			Boxes.	393,923	84.7	( <sup>2</sup> )		
70	Figs.....	4,246,884	49.0	( <sup>2</sup> )			Lbs....	10,074,552	46.2	( <sup>2</sup> )		
71	Alligator pears (avocados).....	4,10,674	89.6	( <sup>2</sup> )			Crates.	7,294	92.1	( <sup>2</sup> )		
72	Dates.....	4,14,406	83.8	( <sup>2</sup> )			Lbs....	118,311	81.6	( <sup>2</sup> )		
73	Olive.....	4,536,543	58.9	( <sup>2</sup> )			Lbs....	12,264,764	69.6	( <sup>2</sup> )		
74	Japanese persimmons.....	4,5,510	39.8	( <sup>2</sup> )			Bu....	9,500	44.3	( <sup>2</sup> )		
75	Pomegranates.....	4,14,710	60.6	( <sup>2</sup> )			Lbs....	580,091	61.9	( <sup>2</sup> )		
76	<b>Nuts:</b>											
77	Almonds.....	4,464,071	19.3	( <sup>2</sup> )			Lbs....	3,190,813	20.3	( <sup>2</sup> )		
78	Walnuts (English or Persian).....	4,616,372	48.4	( <sup>2</sup> )			Lbs....	30,210,494	51.1	( <sup>2</sup> )		

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1909.

<sup>3</sup> Excluding red clover seed (1919).  
<sup>4</sup> Number of trees of bearing age.

<sup>5</sup> Number of vines of bearing age.

IRRIGATION—CALIFORNIA.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909—Continued.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	Unit.	AVERAGE YIELD PER ACRE, 1919.					VALUE.				
		For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase.
				Average.	Per cent of average for state.	Per cent of average on nonirrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.	29.5	24.8	34.5	116.9	139.1	\$3,340,208	57.0	\$440,312	40.0	653.0
2 Oats.....	Bu.	20.2	19.6	28.5	141.1	145.4	256,878	9.0	137,160	5.2	94.0
3 Winter wheat.....	Bu.	15.8	15.5	19.2	121.5	123.9	3,583,942	11.2	428,668	6.8	.....
4 Spring wheat.....	Bu.	13.9	13.5	14.8	108.5	109.6	1,571,432	31.8	.....	.....	.....
5 Barley.....	Bu.	22.2	21.7	25.6	115.3	118.0	5,278,893	15.1	1,097,541	6.4	391.0
6 Rye.....	Bu.	10.1	9.9	11.5	113.9	116.2	54,194	15.8	1,133	1.7	.....
7 Kafir, milo, etc.....	Bu.	24.1	18.2	26.2	103.7	144.0	5,531,309	80.3	(*)	.....	.....
8 Rough rice.....	Bu.	53.1	.....	53.1	100.0	.....	20,432,627	100.0	(*)	.....	.....
9 Mixed crops.....	Bu.	26.9	14.1	35.7	182.7	253.2	81,620	78.5	(*)	.....	.....
<b>Other grains and seeds:</b>											
10 Clover and alfalfa seed *.....	Bu.	3.2	3.0	4.2	131.3	140.0	203,742	23.7	53,829	26.8	278.4
11 Dry beans, navy, etc.....	Bu.	13.9	12.7	16.6	119.4	130.7	11,558,944	37.5	378,770	6.0	.....
12 Dry peas (Canada).....	Bu.	8.7	8.1	16.5	189.7	203.7	88,218	13.6	15,331	15.2	475.4
13 Sugar-beet seed.....	Lbs.	378.7	639.8	274.4	72.5	42.9	96,600	61.8	(*)	.....	.....
14 Flower and vegetable seed.....	Lbs.	388.7	312.9	635.9	164.4	203.2	2,056,510	37.6	(*)	.....	.....
<b>Hay and forage:</b>											
15 Timothy alone.....	Tons.	1.50	1.44	1.69	112.7	117.4	93,784	25.5	90,083	48.5	4.1
16 Timothy and clover mixed.....	Tons.	1.44	1.52	1.41	97.9	92.8	1,013,911	72.8	316,963	50.4	219.5
17 Clover alone.....	Tons.	1.62	1.76	1.31	80.9	74.4	118,326	26.0	40,429	19.0	192.7
18 Alfalfa.....	Tons.	3.38	2.75	3.58	105.1	128.4	44,269,402	81.6	9,983,370	76.3	343.4
19 Other tame grasses.....	Tons.	1.35	1.32	1.43	105.9	108.3	396,830	33.7	112,097	8.8	254.0
20 Annual legumes cut for hay.....	Tons.	1.18	1.15	1.22	105.2	106.1	74,520	12.4	.....	.....	.....
21 Small grains cut for hay.....	Tons.	1.19	1.17	1.27	115.1	117.1	4,686,652	15.4	1,532,681	6.4	210.0
22 Wild, salt, or prairie grasses.....	Tons.	1.04	0.96	1.13	108.7	117.7	1,354,108	52.1	1,194,716	68.9	13.1
23 Silage crops.....	Tons.	7.04	6.67	7.34	104.3	110.0	1,133,264	57.4	(*)	.....	.....
24 Corn cut for forage.....	Tons.	1.83	1.40	2.55	139.3	182.1	181,244	51.9	(*)	.....	.....
25 Kafir, sorghum, etc., for forage.....	Tons.	1.69	1.39	1.98	117.2	142.4	220,005	59.8	(*)	.....	.....
26 Root crops for forage.....	Tons.	18.67	19.67	9.01	48.3	45.8	94,243	4.5	(*)	.....	.....
<b>Vegetables:</b>											
27 Potatoes.....	Bu.	129.8	110.6	151.6	116.8	137.1	10,355,973	54.8	2,440,981	50.0	324.1
28 Sweet potatoes and yams.....	Bu.	113.6	117.0	112.6	99.1	96.2	1,617,388	78.1	(*)	.....	.....
29 Cabbages.....	.....	.....	.....	.....	.....	.....	547,205	57.4	(*)	.....	.....
30 Cantaloupes and muskmelons.....	.....	.....	.....	.....	.....	.....	2,753,155	70.7	(*)	.....	.....
31 Celery.....	.....	.....	.....	.....	.....	.....	721,521	47.5	(*)	.....	.....
32 Cucumbers.....	.....	.....	.....	.....	.....	.....	87,701	28.0	(*)	.....	.....
33 Beans (green).....	.....	.....	.....	.....	.....	.....	292,953	56.1	(*)	.....	.....
34 Peas (green).....	.....	.....	.....	.....	.....	.....	387,079	36.1	(*)	.....	.....
35 Lettuce.....	.....	.....	.....	.....	.....	.....	1,190,363	70.4	(*)	.....	.....
36 Onions.....	.....	.....	.....	.....	.....	.....	2,009,151	71.3	(*)	.....	.....
37 Corn (sweet).....	.....	.....	.....	.....	.....	.....	197,015	42.9	(*)	.....	.....
38 Tomatoes.....	.....	.....	.....	.....	.....	.....	2,121,514	59.3	(*)	.....	.....
39 Watermelons.....	.....	.....	.....	.....	.....	.....	327,028	52.8	(*)	.....	.....
40 Asparagus.....	.....	.....	.....	.....	.....	.....	1,653,081	62.6	(*)	.....	.....
41 Cauliflower.....	.....	.....	.....	.....	.....	.....	437,888	68.3	(*)	.....	.....
42 Peppers (green).....	.....	.....	.....	.....	.....	.....	632,101	83.9	(*)	.....	.....
43 Pumpkins.....	.....	.....	.....	.....	.....	.....	18,753	45.0	(*)	.....	.....
44 Spinach.....	.....	.....	.....	.....	.....	.....	128,516	41.1	(*)	.....	.....
<b>Miscellaneous crops:</b>											
45 Sugar beets grown for sugar.....	Tons.	7.55	7.51	7.58	100.3	100.9	5,491,551	63.3	839,561	19.5	554.1
46 Cotton.....	Bales.	0.53	0.52	0.53	100.0	101.9	8,891,519	96.3	(*)	.....	.....
47 Broom corn.....	Lbs.	383.6	340.0	398.3	109.5	117.1	28,136	44.4	(*)	.....	.....
48 Hops.....	Lbs.	1,553.3	1,499.9	1,699.6	109.4	113.3	1,919,644	29.3	(*)	.....	.....
<b>Small fruits:</b>											
49 Strawberries.....	Qts.	2,172.9	1,614.3	3,510.9	161.6	217.5	1,028,707	47.6	(*)	.....	.....
<b>Orchard fruits:</b>											
50 Apples.....	Bu.	42.5	42.8	41.7	68.0	60.7	2,069,338	17.0	(*)	.....	.....
51 Peaches.....	Bu.	41.8	41.7	41.8	100.0	105.9	19,038,970	64.6	(*)	.....	.....
52 Pears.....	Bu.	41.7	41.7	41.8	105.9	105.9	3,211,112	45.1	(*)	.....	.....
53 Plums and prunes.....	Bu.	41.5	41.4	41.7	113.3	121.4	14,066,478	49.6	(*)	.....	.....
54 Cherries.....	Bu.	41.0	40.9	41.1	110.0	122.2	1,305,796	49.9	(*)	.....	.....
55 Apricots.....	Bu.	41.6	41.6	41.6	100.0	100.0	5,216,272	44.1	(*)	.....	.....
56 Quinces.....	Bu.	41.2	41.0	41.5	125.0	150.0	36,630	58.3	(*)	.....	.....
<b>Grapes:</b>											
57 Grapes.....	Lbs.	18.4	11.6	15.4	114.9	122.8	36,101,606	54.9	3,038,435	28.0	.....
<b>Subtropical fruits:</b>											
58 Oranges.....	Boxes.	42.1	41.8	42.2	104.8	122.2	58,049,366	86.6	(*)	.....	.....
59 Lemons.....	Boxes.	42.3	41.3	42.5	108.7	192.3	16,750,832	88.2	(*)	.....	.....
60 Grape fruit (pomeloes).....	Boxes.	42.0	41.9	42.0	100.0	105.3	787,846	84.7	(*)	.....	.....
61 Figs.....	Lbs.	43.3	45.6	40.8	94.2	89.5	1,007,455	48.2	(*)	.....	.....
62 Alligator pears (avocados).....	Crates.	40.7	40.5	40.7	100.0	140.0	58,352	92.1	(*)	.....	.....
63 Dates.....	Lbs.	48.4	49.2	48.2	97.6	89.1	23,662	81.6	(*)	.....	.....
64 Olives.....	Lbs.	419.3	414.2	422.9	118.7	161.3	931,181	69.8	(*)	.....	.....
65 Japanese persimmons.....	Bu.	41.5	41.4	41.7	113.3	121.4	38,000	44.3	(*)	.....	.....
66 Pomegranates.....	Lbs.	49.8	43.1	40.1	102.0	105.2	35,405	61.9	(*)	.....	.....
<b>Nuts:</b>											
67 Almonds.....	Lbs.	46.5	46.4	46.9	106.2	107.8	797,703	20.3	(*)	.....	.....
68 Walnuts (English or Persian).....	Lbs.	46.4	43.9	49.0	105.6	111.6	9,063,148	51.1	(*)	.....	.....

\* Per cent not shown when more than 1,000  
 † Not reported separately in 1909.

\* Excluding red clover seed (1919).  
 † Yield per tree.

\* Yield per vine.

IRRIGATION—CALIFORNIA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

(A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.)

	THE STATE.	Alameda.	Alpina.	Amador.	Butte.	Calaveras.	Colusa.	Contra Costa.	Eldorado.	
1	Number of all farms in 1920.....	117,670	2,778	21	479	2,219	606	816	1,675	729
2	Number of farms irrigated in 1919.....	67,391	473	18	101	989	306	325	131	393
3	Per cent of all farms.....	57.3	17.0	85.7	21.1	44.6	50.5	39.8	7.8	53.9
4	Number of farms irrigated in 1909.....	39,352	50	32	73	556	154	112	78	244
5	Per cent of increase, 1909-1919.....	71.3				77.9	98.7	190.2		61.1
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres..	99,617,280	463,490	496,640	384,640	1,086,720	657,280	739,600	456,960	1,111,680
7	All land in farms.....acres..	29,365,667	359,742	10,042	312,106	464,625	366,195	438,417	375,065	240,265
8	Improved land in farms.....acres..	11,878,339	185,394	4,306	69,986	253,745	58,957	302,429	238,369	43,413
9	Area irrigated in 1919.....acres..	4,219,040	9,346	4,459	326	93,559	2,859	44,097	33,079	6,731
10	Per cent of improved land in farms.....	35.5	5.0	103.6	0.5	36.9	4.8	14.6	13.9	15.5
11	Area irrigated in 1909.....acres..	2,664,104	1,859	3,349	526	28,764	1,275	4,276	26,856	5,122
12	Per cent of increase, 1909-1919.....	58.4	402.7	33.1	-60.5	225.4	124.2	631.3	23.2	31.4
13	Area enterprises were capable of irrigating in 1920.....acres..	5,894,466	13,357	4,819	489	114,764	33,828	69,149	46,482	9,833
14	Area enterprises were capable of irrigating in 1910.....acres..	3,619,378	1,872	3,399	3,973	115,075	3,161	16,541	32,562	5,501
15	Per cent of increase, 1910-1920.....	62.9	613.5	41.8	-87.7	-0.3	970.2	318.0	42.7	78.7
16	Area included in enterprises in 1920.....acres..	7,895,207	16,543	7,027	1,093	123,524	42,093	88,948	67,876	16,848
17	Area included in enterprises in 1910.....acres..	5,490,360	2,605	3,435	4,139	233,500	3,919	18,783	32,640	20,264
18	Per cent of increase, 1910-1920.....	42.2	635.0	104.6	-73.6	-47.1	974.1	373.6	108.0	-16.9
19	Area of irrigated land reported as available for settlement.....acres..	533,981				4,500	2,960		8,000	
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	24,115	264	16	35	197	140	99	56	91
21	Number, 1910.....	13,970	53	21	49	144	150	45	155	50
Main ditches:										
22	Number, 1920.....	6,040	48	18	23	74	144	84	11	82
23	Number, 1910.....	8,690	49	25	55	135	148	38	176	56
24	Length, 1920.....miles.....	14,437	12	20	64	225	247	258	186	1,268
25	Length, 1910.....miles.....	12,620	21	34	185	270	124	44	172	255
26	Capacity, 1920.....second-feet.....	115,237	23	53	59	2,751	468	2,695	339	390
27	Capacity, 1910.....second-feet.....	89,597	606	179	255	2,028	206	531	60	445
Laterals:										
28	Number, 1920.....	9,190	142	14	3	181	52	100	111	46
29	Number, 1910.....	6,143		3	12	145	32	10		25
30	Length, 1920.....miles.....	12,947	19	1	80	27	131	120	175	110
31	Length, 1910.....miles.....	8,509		1	56	170	31	7		55
Reservoirs:										
32	Number, 1920.....	3,030	10	2	13	8	47	2	1	35
33	Number, 1910.....	1,583	52	14	27	29			1	22
34	Capacity, 1920.....acre-feet.....	1,091,394	1	4	196	30	10,935	51,000	5	19,966
35	Capacity, 1910.....acre-feet.....	743,269	3		309	360	12,029		1	711
Flowing wells:										
36	Number, 1920.....	1,415					5		2	
37	Number, 1910.....	2,361					6		1	
38	Capacity, 1920.....gallons per minute.....	287,187					65			
39	Capacity, 1910.....gallons per minute.....	477,343					40		143	
Pumped wells:										
40	Number, 1920.....	25,401	382		4	153	20	66	49	6
41	Number, 1910.....	10,724	56			46	7	3	26	
42	Capacity, 1920.....gallons per minute.....	10,608,476	95,329		150	53,890	1,205	48,735	5,897	730
43	Capacity, 1910.....gallons per minute.....	4,119,576	3,740			29,696	844	977	1,339	
Pumping plants:										
44	Number, 1920.....	21,561	290		9	157	32	103	56	6
45	Number, 1910.....	9,297	57		1	46	9	12	30	
46	Engine capacity, 1920.....horsepower.....	386,200	3,797		34	2,863	234	6,931	3,236	15
47	Engine capacity, 1910.....horsepower.....	128,143	384		5	555	44	516	751	
48	Pump capacity, 1920.....gallons per minute.....	16,773,692	112,508		1,890	113,036	7,988	528,610	74,004	830
49	Pump capacity, 1910.....gallons per minute.....	5,276,298	5,019		100	32,391	1,094	51,365	138,947	
50	Average lift, 1920.....feet.....	41	40		32	24	41	25		37
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars..	194,896,388	530,053	40,385	91,295	3,383,646	1,315,617	2,594,164	1,330,210	499,269
52	Capital invested to July 1, 1910.....dollars..	72,580,030	57,156	7,493	265,608	1,231,894	121,033	76,112	90,508	346,939
53	Per cent of increase, 1910-1920.....	168.5	827.4	459.0	-65.6	174.7	987.0			43.9
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	33.06	39.68	8.38	186.70	29.49	33.89	57.62	29.69	50.77
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	20.05	30.53	2.20	66.85	10.71	33.29	4.60	2.78	63.07
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars..	225,799,123	538,538	41,385	91,295	3,776,271	1,329,119	2,631,964	1,587,960	702,269
57	Estimated final cost of existing enterprises in 1910.....dollars..	84,392,344	57,156	7,493	265,608	1,381,894	121,033	76,112	90,508	346,939
58	Per cent of increase, 1910-1920.....	167.6	842.2	452.3	-65.6	173.3	998.1			102.4
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	28.93	32.55	5.89	33.53	30.57	31.58	52.40	28.40	41.68
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	15.37	21.94	2.18	64.17	5.92	30.88	4.05	2.77	17.12

<sup>1</sup> Includes Del Norte County, for which no irrigation is reported.

IRRIGATION—CALIFORNIA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Fresno.	Glenn.	Humboldt.	Imperial.	Inyo.	Kern.	Kings.	Lake.	Lassen.
1	8,917	1,320	1,756	2,843	521	2,020	2,171	771	606
2	7,792	897	53	2,707	329	1,474	1,634	71	306
3	87.4	68.0	3.0	95.2	63.1	73.0	75.3	9.2	50.5
4	5,310	198	33	1,250	408	876	1,126	43	355
5	46.7	357.7		116.6	-19.4	68.3	45.1		-13.8
<b>LAND AND FARM AREA.</b>									
6	3,808,000	855,680	2,283,000	2,616,960	6,394,240	5,121,920	741,780	792,320	2,899,840
7	1,319,531	524,407	717,174	347,485	140,029	1,497,045	505,553	241,899	741,220
8	672,591	336,482	98,064	310,708	39,904	390,932	259,639	45,355	140,887
9	547,587	105,004	355	415,304	74,958	223,593	187,868	1,107	53,684
10	81.4	31.2	0.4	133.7	187.8	57.2	72.4	2.4	38.2
11	402,318	5,661	208	190,711	65,163	190,034	190,949	582	77,079
12	36.1		70.7	117.8	15.0	17.7	-1.6	90.2	-30.1
13	838,048	126,992	590	457,815	79,771	329,773	376,906	1,517	71,582
14	560,326	16,804	333	242,000	71,815	217,418	289,523	828	89,815
15	49.6	655.7	50.2	89.2	11.1	61.7	30.2	83.2	-20.3
16	1,098,755	202,399	664	530,855	97,998	475,645	490,835	1,831	85,873
17	633,652	220,664	966	375,000	92,319	402,806	310,523	1,268	149,530
18	73.4	-8.3	-31.3	41.6	6.2	18.1	58.1	44.4	-42.6
19	67,667	4,745		1,800	4,300	524	14,000		3,000
<b>IRRIGATION WORKS.</b>									
<b>Independent enterprises:</b>									
20	2,968	213	33	17	87	875	845	70	175
21	975	118	33	9	188	244	77	48	233
<b>Main ditches:</b>									
22	106	86	27	46	56	165	98	38	208
23	254	50	33	12	184	178	27	44	295
24	1,339	181	34	537	132	445	896	18	404
25	831	136	26	117	396	441	157	26	368
26	10,785	2,515	200	10,575	1,368	6,314	13,586	242	2,732
27	6,299	1,659	145	3,260	2,762	9,990	4,840	90	2,248
<b>Laterals:</b>									
28	1,044	168	4	395	5	224	323	22	231
29	688	554	4	179	326	118	51	21	263
30	2,003	329	6	2,690	4	149	387	1	114
31	1,354	1,073	2	890	168	257	159	2	116
<b>Reservoirs:</b>									
32	72	9	3		18	536	20	9	31
33	8	12	5		1	51	37	3	29
34	141	8	6		1,006	61,183	6,063	181	194,422
35	402	45,009	7		11,300	1,601	111	2	169,552
<b>Flowing wells:</b>									
36	59				23	27	13	7	10
37	3				10	25	75	1	
38	18,400				537	17,643	2,150	950	233
39	450				500	12,283	19,436	75	
<b>Pumped wells:</b>									
40	2,281	263		1	9	983	498	17	
41	855	105	2		1	140	20	3	
42	1,280,347	176,251		900	4,088	415,412	202,967	5,545	1,305
43	443,024	26,484	105		100	90,618	8,700	272	
<b>Pumping plants:</b>									
44	2,130	215	3	1	13	869	346	33	11
45	688	77	1		1	114	18	11	2
46	32,361	9,214	36	38	137	12,504	5,225	241	93
47	8,990	896	3		5	2,846	174	49	90
48	1,442,383	1,065,729	2,000	900	4,558	1,219,402	283,339	13,111	6,990
49	515,380	62,449	105		100	90,668	12,759	4,577	6,100
50	22	23	11	70	24	53	23	18	22
<b>CAPITAL INVESTED.</b>									
51	8,067,930	5,586,804	37,298	14,223,585	2,487,561	18,419,752	3,968,358	116,286	519,656
52	1,898,460	1,519,561	29,027	4,955,272	962,698	1,788,635	687,381	12,124	894,965
53	325.0	267.7	28.5	187.0	158.4	928.8	480.4	859.1	-41.8
54	9.63	43.99	74.60	31.07	31.18	55.86	10.58	76.66	7.26
55	8.39	90.43	87.17	20.48	13.41	8.23	2.37	14.64	9.85
<b>ESTIMATED FINAL COST.</b>									
56	9,249,614	7,283,303	37,798	14,323,585	2,607,111	18,629,815	4,362,178	216,346	583,458
57	1,898,460	3,716,976	29,027	5,884,182	962,698	1,788,635	687,381	12,124	1,034,965
58	387.2	95.9	30.2	143.4	170.8	952.7	534.6		-43.6
59	8.42	35.98	56.92	26.98	26.60	39.59	8.89	118.16	6.79
60	3.00	16.84	30.05	15.69	10.43	4.44	2.21	9.56	6.92

# IRRIGATION—CALIFORNIA.

**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Los Angeles.	Madera.	Marin.	Mariposa.	Mendocino.	Merced.	Modoc.	Mono.	Monterey.	Napa.	
1	Number of all farms in 1920.....	12,444	1,402	718	367	1,759	2,846	743	74	1,712	1,428
2	Number of farms irrigated in 1919.....	9,102	930	14	48	92	2,334	441	66	451	39
3	Per cent of all farms.....	73.1	66.3	1.9	13.1	5.2	82.0	59.4	89.2	26.3	2.7
4	Number of farms irrigated in 1909.....	4,669	158	6	56	39	1,417	437	76	258	36
5	Per cent of increase, 1909-1919.....	94.9	488.6				64.7	0.9		74.8	
<b>LAND AND FARM AREA.</b>											
6	Approximate land area.....acres..	2,633,600	1,351,630	838,560	936,920	2,264,060	1,276,800	2,448,720	1,939,200	2,131,200	501,120
7	All land in farms.....acres..	882,333	536,726	290,148	235,848	923,037	1,122,550	596,757	42,034	1,104,048	283,025
8	Improved land in farms.....acres..	483,096	262,971	87,846	49,587	101,220	606,582	168,251	8,740	398,320	116,723
9	Area irrigated in 1919.....acres..	248,412	100,220	564	66	1,255	212,851	82,845	46,012	47,336	660
10	Per cent of improved land in farms.....	51.4	38.1	0.6	0.1	1.2	42.0	49.2		11.9	0.6
11	Area irrigated in 1909.....acres..	145,586	38,705	67	376	371	151,998	82,075	49,077	15,056	1,191
12	Per cent of increase, 1909-1919.....	70.6	158.9		-82.4	238.3	40.0	0.9	-6.1	214.4	-44.6
13	Area enterprises were capable of irrigating in 1920.....acres..	319,368	118,672	704	89	11,566	238,157	89,801	89,335	56,159	1,284
14	Area enterprises were capable of irrigating in 1910.....acres..	183,506	51,230	71	546	590	248,670	89,478	60,007	27,176	2,035
15	Per cent of increase, 1910-1920.....	74.0	131.6		-83.7		15.9	0.4	78.6	106.6	-36.9
16	Area included in enterprises in 1920.....acres..	364,574	161,032	713	109	11,686	457,494	112,200	121,878	59,659	1,405
17	Area included in enterprises in 1910.....acres..	241,794	82,321	71	767	1,365	281,719	124,166	84,973	29,914	2,443
18	Per cent of increase, 1910-1920.....	50.8	95.6		-85.8	758.1	62.4	-9.6	43.4	99.4	-42.5
19	Area of irrigated land reported as available for settlement.....acres..	6,100					212,500		40,000		
<b>IRRIGATION WORKS.</b>											
<b>Independent enterprises:</b>											
20	Number, 1920.....	1,883	689	4	9	64	479	378	78	189	32
21	Number, 1910.....	1,567	35	6	48	37	135	388	77	117	35
<b>Main ditches:</b>											
22	Number, 1920.....	414	29		6	23	233	470	101	120	6
23	Number, 1910.....	601	34	5	49	33	45	448	85	106	26
24	Length, 1920.....miles..	332	63		3	13	684	655	223	108	1
25	Length, 1910.....miles..	800	79	5	21	19	261	637	172	223	8
26	Capacity, 1920.....second-feet..	5,059	2,066		6	86	3,972	3,078	1,526	528	20
27	Capacity, 1910.....second-feet..	2,296	1,515	21	28	49	4,478	2,907	1,243	1,903	25
<b>Laterals:</b>											
28	Number, 1920.....	621	34			28	763	175	15	398	
29	Number, 1910.....	494	30			8	853	490	101	23	3
30	Length, 1920.....miles..	221	126			365	552	101	14	98	
31	Length, 1910.....miles..	500	294			6	852	175	65	32	3
<b>Reservoirs:</b>											
32	Number, 1920.....	411	107	1	3	10	64	71	12	9	3
33	Number, 1910.....	279	3	1	8	7	10	32		10	3
34	Capacity, 1920.....acre-feet..	37,591	418	3		296	20,651	80,285	44,740	54	1
35	Capacity, 1910.....acre-feet..	993	12,841	1	3	10	15,008	83,993		2	13
<b>Flowing wells:</b>											
36	Number, 1920.....	123	8	1			13	71		1	1
37	Number, 1910.....	376					29	45			
38	Capacity, 1920.....gallons per minute..	41,336	2,100				3,212	5,607		400	1,000
39	Capacity, 1910.....gallons per minute..	70,818					2,567	1,266			
<b>Pumped wells:</b>											
40	Number, 1920.....	2,228	753	7		14	543	7	10	606	11
41	Number, 1910.....	1,673	33	1	2	6	78	2		102	2
42	Capacity, 1920.....gallons per minute..	1,131,797	189,455	308		1,859	299,395	675	5,919	407,310	9,005
43	Capacity, 1910.....gallons per minute..	871,143	26,518	150	49	2,296	52,008	44		196,236	300
<b>Pumping plants:</b>											
44	Number, 1920.....	1,854	701	4		39	539	11	9	203	31
45	Number, 1910.....	1,361	25	6	2	10	108	2		124	17
46	Engine capacity, 1920.....horsepower..	45,752	8,307	19		481	6,094	146	214	9,631	314
47	Engine capacity, 1910.....horsepower..	30,632	604	48	1	65	1,505	2		5,338	115
48	Pump capacity, 1920.....gallons per minute..	1,166,131	896,483	325		18,424	349,530	9,250	5,919	406,617	21,126
49	Pump capacity, 1910.....gallons per minute..	872,718	26,518	1,100	49	3,586	93,239	44		250,513	7,751
50	Average lift, 1920.....feet..	60	33	27		33	22	30	34	33	24
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920.....dollars..	21,038,616	1,351,854	15,731	3,786	582,640	6,614,674	663,660	5,679,375	2,450,643	70,168
52	Capital invested to July 1, 1910.....dollars..	7,817,023	512,098	3,380	13,440	30,297	3,748,211	301,040	64,282	495,916	53,948
53	Per cent of increase, 1910-1920.....	169.1	164.0	365.4	-71.8		76.5	120.5		394.2	30.1
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	65.88	11.39	22.35	42.54	50.38	22.96	7.39	63.57	43.64	54.65
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	42.60	10.00	47.61	24.62	51.85	15.07	3.96	1.29	18.25	26.51
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920.....dollars..	23,271,909	1,366,599	15,731	3,788	588,040	13,106,429	780,435	7,045,875	2,460,643	72,668
57	Estimated final cost of existing enterprises in 1910.....dollars..	9,266,023	512,098	3,380	13,440	30,297	3,748,211	316,040	64,282	578,916	53,948
58	Per cent of increase, 1910-1920.....	151.2	166.9	365.4	-71.8		249.7	140.6		325.0	34.7
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	63.83	8.49	22.06	34.73	50.32	28.65	6.78	57.81	41.25	51.72
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	38.32	6.22	47.61	17.52	22.20	13.30	2.55	0.76	19.35	22.08

IRRIGATION—CALIFORNIA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	Nevada.	Orange.	Placer.	Plumas.	River- side.	Sacra- mento.	San Benito.	San Ber- nardino.	San Diego.	San Fran- cisco.
1	481	4,188	1,280	150	3,949	2,975	945	4,023	3,200	74
2	311	3,846	814	108	2,670	1,747	349	3,350	1,696	23
3	64.7	91.8	63.6	72.0	67.6	58.7	36.9	83.3	53.1	31.1
4	300	2,215	618	151	2,174	1,053	240	2,463	890	25
5	3.7	73.6	31.7	-28.5	22.8	65.9	45.4	36.0	90.8	.....
<b>LAND AND FARM AREA.</b>										
6	623,360	508,800	903,040	1,659,520	4,622,720	629,120	890,880	12,912,000	2,701,440	26,880
7	198,441	325,703	233,153	101,653	676,283	555,503	539,378	415,738	925,192	1,295
8	26,196	200,945	136,455	34,223	348,538	399,024	122,606	175,272	262,646	840
9	3,441	87,330	27,520	22,852	106,212	72,960	12,468	105,906	24,996	372
10	13.1	43.5	20.2	68.8	30.5	18.3	10.2	60.1	9.5	44.3
11	3,839	55,056	16,845	36,602	71,439	53,633	7,188	70,278	24,944	383
12	-10.4	58.6	63.4	-37.6	48.7	35.9	73.5	49.8	0.2	-2.9
13	5,002	102,076	27,520	25,478	128,788	103,271	17,186	120,798	32,148	412
14	4,259	63,486	23,365	37,529	103,233	69,970	13,790	86,107	31,205	363
15	17.4	60.8	17.8	-32.1	24.8	47.6	24.6	40.3	2.0	7.6
16	5,601	113,026	40,000	28,265	226,927	141,275	23,017	184,024	68,401	412
17	5,267	71,444	61,761	37,901	210,452	74,588	20,067	152,415	45,535	383
18	6.3	58.2	-35.2	-25.4	7.8	89.4	14.7	20.7	50.2	7.6
19	.....	.....	.....	.....	11,240	15,086	1,700	.....	7,500	.....
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	96	1,012	64	102	807	1,159	217	622	637	33
21	103	619	35	127	610	889	109	521	384	39
Main ditches:										
22	96	34	38	116	91	134	88	96	50	.....
23	110	309	35	147	301	213	64	291	288	24
24	342	82	131	135	235	269	64	141	137	.....
25	236	180	194	201	500	238	61	466	259	7
26	454	780	657	1,369	2,649	1,937	284	1,291	1,653	.....
27	372	876	437	1,176	2,825	1,556	366	1,315	1,464	11
Laterals:										
28	33	116	53	213	221	254	80	81	107	.....
29	46	115	46	62	262	5	12	237	244	.....
30	3	73	216	66	196	148	29	30	18	.....
31	32	246	108	16	288	8	33	283	140	.....
Reservoirs:										
32	25	27	17	1	201	7	19	99	134	.....
33	24	19	29	.....	131	2	6	83	68	27
34	50,021	1,044	10,112	240	113,996	698	5,996	1,399	22,142	.....
35	26,438	189	52,354	.....	58,440	352	5,202	96,969	26,845	2
Flowing wells:										
36	3	365	.....	6	306	.....	4	124	5	1
37	.....	588	.....	3	553	.....	.....	79	.....	.....
38	38	34,199	.....	476	69,110	.....	600	20,310	231	.....
39	.....	92,689	.....	504	90,331	.....	.....	21,625	.....	.....
Pumped wells:										
40	5	1,151	31	.....	837	1,433	365	675	1,122	48
41	5	580	2	.....	792	1,168	87	449	438	39
42	146	549,910	4,532	.....	378,010	480,229	104,860	400,293	147,860	1,725
43	48	260,947	289	.....	289,472	260,303	25,622	209,747	110,807	4,444
Pumping plants:										
44	8	1,002	44	2	628	1,465	183	583	651	45
45	4	433	5	.....	405	1,192	54	402	363	39
46	38	24,495	276	170	15,473	17,283	4,009	20,120	5,190	154
47	12	8,575	30	.....	11,067	5,059	677	10,700	2,857	89
48	464	604,759	8,131	9,000	404,046	788,172	114,360	423,835	161,517	1,807
49	848	286,003	1,284	.....	346,788	335,666	29,452	233,186	112,256	4,444
50	31	51	29	10	58	28	34	82	52	83
<b>CAPITAL INVESTED.</b>										
51	1,190,790	6,501,903	1,162,774	226,717	12,473,520	3,810,695	754,861	8,738,603	4,948,939	70,831
52	1,569,028	1,948,246	2,798,740	107,118	5,648,469	1,452,471	177,924	9,416,960	3,753,127	21,975
53	-24.1	233.7	-58.5	111.7	120.8	182.4	324.3	-7.2	31.9	222.3
54	238.06	63.70	42.25	8.90	96.85	36.90	43.62	72.34	153.94	171.92
55	368.40	30.69	119.78	2.85	54.72	20.76	12.90	109.36	120.27	57.38
<b>ESTIMATED FINAL COST.</b>										
56	1,190,790	6,758,018	1,163,209	226,717	14,796,051	4,291,620	767,701	8,938,516	5,592,954	70,831
57	1,569,028	1,948,246	2,798,740	107,118	5,698,469	1,452,471	267,924	13,038,449	3,767,127	21,975
58	-24.1	246.9	-58.4	111.7	156.6	185.5	186.5	-31.4	48.5	222.3
59	212.60	59.79	29.08	8.02	65.20	30.38	33.35	48.57	81.77	171.92
60	297.90	27.27	45.32	2.83	27.08	19.47	13.35	85.55	82.73	57.38



IRRIGATION—CALIFORNIA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	San Joaquin.	San Luis Obispo.	San Mateo.	Santa Barbara.	Santa Clara.	Santa Cruz.	Shasta.	Sierra.	Siakiyou.	Solano.
1 Number of all farms in 1920.....	4,500	1,803	624	1,485	5,016	1,759	949	77	1,052	1,358
2 Number of farms irrigated in 1919.....	3,047	143	205	437	2,649	145	598	62	584	278
3 Per cent of all farms.....	67.7	7.9	32.9	29.4	52.8	8.2	63.0	80.5	55.5	20.5
4 Number of farms irrigated in 1909.....	1,452	91	75	137	1,101	108	639	94	636	180
5 Per cent of increase, 1909-1919.....	109.8	.....	.....	219.0	140.6	86.8	-8.4	.....	-8.2	85.3
<b>LAND AND FARM AREA.</b>										
6 Approximate land area.....acres	926,720	2,133,760	286,080	1,753,600	849,920	278,400	2,489,120	590,720	4,003,840	526,080
7 All land in farms.....acres	706,308	1,377,536	117,109	869,781	678,812	144,751	565,235	60,667	537,396	408,298
8 Improved land in farms.....acres	596,403	402,299	77,736	210,363	206,890	67,838	103,470	21,607	166,621	299,264
9 Area irrigated in 1919.....acres	183,923	5,302	7,142	16,335	70,312	1,204	50,215	15,292	65,602	23,650
10 Per cent of improved land in farms.....	30.7	1.3	9.2	7.8	34.0	1.9	48.5	70.8	39.4	7.9
11 Area irrigated in 1909.....acres	59,811	1,637	3,648	12,012	37,637	1,201	33,004	17,504	60,301	3,610
12 Per cent of increase, 1909-1919.....	207.5	214.3	95.8	36.0	86.8	7.7	52.1	-12.6	8.8	55.1
13 Area enterprises were capable of irrigating in 1920.....acres	231,125	10,872	8,164	34,408	75,348	2,069	53,903	15,873	70,987	28,702
14 Area enterprises were capable of irrigating in 1910.....acres	77,088	2,416	3,653	13,572	50,939	1,313	36,564	17,505	66,866	7,160
15 Per cent of increase, 1910-1920.....	199.8	350.0	123.5	153.5	47.9	57.6	61.1	-9.3	6.2	300.9
16 Area included in enterprises in 1920.....acres	324,404	11,229	9,449	37,795	86,761	2,700	110,382	16,547	130,654	36,078
17 Area included in enterprises in 1910.....acres	173,563	2,539	3,983	13,603	60,140	2,232	72,653	18,249	79,161	8,192
18 Per cent of increase, 1910-1920.....	86.9	342.3	137.2	177.8	44.3	21.0	51.9	1.6	65.0	340.4
19 Area of irrigated land reported as available for settlement.....acres	.....	.....	.....	.....	.....	.....	15,000	.....	2,800	.....
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20 Number, 1920.....	1,233	128	206	275	1,561	67	326	70	455	251
21 Number, 1910.....	1,206	65	85	108	842	97	472	100	572	132
Main ditches:										
22 Number, 1920.....	256	38	15	55	26	11	385	87	714	36
23 Number, 1910.....	298	51	57	76	458	81	446	119	595	20
24 Length, 1920.....miles	1,089	20	7	31	30	2	550	80	850	45
25 Length, 1910.....miles	308	42	58	75	228	41	678	150	688	22
26 Capacity, 1920.....second-feet	2,609	53	13	312	328	7	3,970	282	4,255	111
27 Capacity, 1910.....second-feet	5,416	84	458	140	1,511	161	3,150	2,304	2,576	101
Laterals:										
28 Number, 1920.....	417	5	54	47	6	1	118	48	316	52
29 Number, 1910.....	49	5	.....	4	39	.....	130	4	172	.....
30 Length, 1920.....miles	888	.....	.....	7	21	.....	151	15	109	35
31 Length, 1910.....miles	192	.....	.....	5	27	.....	81	1	41	.....
Reservoirs:										
32 Number, 1920.....	25	15	157	83	8	10	12	1	29	4
33 Number, 1910.....	73	8	8	32	142	55	10	3	29	3
34 Capacity, 1920.....acre-feet	36,037	21	1,244	14,052	21	88	6,812	.....	4,591	.....
35 Capacity, 1910.....acre-feet	134,014	52	33	13	9	1,228	3,903	8	107	1
Flowing wells:										
36 Number, 1920.....	3	19	17	33	80	1	3	.....	5	4
37 Number, 1910.....	.....	4	.....	7	438	2	.....	.....	.....	.....
38 Capacity, 1920.....gallons per minute	180	3,808	25,723	4,841	13,075	125	150	.....	1,350	.....
39 Capacity, 1910.....gallons per minute	70	70	.....	250	110,816	10	290	.....	.....	.....
Pumped wells:										
40 Number, 1920.....	1,376	161	229	296	2,189	44	4	1	26	322
41 Number, 1910.....	1,618	12	40	113	800	58	34	.....	3	125
42 Capacity, 1920.....gallons per minute	630,697	35,852	27,009	101,925	648,247	11,076	1,340	500	9,995	145,982
43 Capacity, 1910.....gallons per minute	432,281	4,416	3,956	24,520	237,668	3,393	6,550	.....	250	70,336
Pumping plants:										
44 Number, 1920.....	1,371	119	251	235	1,572	59	51	1	45	281
45 Number, 1910.....	1,304	31	59	65	537	70	61	.....	10	127
46 Engine capacity, 1920.....horsepower	13,987	1,692	2,219	5,657	33,721	686	694	.....	2,903	4,547
47 Engine capacity, 1910.....horsepower	7,582	155	421	1,442	9,404	384	418	.....	69	1,562
48 Pump capacity, 1920.....gallons per minute	997,850	62,519	26,400	543,273	780,874	19,378	47,896	500	125,674	199,892
49 Pump capacity, 1910.....gallons per minute	563,184	12,116	8,341	37,135	338,915	16,324	31,937	.....	1,217	100,715
50 Average lift, 1920.....feet	28	25	78	51	56	42	17	6	40	34
<b>CAPITAL INVESTED.</b>										
51 Capital invested to Jan. 1, 1920.....dollars	7,432,763	304,119	488,856	1,418,022	4,364,808	388,145	3,020,700	100,810	1,589,073	535,348
52 Capital invested to July 1, 1910.....dollars	1,689,720	32,311	90,921	370,186	1,337,216	76,621	430,766	69,650	370,627	135,532
53 Per cent of increase, 1910-1920.....	339.9	841.2	437.7	283.1	226.4	406.6	601.2	44.7	328.8	285.0
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars	32.16	27.97	59.88	41.21	57.63	137.60	51.28	6.35	22.39	18.65
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars	21.92	13.37	24.89	27.28	26.25	58.36	11.78	3.98	5.54	18.98
<b>ESTIMATED FINAL COST.</b>										
56 Estimated final cost of existing enterprises in 1920.....dollars	7,516,649	317,729	491,366	1,493,233	4,551,153	388,645	3,344,079	101,940	1,814,803	660,348
57 Estimated final cost of existing enterprises in 1910.....dollars	3,324,720	32,311	90,921	370,186	1,337,216	76,621	430,766	69,650	370,627	135,532
58 Per cent of increase, 1910-1920.....	126.1	883.3	440.4	304.7	240.3	407.2	653.7	46.4	389.7	313.4
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars	23.17	28.30	52.00	39.64	52.46	143.94	30.30	5.50	13.89	15.53
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars	19.16	12.73	22.83	27.21	22.24	34.33	6.07	3.82	4.63	16.54

IRRIGATION—CALIFORNIA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Sonoma.	Stanislaus.	Sutter.	Tehama.	Trinity.	Tulare.	Tuolumne.	Ventura.	Yolo.	Yuba.
1 Number of all farms in 1920.....	5,739	4,586	1,437	1,414	377	6,372	303	1,543	1,613	487
2 Number of farms irrigated in 1919.....	113	4,091	689	640	217	5,184	149	818	688	242
3 Per cent of all farms.....	2.0	89.6	46.8	45.3	57.6	81.4	41.0	53.0	42.7	49.7
4 Number of farms irrigated in 1909.....	38	1,911	39	366	201	3,048	157	489	333	112
5 Per cent of increase, 1909-1919.....		114.1		74.9	8.0	70.1	-5.1	67.3	106.6	116.1
<b>LAND AND FARM AREA.</b>										
6 Approximate land area..... acres..	1,012,480	928,000	399,120	1,872,000	1,981,440	3,107,840	1,401,600	1,189,120	648,960	404,480
7 All land in farms..... acres..	748,147	748,678	288,940	1,124,502	130,230	1,084,234	220,730	384,865	398,165	228,797
8 Improved land in farms..... acres..	251,730	477,871	232,070	232,722	15,078	544,598	35,380	189,924	300,094	98,997
9 Area irrigated in 1919..... acres..	2,126	197,249	47,305	23,153	5,810	398,662	2,892	31,716	42,493	20,773
10 Per cent of improved land in farms.....	0.8	41.3	20.4	9.9	38.5	73.2	8.2	16.7	14.2	21.0
11 Area irrigated in 1909..... acres..	631	84,015	1,173	14,281	6,324	265,404	2,035	25,273	11,754	3,073
12 Per cent of increase, 1909-1919.....	238.9	134.8		62.1	-8.1	50.2	42.1	25.5	261.5	576.0
13 Area enterprises were capable of irrigating in 1920..... acres..	3,091	309,362	98,984	39,415	9,041	658,386	2,943	35,875	65,440	24,049
14 Area enterprises were capable of irrigating in 1910..... acres..	761	141,785	1,361	23,167	7,127	337,938	2,083	49,407	14,697	6,401
15 Per cent of increase, 1910-1920.....	306.2	118.2		70.1	26.9	94.8	41.3	-27.4	345.3	275.7
16 Area included in enterprises in 1920..... acres..	11,256	375,270	102,945	44,670	15,010	764,733	25,371	50,737	104,716	71,995
17 Area included in enterprises in 1910..... acres..	951	340,914	1,959	36,020	9,513	466,735	5,958	56,357	55,967	43,322
18 Per cent of increase, 1910-1920.....		10.1		24.0	57.8	63.8	325.8	-10.0	87.1	56.4
19 Area of irrigated land reported as available for settlement..... acres..		77,833		2,900		2,700			20,906	6,720
<b>IRRIGATION WORKS.</b>										
<b>Independent enterprises:</b>										
20 Number, 1920.....	93	106	497	333	222	3,570	83	130	254	78
21 Number, 1910.....	40	27	21	270	193	908	61	189	47	39
<b>Main ditches:</b>										
22 Number, 1920.....	5	94	67	150	261	211	50	23	28	67
23 Number, 1910.....	32	23	13	138	208	752	62	148	8	36
24 Length, 1920..... miles..	2	607	100	193	245	770	63	42	139	188
25 Length, 1910..... miles..	21	153	6	164	228	1,033	153	177	87	129
26 Capacity, 1920..... second-feet..	6	6,150	1,168	1,111	1,536	8,018	251	169	1,641	786
27 Capacity, 1910..... second-feet..	14	3,074	27	1,325	802	6,526	245	627	214	396
<b>Laterals:</b>										
28 Number, 1920.....	2	914	201	97	55	432	32	48	43	43
29 Number, 1910.....		34		41	41	577	11	53	8	13
30 Length, 1920..... miles..		1,074	182	226	15	1,252	130	30	155	105
31 Length, 1910..... miles..		274		40	13	629	24	87	83	87
<b>Reservoirs:</b>										
32 Number, 1920.....	4	4	4	14	41	527	15	23	3	9
33 Number, 1910.....	8	5	6	43	30	63	9	32	5	5
34 Capacity, 1920..... acre-feet..		75,156	2	185	90,458	112,806	6,086	2,749	151	6,651
35 Capacity, 1910..... acre-feet..	1	30,016	1	311	427	1,326	10	80	2	80
<b>Flowing wells:</b>										
36 Number, 1920.....	1	1	2			23		42		
37 Number, 1910.....						79		32		
38 Capacity, 1920..... gallons per minute..		400	800	1		7,173		11,435		
39 Capacity, 1910..... gallons per minute..				8		35,513	14	17,455		
<b>Pumped wells:</b>										
40 Number, 1920.....	78	100	742	281	5	4,515	2	149	285	49
41 Number, 1910.....	11	3	18	141	1	794	4	157	58	11
42 Capacity, 1920..... gallons per minute..	28,331	84,205	319,535	96,585	605	1,776,335	25	89,734	168,698	30,551
43 Capacity, 1910..... gallons per minute..	6,831	950	6,616	16,275	750	237,420	16	64,829	29,409	1,605
<b>Pumping plants:</b>										
44 Number, 1920.....	98	114	628	261	12	3,758	4	105	276	41
45 Number, 1910.....	27	21	19	165	3	739	7	126	46	11
46 Engine capacity, 1920..... horsepower..	614	4,803	10,541	2,190	69	45,032	12	5,592	8,852	2,365
47 Engine capacity, 1910..... horsepower..	134	707	124	751	34	7,864	89	2,976	981	62
48 Pump capacity, 1920..... gallons per minute..	33,524	232,785	826,630	106,285	3,990	2,331,179	25	94,130	549,814	29,852
49 Pump capacity, 1910..... gallons per minute..	16,763	185,950	6,616	39,680	1,920	244,318	785	72,704	69,694	1,605
50 Average lift, 1920..... feet..	19	31	21	27	15	43	36	82	26	24
<b>CAPITAL INVESTED.</b>										
51 Capital invested to Jan. 1, 1920..... dollars..	107,314	9,639,519	2,931,118	1,048,959	206,875	12,529,432	965,667	2,691,027	2,003,591	1,486,598
52 Capital invested to July 1, 1910..... dollars..	13,801	4,051,870	18,800	263,055	173,414	5,634,379	180,474	2,262,205	311,660	198,268
53 Per cent of increase, 1910-1920.....	677.6	137.9		298.8	19.3	122.4	435.1	19.0	542.9	649.8
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	34.72	31.16	30.22	26.61	22.88	19.03	328.12	75.01	30.62	61.82
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	18.14	28.58	13.81	11.35	24.33	16.67	86.64	45.79	21.21	30.97
<b>ESTIMATED FINAL COST.</b>										
56 Estimated final cost of existing enterprises in 1920..... dollars..	125,064	17,006,504	3,239,043	1,081,145	215,025	12,973,885	965,667	3,066,027	3,629,826	1,981,373
57 Estimated final cost of existing enterprises in 1910..... dollars..	13,801	5,326,870	18,800	342,555	173,414	5,643,379	180,474	2,317,205	311,660	198,268
58 Per cent of increase, 1910-1920.....	806.2	219.8		215.6	24.0	129.9	435.1	82.8		899.3
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	11.11	45.32	31.46	24.20	14.33	16.97	33.06	60.43	34.66	37.52
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	14.51	15.68	9.60	9.51	18.23	12.09	30.29	41.12	5.57	4.28

# COLORADO.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Colorado collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

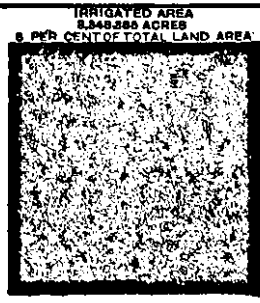
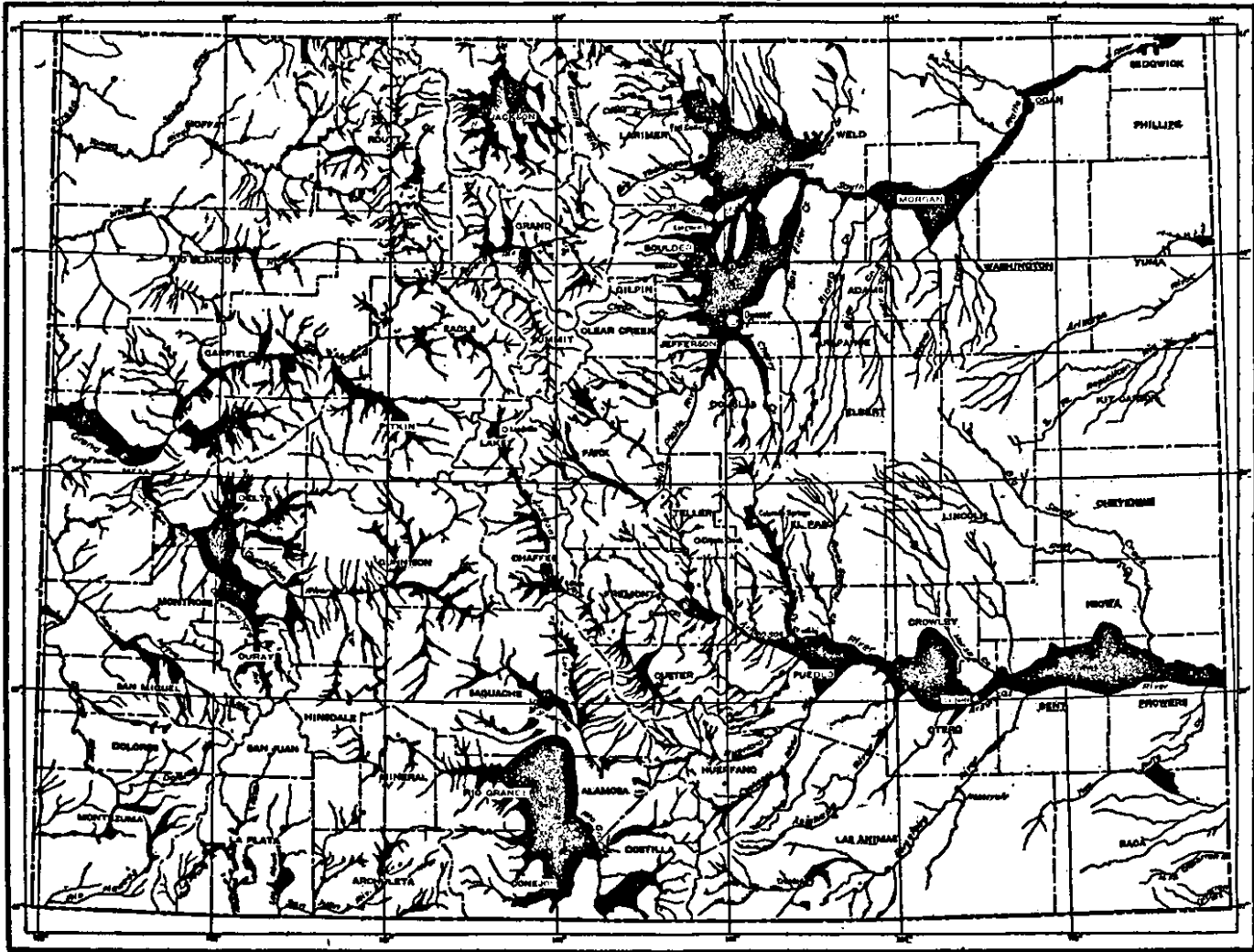
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	59,934	46,170	13,764	29.8
Approximate land area of the state.....acres..	66,341,120	66,341,120		
All land in farms.....acres..	24,462,014	13,532,113	10,929,901	80.8
Improved land in farms.....acres..	7,744,757	4,302,101	3,442,656	80.0
Number of farms irrigated.....	28,756	25,857	2,899	11.2
Area irrigated.....acres..	3,348,385	2,792,032	556,353	19.9
Area enterprises were capable of irrigating.....acres..	3,855,348	3,990,168	-134,818	-3.4
Area included in enterprises.....acres..	5,220,588	5,917,457	-696,869	-11.8
Per cent irrigated:				
Number of all farms.....	48.0	56.0	-8.0	
Approximate land area of the state.....	5.0	4.2	0.8	
Land in farms.....	13.7	20.6	-6.9	
Improved land in farms.....	43.2	64.9	-21.7	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	508,963	1,198,134	-691,171	-57.7
Excess of area included in enterprises over area irrigated.....acres..	1,872,203	3,125,425	-1,253,222	-40.1
Area of irrigated land reported as available for settlement.....acres..	274,282	( <sup>2</sup> )		
Capital invested.....	\$88,302,442	\$56,636,443	\$31,665,999	55.9
Average per acre enterprises were capable of irrigating.....	\$22.90	\$14.19	\$8.71	61.4
Estimated final cost of existing enterprises.....	\$95,198,423	\$76,443,239	\$18,755,184	24.5
Average per acre included in enterprises.....	\$18.24	\$12.92	\$5.32	41.2
Average cost of operation and maintenance per acre.....	\$0.87	\$0.75	\$0.12	16.0
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	6,634	9,065	-2,431	-26.8
Number of main ditches.....	8,867	8,405	462	5.5
Length of main ditches.....miles..	19,022	17,564	1,458	8.3
Capacity of main ditches.....second-feet..	119,558	148,483	-28,925	-19.5
Number of lateral ditches.....	6,185	5,612	573	10.2
Length of lateral ditches.....miles..	8,571	5,006	3,565	71.2
Number of reservoirs.....	979	1,084	-105	-9.7
Capacity of reservoirs.....acre-feet..	2,406,372	2,646,593	-240,221	-9.1
Number of flowing wells.....	476	313	163	52.1
Capacity of flowing wells.....gallons per minute..	20,139	41,989	-21,850	-52.0
Number of pumped wells.....	527	121	406	335.5
Capacity of pumped wells.....gallons per minute..	210,094	53,564	156,530	292.2
Number of pumping plants.....	406	206	200	97.1
Engine capacity.....horsepower..	8,635	7,969	666	8.4
Pump capacity.....gallons per minute..	299,726	296,937	2,789	0.9
Average lift.....feet..	23	( <sup>2</sup> )	23	

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not reported in 1910.

# COLORADO

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



## CLIMATIC CONDITIONS.

The main ranges of the Rocky Mountains divide the state of Colorado approximately in half, east and west. In the mountainous section, through the middle of the state, the precipitation is heavy. Both east and west of the mountains it decreases. That part of the state east of the mountains consists of high plains sloping to the east, with a divide running from the base of the mountains to the eastern line of the state. From this divide the land slopes to the north toward South Platte River and to the south toward Arkansas River. The precipitation drops abruptly near the base of the mountains and gradually increases toward the east, the normal precipitation on the plains being between 12 and 15 inches, being highest on the divide between the South Platte and the Arkansas and lowest in the stream valleys. The heaviest precipitation occurs in the summer months. In all of the plains section some crops are grown without irrigation, but irrigation is practiced wherever water is available. In this part of the state the area of land susceptible of irrigation is practically unlimited, but the water supply is sufficient for only a small part of the land.

To the west of the main ranges of mountains the country is very much broken by short ranges of mountains and hills, and precipitation varies greatly with altitude and exposure. The valleys of the western slope have the smallest annual precipitation in the state, the normal being but 7 or 8 inches in the valley of Grand River and in the northwestern part of the state. In these lower valleys crops can not be grown successfully without irrigation. In this western half of the state the tillable land is limited to the comparatively narrow valleys, most of the remainder of the land being too rough for cultivation.

In the south central part of the state, on the headwaters of the Rio Grande, lies the San Luis Valley, which contains a large area of level land. The altitude is high, the seasons are short, and the normal precipitation is less than 10 inches. Toward the base of the mountains that surround the valley the precipitation is heavier and crops are grown without irrigation.

In the north central part of the state is a similar high valley on the headwaters of the North Platte. This valley is not so extensive as the San Luis Valley, and the rainfall is slightly greater.

For the state as a whole the precipitation for 1919 was slightly above the normal, but it was considerably below normal in the South Platte Valley and considerably above normal in the Arkansas Valley. On the western slope it was about normal.

The state has a large percentage of sunshine with a low relative humidity, making very favorable climatic conditions for crop growing, when sufficient moisture is available, from either rainfall or irrigation.

## WATER SUPPLY FOR IRRIGATION.

From the high mountain mass in central Colorado streams flow in all directions. To the east the South Platte and the Arkansas flow across the plains into Nebraska and Kansas, respectively; to the south the Rio Grande flows into and through New Mexico; to the west flow the Grand and other streams that unite to form the Colorado; and to the north flows the North Platte, into and through Wyoming. On all these streams there is more or less controversy between water users in Colorado and those in the lower states. These mountains receive a heavy snowfall in winter, and the melting snows supply most of the spring and summer flow of the streams, although the summer rains help to keep up stream flow. All of the streams heading in the mountains have high floods in the early summer, with much reduced flow during the late summer and autumn. The floods supply abundant water for grain and hay crops that mature in June and July, but the growing of crops that have a long growing season and mature in the fall, such as potatoes, beets, orchard fruits, and alfalfa, requires storage of the flood and winter flow of the streams.

In the valleys of the South Platte and the Arkansas many reservoirs have been built, and most of the flood and winter flow is stored. These streams are typical plains streams, and in their natural condition lost in the sands in their courses across the plains much of the water flowing in them as they left the mountains. The irrigation of the lands along these rivers has caused a large inflow by seepage from the watered lands, resulting in a much better supply of water along their courses than was available before irrigation began. The storage of flood waters and return seepage have made possible a large extension of the irrigated areas on the lower reaches of these rivers.

On account of the limited area on the western slope susceptible of irrigation and the large flow of the streams there has not been so much necessity for storage, and consequently, there are few reservoirs.

The existence of an abundant supply of water on the western slope and an unlimited area of irrigable land on the plains has led to the diversion of some water from the streams on the western side of the mountains to the streams flowing onto the plains and to the formulation of plans for diverting much larger volumes. On the other hand, there are plans for storing the surplus water on the western slope for use on lands in Arizona and California that can be reached by canals from Colorado River.

Up to the present time there has been little occasion to use underground water for irrigation. No doubt large quantities of water can be pumped from wells.

On the plains there are many drainage channels which carry water during storms or when local snows are melting, but their supply is so uncertain that they are of little value for irrigation.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Num-ber.	Per cent of in-crease.	Per cent of all farms.	Acres.	Per cent of in-crease.	Per cent of total land area.	Per cent of land in farms.	Per cent of im-proved land in farms.
1920.....	28,756	11.2	48.0	3,348,385	19.9	5.0	13.7	43.2
1910.....	25,857	46.8	56.0	2,792,032	73.3	4.2	20.6	64.9
1900.....	17,613	82.3	71.3	1,611,271	80.9	2.4	17.0	70.9
1890.....	9,659		58.9	890,735		1.3	19.4	43.8

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Num-ber of enter-prises.	Area in-cluded in enter-prises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enter-prises were ca-pable of irrigating in 1920 (acres).
			Acres.	Per cent of acre-ge in enter-prises.	
Total.....	6,034	5,220,588	3,348,385	64.1	3,855,348
Before 1860.....	38	43,371	37,742	87.0	38,440
1860-1869.....	507	714,931	634,865	88.8	660,950
1870-1879.....	976	859,680	647,771	75.4	710,167
1880-1889.....	1,799	1,633,747	1,155,088	70.7	1,315,772
1890-1899.....	953	494,975	294,493	59.5	344,834
1900-1904.....	594	412,782	210,678	51.0	282,857
1905-1909.....	494	609,773	215,729	35.4	289,617
1910-1914.....	525	318,365	80,674	25.3	124,976
1915-1919.....	393	57,815	19,835	34.4	30,626
Not reported.....	355	75,149	51,465	68.5	57,109

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enter-prises were ca-pable of irrigating in 1920 (acres).	Area in-cluded in enter-prises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	3,348,385	2,792,032	556,353	19.9	3,855,348	5,220,588
Streams, gravity.....	3,028,787	2,745,035	283,752	10.3	3,465,037	4,459,303
Streams, pumped.....	12,747	13,248	-501	-3.8	20,256	26,699
Streams, pumped and gravity.....	9,480	( <sup>2</sup> )	9,430		9,525	9,820
Wells, pumped.....	10,114	3,111	7,003	225.1	18,061	19,840
Wells, flowing.....	4,191	5,171	-980	-19.0	4,335	5,934
Wells, flowing and pumped.....	85	( <sup>2</sup> )	85		160	2,045
Lakes, pumped.....	871	634	237	27.4	1,171	1,249
Lakes, gravity.....	2,867	422	2,445	579.4	3,589	5,247
Springs.....	10,856	8,320	2,536	30.5	13,677	13,711
Stored storm water.....	16,909	16,091	818	5.1	33,139	53,298
City water.....	11	( <sup>2</sup> )	11		19	38
Sewage.....	195	( <sup>2</sup> )	195		255	460
Streams, gravity, and pumped wells.....	16,258	( <sup>2</sup> )	16,258		16,564	17,183
Streams, gravity, and flowing wells.....	67,880	( <sup>2</sup> )	67,880		82,520	179,745
Other mixed.....	165,825	( <sup>2</sup> )	165,825		187,157	413,973
Other and not reported.....	1,359	( <sup>2</sup> )	1,359		1,883	2,038

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

The original irrigation district law in Colorado was enacted in 1901, and it has been amended from time to time since that date. Generally, irrigation dis-

tricts have been organized to take over works already built, but in Colorado this form of organization has been utilized to a considerable extent for building new works. In some instances they have taken over cooperative or commercial enterprises, but the larger part of the acreage credited to districts in Table 5 represents enterprises originally undertaken by districts.

In addition to supplying water to lands in its own projects, as shown in Table 5, the United States Reclamation Service works delivered water to about 8,500 acres in other enterprises under the terms of the Warren Act (act of Congress, Feb. 21, 1911).

The state of Colorado accepted the conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1895, and has amended this law from time to time, but very little has been accomplished under this law.

Colorado undertook the construction of irrigation works by the use of convict labor, but this policy was abandoned and the works that were begun were turned over to other agencies.

The small area credited to the state in Table 5 belongs to a state institution and does not represent a scheme of state construction.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
ACREAGE IRRIGATED.				
Total.....	3,348,385	2,792,032	556,353	19.9
Individual and partnership.....	1,014,412	1,226,025	-211,613	-17.3
Cooperative.....	1,789,385	1,273,141	516,244	40.5
Irrigation district.....	248,409	115,304	133,106	115.4
Carey Act.....	2,430	485	1,945	401.0
Commercial.....	212,138	159,457	52,681	33.0
U. S. Reclamation Service.....	* 71,145	16,600	54,545	328.6
U. S. Indian Service.....	4,266	1,020	3,246	318.2
State.....	80	( <sup>2</sup> )	80	
City.....	5,825	( <sup>2</sup> )	5,825	
Not reported.....	295	( <sup>2</sup> )	295	
ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.				
Total.....	3,855,348	3,990,166	-134,818	-3.4
Individual and partnership.....	1,194,422	1,581,941	-387,519	-24.5
Cooperative.....	1,993,361	1,870,447	122,914	6.6
Irrigation district.....	269,504	207,570	61,934	29.8
Carey Act.....	16,000	6,085	9,915	163.5
Commercial.....	226,641	292,103	-65,462	-22.4
U. S. Reclamation Service.....	* 135,265	30,000	105,265	350.9
U. S. Indian Service.....	14,900	2,020	12,880	637.6
State.....	80	( <sup>2</sup> )	80	
City.....	5,825	( <sup>2</sup> )	5,825	
Not reported.....	350	( <sup>2</sup> )	350	
ACREAGE INCLUDED IN ENTERPRISES.				
Total.....	5,220,588	5,917,457	-696,869	-11.8
Individual and partnership.....	1,730,635	2,039,533	-308,898	-15.1
Cooperative.....	2,419,267	2,436,367	-17,100	-0.7
Irrigation district.....	504,973	487,370	17,603	3.6
Carey Act.....	34,000	59,480	-25,480	-42.8
Commercial.....	353,243	681,687	-328,444	-47.4
U. S. Reclamation Service.....	* 150,515	193,000	-42,485	-22.0
U. S. Indian Service.....	16,100	20,020	-3,920	-19.6
State.....	80	( <sup>2</sup> )	80	
City.....	6,425	( <sup>2</sup> )	6,425	
Not reported.....	350	( <sup>2</sup> )	350	

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Does not include about 8,500 acres to which water is supplied under the Warren Act.  
<sup>3</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Colorado relating to water rights are summarized in the following paragraphs:

The territory of Colorado was organized in 1861, and the first territorial legislature enacted a law declaring the right of persons holding land on the banks or margins or in the neighborhood of streams to use the water for purposes of irrigation, and providing for securing the right of way for ditches to lands not bordering the streams. The supreme court of the state has held that this is not a recognition of riparian rights, but rather of the right to take water away from the streams. (Crippen v. White, 28 Colo., p. 298.)

During the territorial period the legislature enacted many laws chartering ditch companies, and granting them the right to construct ditches and collect charges for supplying water, but it enacted no further general legislation.

The state of Colorado was admitted to the Union in 1876. The constitution of the state, adopted March 14, 1876, declared that "The water of every natural stream not heretofore appropriated within the state of Colorado is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided," and "The right to divert unappropriated waters of any natural stream for beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose."

In 1881 a law was enacted requiring parties building irrigation works to file in the county offices maps and statements describing their works and the intended use of water. This act was declared unconstitutional in 1899 (Lamar Canal Co. v. Amity Canal Co., 26 Colo., p. 370), but during the 18 years from its passage to 1899 many filings were made in the county offices throughout the state.

A law requiring the filing of maps and plans in the office of the state engineer was enacted in 1903, and this law, with various amendments, is still in force. This filing is not an application for permission to appropriate water, no such permits being required in Colorado.

Colorado was the pioneer state in providing a special procedure in the courts for defining rights to water. A law enacted in 1879 divided the state into districts, gave the district courts exclusive jurisdiction of water-right adjudications, and provided that on or before July 5, 1879, the district judges should appoint referees who were to bring actions to define all rights to water and formulate decrees. This law was superseded in 1881 by a law requiring all claimants to file statements of their claims with the clerks of the appropriate district courts on or before June 1, 1881, and providing that at any time after that date any one or more parties claiming water from any stream might petition the court having jurisdiction of the stream for an adjudication of all rights to water from that stream. This law, with provision for the defining of rights acquired after an adjudication, is still in force.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909
	Acres.	Per cent of total.	Per cent of total.
Total.....	3,343,385	100.0	100.0
Appropriation and use.....	114,616	3.4	9.3
Notice filed and posted.....	209,262	6.2	5.1
Adjudicated by court.....	2,918,338	87.2	84.4
Underground.....	14,538	0.4	(1)
Other and mixed.....	12,275	0.4	(1)
Not reported.....	79,291	2.4	(1)

<sup>1</sup> All land for which the class of rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase.		
Total.....	3,343,385	1,754,761	90.8	5,220,588	3,855,348
South Platte River and tributaries.....	1,179,880	661,981	78.2	1,607,394	1,280,347
South Platte River direct.....	845,130	218,527	57.9	500,912	379,720
Bear Creek.....	8,778	11,174	-21.4	12,068	10,373
Clear Creek.....	79,172	76,259	3.8	84,450	79,940
St. Vrain Creek.....	244,831	96,583	153.5	281,467	265,731
Big Thompson Creek.....	96,678	68,806	40.5	105,673	98,711
Big Beaver Creek.....	6,429	17,100	-62.4	11,825	10,699
Cache la Poudre River.....	263,708	145,203	81.6	287,963	278,613
Lone Tree Creek.....	2,968	(2)		122,466	5,362
Crow Creek.....	1,945	(2)		7,450	2,250
Other tributaries of South Platte River.....	130,241	*23,329	359.7	193,085	148,948
Republican River and tributaries.....	8,441	5,097	65.6	15,507	10,467
Smoky Hill River and tributaries.....	30	(2)		30	30
Arkansas River and tributaries.....	641,476	300,115	113.7	988,533	709,068
Arkansas River direct.....	421,051	212,341	98.3	490,580	438,378
South Fork.....	10,401	5,422	91.8	12,374	10,430
Fountain River.....	20,485	13,370	47.5	39,224	24,964
St. Charles River.....	11,855	3,432	245.4	22,810	13,761
Huerfano River.....	55,528	14,078	294.4	103,554	64,474
Apishapa River.....	8,292	4,089	102.8	65,615	11,430
Purgatoire or Las Animas River.....	43,533	19,702	121.0	51,172	47,402
Other tributaries of Arkansas River.....	70,351	*27,181	158.8	158,704	98,199
Rio Grande and tributaries.....	608,924	308,985	100.3	1,068,666	746,610
Rio Grande direct.....	326,688	187,837	73.9	608,127	420,140
Saguache River.....	38,032	11,730	224.2	41,447	39,393
San Luis River.....	51,829	3,679		175,871	68,309
Alamosa River.....	35,601	15,753	126.0	72,528	40,551
La Jara River.....	10,627	(2)		15,424	12,005
Conejos River.....	88,678	44,035	101.4	115,887	95,680
Trinchera River.....	12,485	3,768	231.3	59,699	19,319
Other tributaries of Rio Grande.....	45,496	*37,183	22.3	74,673	51,243
San Juan River and tributaries.....	87,228	34,757	161.0	152,934	103,675
San Juan River direct.....	1,451	1,947	-25.5	2,939	1,634
Los Pinos River.....	28,762	6,130	369.2	52,946	40,773
Animas River.....	17,819	6,589	158.7	38,043	19,519
La Plata River.....	17,174	6,972	146.3	20,473	17,935
Mancos River.....	9,040	5,115	76.7	18,149	9,494
Other tributaries of San Juan River.....	12,983	*7,704	68.5	20,334	14,330

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Included in "other tributaries" in 1902.  
<sup>3</sup> Includes springs and wells.



TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902—Continued.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Grand River and tributaries..	585,301	300,631	94.7	1,041,637	733,805
Grand River direct.....	71,958	37,878	90.0	125,422	101,249
Fraser River.....	9,331	2,676	248.7	27,010	10,795
Muddy Creek.....	5,050	4,105	23.0	7,255	5,075
Blue River.....	10,541	2,794	277.3	16,297	11,771
Eagle River.....	15,118	10,895	39.1	28,435	15,586
Roaring Fork.....	30,738	21,050	46.0	47,305	34,104
Plateau Creek.....	26,260	13,380	96.3	40,767	25,616
Gunnison River and tributaries.....	250,913	150,254	67.0	409,934	329,756
Gunnison River direct.....	16,813	9,000	86.8	21,649	19,909
Taylor River.....	560	12,018	-85.3	620	620
Tomichi Creek.....	21,752	10,152	114.3	30,298	23,068
North Fork River.....	31,006	17,174	80.5	57,139	33,891
Smith Fork River.....	15,314	5,954	157.2	31,340	25,600
Uncompahgre River.....	86,119	56,399	52.7	139,756	137,756
Other tributaries of Gunnison River.....	70,349	* 39,557	100.6	129,082	88,912
Rio Dolores.....	74,916	21,560	247.5	180,611	84,973
Other tributaries of Grand River.....	90,476	* 36,069	150.8	158,611	114,880
Green River and tributaries..	94,003	82,451	14.0	165,279	115,921
Yampa River and tributaries.....	68,198	59,059	15.5	124,598	86,503
Yampa River direct.....	18,029	( <sup>1</sup> )		23,221	18,632
Little Snake River.....	9,617	( <sup>1</sup> )		16,242	12,449
Other tributaries of Yampa River.....	40,552	( <sup>1</sup> )		80,135	55,222
White River.....	25,625	22,752	12.6	40,441	29,238
Other tributaries of Green River.....	180	* 640	-71.9	240	180
North Platte River and tributaries.....	143,102	65,744	117.7	235,628	155,485
North Platte River direct.....	2,520	( <sup>1</sup> )		23,520	2,520
Laramie River.....	6,160	( <sup>1</sup> )		6,425	6,160
Other tributaries of North Platte River.....	134,422	( <sup>1</sup> )		205,683	146,805

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Included in "other tributaries" in 1902.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$88,302,442	55.9	\$22.90	61.4
1910.....	56,636,443	381.7	14.19	94.4
1900.....	11,758,703	84.6	7.30	2.1
1900.....	6,368,756		7.15	

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$88,302,442	100.0	\$22.90
Before 1860.....	265,060	0.3	6.91
1860-1869.....	14,410,037	16.3	21.80
1870-1879.....	8,150,179	9.2	11.48
1880-1889.....	17,150,419	19.4	13.03
1890-1899.....	7,043,683	8.0	20.43
1900-1904.....	14,101,894	16.0	56.90
1905-1909.....	14,192,932	16.1	49.01
1910-1914.....	11,479,877	13.0	95.68
1915-1919.....	550,890	0.6	17.99
Not reported.....	956,866	1.1	16.76

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$88,302,442	100.0	\$22.90	3,030,771	\$0.87
Streams, gravity.....	68,852,489	78.0	19.87	2,729,530	0.82
Streams, pumped.....	2,490,900	2.8	122.97	11,617	9.49
Streams, pumped and gravity.....	397,392	0.4	41.72	9,430	2.34
Wells, pumped.....	375,277	0.4	23.37	9,350	4.54
Wells, flowing.....	55,251	0.1	12.75	3,847	0.52
Wells, flowing and pumped.....	5,300	( <sup>2</sup> )	33.12	85	4.78
Lakes, pumped.....	27,530	( <sup>2</sup> )	23.51	801	3.21
Lakes, gravity.....	84,935	0.1	23.67	1,751	1.14
Springs.....	183,920	0.2	13.81	7,695	1.20
Stored storm water.....	1,467,459	1.7	44.28	14,648	1.25
City water.....	97	( <sup>2</sup> )	5.11	11	1.82
Sewage.....	1,648	( <sup>2</sup> )	6.46	95	0.71
Streams, gravity, and pumped wells.....	190,454	0.2	11.50	15,913	0.75
Streams, gravity, and flowing wells.....	1,033,076	1.2	12.52	67,890	0.59
Other mixed.....	13,084,359	14.8	69.91	156,697	1.07
Other and not reported.....	47,355	0.1	25.15	1,121	1.60

<sup>1</sup> Based on area irrigated in 1919.  
<sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$88,302,442	\$14,769,561	\$73,532,881	497.9
South Platte River and tributaries.....	36,019,471	4,786,288	31,233,183	652.6
South Platte River direct.....	9,111,900	2,003,610	7,108,290	354.8
Bear Creek.....	137,240	76,635	60,605	79.1
Clear Creek.....	882,209	404,775	477,434	113.0
St. Vrain Creek.....	9,298,122	398,650	8,899,472	33.7
Big Thompson Creek.....	1,102,316	600,166	502,150	83.7
Big Beaver Creek.....	52,600	98,000	-45,400	-46.3
Cachela Poudre River.....	7,907,593	1,065,357	6,842,236	642.2
Lone Tree Creek.....	2,731,100	( <sup>1</sup> )	2,731,100	
Crow Creek.....	51,700	( <sup>2</sup> )	51,700	
Other tributaries of South Platte River.....	4,784,691	* 139,065	4,625,696	
Republican River and tributaries.....	89,463	63,782	25,681	40.3
Smoky Hill River and tributaries.....	1,200	( <sup>1</sup> )	1,200	
Arkansas River and tributaries.....	19,710,289	3,626,670	16,083,619	443.5
Arkansas River direct.....	10,989,245	2,951,550	8,037,695	272.3
South Fork.....	69,000	24,785	44,215	178.4
Fountain River.....	965,287	106,240	859,047	308.6
St. Charles River.....	241,884	22,060	219,824	966.6
Huerfano River.....	3,204,519	73,690	3,131,829	
Apishapa River.....	1,190,695	4,970	1,185,725	
Purgatoire or Las Animas River.....	491,450	151,413	340,037	224.6
Other tributaries of Arkansas River.....	2,558,209	* 292,262	2,265,947	773.2
Rio Grande and tributaries.....	4,825,660	1,979,939	2,845,721	143.7
Rio Grande direct.....	1,526,753	1,717,395	-190,642	-11.1
Saguache River.....	103,048	16,165	86,883	537.6
San Luis River.....	184,212	4,220	180,092	
Alamosa River.....	556,909	27,080	529,829	
La Jara River.....	30,275		30,275	
Conejos River.....	584,739	68,242	496,497	727.6
Trinchera River.....	659,890	23,650	636,240	
Other tributaries of Rio Grande.....	1,199,784	* 123,187	1,076,597	873.9
San Juan River and tributaries.....	1,166,170	238,990	927,180	388.0
San Juan River direct.....	25,200	14,925	10,275	68.8
Los Pinos River.....	521,590	80,030	441,560	551.7
Animas River.....	323,638	65,770	257,868	480.3
La Plata River.....	94,613	38,185	56,428	147.8
Mancos River.....	35,477	14,910	20,567	137.9
Other tributaries of San Juan River.....	165,652	* 35,170	130,482	371.0

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Included in "other tributaries" in 1902.  
<sup>3</sup> Includes springs and wells.  
<sup>4</sup> None reported in 1902.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902—Continued.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Grand River and tributaries.....	\$24,281,722	\$3,547,697	\$20,734,025	584.4
Grand River direct.....	5,923,462	477,950	5,445,512	.....
Fraser River.....	56,890	5,235	50,655	967.0
Muddy Creek.....	33,122	8,650	24,472	232.9
Blue River.....	118,608	21,359	97,249	445.9
Eagle River.....	109,012	75,570	33,442	44.3
Roaring Fork.....	407,266	168,170	244,096	149.6
Plateau Creek.....	341,755	60,035	281,720	499.3
Gunnison River and tributaries.....	10,745,787	1,351,906	9,393,881	694.9
Gunnison River direct.....	1,001,819	55,380	946,439	.....
Taylor River.....	6,900	64,985	-58,085	-89.4
Tomichi Creek.....	129,243	28,350	100,893	355.9
North Fork River.....	622,647	272,705	349,942	128.3
Smith Fork River.....	366,075	21,600	374,475	.....
Uncompahgre River.....	6,945,702	643,121	6,302,581	930.0
Other tributaries of Gunnison River.....	1,643,381	* 265,765	1,377,616	518.4
Rio Dolores.....	4,847,569	1,155,793	3,691,776	819.1
Other tributaries of Grand River.....	1,701,301	* 227,029	1,474,272	649.4
Green River and tributaries.....	1,372,889	382,895	989,994	258.6
Yampa River and tributaries.....	923,672	244,785	678,887	277.3
Yampa River direct.....	162,788	(*)	(*)	.....
Little Snake River.....	237,254	(*)	(*)	.....
Other tributaries of Yampa River.....	523,631	(*)	(*)	.....
White River.....	447,141	137,005	310,136	222.4
Other tributaries of Green River.....	2,075	* 1,105	970	87.8
North Platte River and tributaries.....	835,578	143,300	692,278	483.1
North Platte River direct.....	41,200	(*)	(*)	.....
Laramie River.....	51,800	(*)	(*)	.....
Other tributaries of North Platte River.....	742,578	(*)	(*)	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Main stream and tributaries shown as one item in 1902; consequently only increase for group as a whole can be shown.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$38,302,442	100.0	3,030,771	\$6.87
Individual and partnership.....	11,599,833	13.1	854,213	0.70
Cooperative.....	42,911,035	48.6	1,634,568	0.75
Irrigation district.....	16,269,026	18.4	248,409	1.50
Carey Act.....	1,205,983	1.4	2,430	2.88
Commercial.....	5,711,887	5.5	212,135	1.11
U. S. Reclamation Service.....	10,253,231	11.6	71,145	2.59
U. S. Indian Service.....	220,979	0.3	3,766	0.67
State.....	3,994	(*)	80	7.50
City.....	117,665	0.1	4,025	3.17
Not reported.....	8,754	(*)	.....	.....

<sup>1</sup> Based on area irrigated in 1919.  
<sup>2</sup> Less than one-tenth of 1 per cent.

In classifying capital invested by type of enterprise the average capital invested per acre is not presented,

for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies water to enterprises controlled by agencies of other classes shown in the table and a part of its expenditure is properly chargeable to those lands; but the area so served varies from time to time, and consequently it is not possible to tell how much should be charged to such lands or how it should be distributed among the various classes.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	420
Acreage included in enterprises reporting land drained or needing drainage.....	1,526,311
Acreage for which drains have been installed.....	113,899
Additional acreage needing drainage.....	220,711
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	7.5
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	2.2
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	6.4

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-feet.....	37,146	14,558	22,588
Area irrigated in 1919..... acres.....	2,174,612	1,373,031	801,581
Average number of acres per second-foot.....	59	94	35
Total quantity of water entering canals, acre-feet.....	13,877,292	4,848,103	9,029,189
Area irrigated in 1919..... acres.....	2,446,702	1,752,587	694,115
Average quantity per acre..... acre-feet.....	5.7	2.8	13.0
Total quantity of water delivered..... acre-feet.....	3,233,531	1,832,530	1,401,001
Area irrigated in 1919..... acres.....	1,504,593	1,069,659	434,934
Average quantity per acre..... acre-feet.....	2.1	1.7	3.4

IRRIGATION—COLORADO.

IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	3,647	803	8,867	119,558	19,022	6,185	8,571	979	2,406,372
Before 1860.....	35	2	47	1,275	137	55	53	1	938
1860-1869.....	562	61	704	15,006	2,233	914	1,509	60	217,190
1870-1879.....	769	84	1,614	17,903	3,232	710	1,340	109	252,248
1880-1889.....	1,035	170	2,593	35,600	5,472	1,920	2,509	196	462,018
1890-1899.....	380	147	1,204	12,981	2,511	859	643	187	153,435
1900-1904.....	226	68	740	12,389	1,599	521	713	98	304,827
1905-1909.....	294	112	631	13,065	1,799	379	962	142	868,305
1910-1914.....	183	79	557	5,161	1,007	421	423	109	107,673
1915-1919.....	78	39	350	4,662	325	184	60	41	27,570
Not reported.....	85	32	427	1,516	707	222	359	36	12,178

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	217.3	476	20,139	527	210,094	406	8,635	435	299,726
Before 1860.....	0.5			1	700	1	10	1	700
1860-1869.....	30.5			4	2,100	5	68	5	3,100
1870-1879.....	8.1			1	599	4	77	4	2,711
1880-1889.....	15.1	306	12,100	15	9,838	18	240	22	14,807
1890-1899.....	7.8	36	859	19	10,200	18	361	18	16,131
1900-1904.....	19.7	35	1,895	28	11,575	29	310	36	20,805
1905-1909.....	106.9	20	820	37	25,549	42	3,583	55	46,024
1910-1914.....	24.9	29	3,104	132	48,714	115	1,639	115	79,954
1915-1919.....	5.8	17	782	268	84,256	155	2,116	160	106,544
Not reported.....	3.0	11	480	22	7,162	19	231	19	8,950

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	3,647	803	8,867	119,558	19,022	6,185	8,571	979	2,406,372
Individual and partnership.....	3,153	479	8,156	54,191	12,195	3,438	2,441	644	567,316
Cooperative.....	429	260	594	48,985	5,324	1,991	4,144	293	951,984
Irrigation district.....	23	18	48	5,678	681	266	354	25	277,101
Carey Act.....	2	2	4	520	42	5	23	3	57,000
Commercial.....	17	18	35	6,816	468	316	1,035	13	552,947
U. S. Reclamation Service.....	16		11	2,898	217	144	518		
U. S. Indian Service.....	1		6	197	45	13	53		
State.....						10	2		
City.....	6	1	7	232	48			1	26
Not reported.....			2	41	3	2	1		

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	217.3	476	20,139	527	210,094	406	8,635	435	299,726
Individual and partnership.....	66.5	169	8,039	506	198,344	388	4,875	403	264,431
Cooperative.....	36.2	7	100	8	4,500	6	342	7	13,300
Irrigation district.....	10.5	300	12,000			4	2,525	11	3,500
Carey Act.....	41.2								
Commercial.....	44.0					1	600	7	25
U. S. Reclamation Service.....	11.8					1	125	1	11,220
U. S. Indian Service.....									
State.....				8	1,500	1	25	1	1,600
City.....	7.1								
Not reported.....				5	5,750	5	149	5	5,750

IRRIGATION—COLORADO.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
<b>Total</b> .....	<b>3,647</b>	<b>803</b>	<b>3,867</b>	<b>119,558</b>	<b>19,022</b>	<b>6,185</b>	<b>8,571</b>	<b>979</b>	<b>2,406,372</b>
<b>South Platte River and tributaries</b> .....	<b>631</b>	<b>294</b>	<b>1,327</b>	<b>36,837</b>	<b>4,860</b>	<b>1,109</b>	<b>2,230</b>	<b>301</b>	<b>916,770</b>
South Platte River direct.....	103	14	201	12,074	1,259	286	466	22	421,202
Bear Creek.....	29	7	37	359	54	27	8	7	916
Clear Creek.....	81	5	60	1,806	177	65	94	12	6,707
St. Vrain Creek.....	171	83	195	5,600	1,649	219	856	69	123,365
Big Thompson Creek.....	33	22	42	2,810	241	64	146	20	44,617
Big Beaver Creek.....	4	1	8	226	27	1	1	3	103
CACHE LA POUDE RIVER.....	98	89	232	8,379	568	313	1,016	91	237,538
Lone Tree Creek.....	1	1	5	7	3	1	1	1	12
Crow Creek.....	6	9	6	105	8	5	6	9	4,200
Other tributaries of South Platte River.....	306	62	541	4,871	874	128	135	67	77,930
Republican River and tributaries.....	25	7	33	672	67	47	39	4	30
Smoky Hill River and tributaries.....	1	1	1	5	1	1	1	1	5
<b>Arkansas River and tributaries</b> .....	<b>919</b>	<b>154</b>	<b>2,022</b>	<b>28,647</b>	<b>3,529</b>	<b>2,440</b>	<b>2,529</b>	<b>245</b>	<b>1,075,580</b>
Arkansas River direct.....	58	29	198	10,419	980	1,879	1,820	33	395,162
South Fork.....	30	9	65	348	122	42	25	1	202
Fountain River.....	6	9	113	1,046	219	64	21	36	13,246
St. Charles River.....	87	12	114	757	162	42	24	14	3,418
Huerfano River.....	285	22	336	4,336	581	606	350	40	111,627
Apishapa River.....	39	15	52	1,800	103	21	32	15	54,321
Purgatoire or Las Animas River.....	101	9	147	2,606	356	38	30	18	403,099
Other tributaries of Arkansas River.....	313	58	997	7,330	996	348	227	89	94,207
<b>Rio Grande and tributaries</b> .....	<b>566</b>	<b>28</b>	<b>1,081</b>	<b>14,754</b>	<b>1,971</b>	<b>556</b>	<b>1,166</b>	<b>38</b>	<b>265,170</b>
Rio Grande direct.....	47	8	101	5,599	387	141	603	9	53,678
Saguache River.....	152	2	251	752	176	88	78	11	202
San Luis River.....	40	2	252	1,070	349	50	70	2	179
Alamosa River.....	30	2	39	1,321	142	32	58	2	31,750
La Jara River.....	30	2	81	390	69	9	12	2	3,001
Conejos River.....	108	2	105	3,188	317	52	72	2	26,500
Trinchera River.....	27	2	25	1,559	182	7	4	2	150,860
Other tributaries of Rio Grande.....	187	7	227	1,675	349	177	271	5	150,860
<b>San Juan River and tributaries</b> .....	<b>78</b>	<b>6</b>	<b>417</b>	<b>2,775</b>	<b>894</b>	<b>259</b>	<b>148</b>	<b>13</b>	<b>3,430</b>
San Juan River direct.....	5	1	17	97	32	18	2	2	105
Los Pinos River.....	81	3	63	821	192	24	69	1	15
Animas River.....	19	3	121	771	250	40	9	4	150
La Plata River.....	11	3	55	426	133	45	45	1	3,160
Mancos River.....	7	3	38	285	87	11	12	1	150
Other tributaries of San Juan River.....	7	3	128	875	195	121	10	5	3,160
<b>Grand River and tributaries</b> .....	<b>821</b>	<b>234</b>	<b>2,834</b>	<b>24,928</b>	<b>5,430</b>	<b>1,440</b>	<b>1,922</b>	<b>289</b>	<b>120,590</b>
Grand River direct.....	9	5	69	2,541	361	264	233	4	475
Fraser River.....	14	2	61	352	112	2	1	2	10
Muddy Creek.....	49	10	50	254	64	34	7	10	1,727
Blue River.....	46	3	143	467	172	34	7	7	39
Eagle River.....	12	4	123	449	202	19	10	8	105
Roaring Fork.....	17	4	246	1,314	413	163	53	13	804
Plateau Creek.....	3	41	164	790	213	127	81	45	15,973
<b>Gunnison River and tributaries</b> .....	<b>383</b>	<b>118</b>	<b>1,210</b>	<b>12,419</b>	<b>2,257</b>	<b>333</b>	<b>601</b>	<b>140</b>	<b>47,821</b>
Gunnison River direct.....	14	1	63	1,143	151	35	19	1	120
Taylor River.....	187	1	258	1,731	273	7	5	1	11,134
Tomichi Creek.....	19	17	138	1,154	306	87	76	26	1,255
North Fork River.....	5	9	46	562	119	21	38	9	220
Smith Fork River.....	26	4	180	2,402	446	151	359	5	34,752
Uncompahgre River.....	167	86	521	5,337	950	87	104	98	42,958
Other tributaries of Gunnison River.....	87	19	255	2,622	622	143	417	21	10,948
Rio Dolores.....	203	28	580	3,720	1,014	309	534	38	10,948
<b>Green River and tributaries</b> .....	<b>144</b>	<b>78</b>	<b>309</b>	<b>5,333</b>	<b>1,428</b>	<b>302</b>	<b>413</b>	<b>63</b>	<b>9,568</b>
Yampa River and tributaries.....	101	57	542	2,447	1,013	135	370	64	7,860
Yampa River direct.....	16	4	65	493	142	19	12	4	1,569
Little Snake River.....	2	6	77	534	138	13	6	6	883
Other tributaries of Yampa River.....	83	47	400	1,364	733	156	322	54	5,403
White River.....	43	16	265	2,833	403	114	43	19	1,708
Other tributaries of Green River.....	1	1	2	3	2	1	1	1	1
<b>North Platte River and tributaries</b> .....	<b>268</b>	<b>11</b>	<b>393</b>	<b>5,607</b>	<b>842</b>	<b>22</b>	<b>54</b>	<b>10</b>	<b>15,234</b>
North Platte River direct.....	3	2	5	310	16	1	1	2	2,700
Laramie River.....	32	1	38	478	63	11	11	1	75
Other tributaries of North Platte River.....	233	8	350	4,819	763	21	43	7	12,459

IRRIGATION—COLORADO.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	217.3	476	20,139	527	210,094	406	8,635	435	299,726	23
South Platte River and tributaries.....	46.8	4	230	283	124,338	226	3,103	241	166,263	22
South Platte River direct.....	9.7	3	170	90	42,452	76	1,096	78	50,812	22
Bear Creek.....	1.0					1	7	5		40
Clear Creek.....	0.1									
St. Vrain Creek.....	12.7			1		4	100	4	1,000	22
Big Thompson Creek.....	1.9			1	1,200	6	108	6	5,831	17
Big Beaver Creek.....				7	15,250	4	65	6	15,250	26
Cachela Poudre River.....	17.5	1	60	123	53,643	107	1,388	107	74,943	21
Lone Tree Creek.....	0.5			20	6,938	13	172	20	10,160	24
Other tributaries of South Platte River.....	3.4			41	4,825	15	171	15	8,267	26
Smoky Hill River and tributaries.....	0.1									
Arkansas River and tributaries.....	118.6	18	3,140	243	85,756	144	1,936	150	105,287	24
Arkansas River direct.....	13.8	2	315	167	66,235	98	1,564	104	83,636	23
Fountain River.....	11.7	8	30	19	7,700	8	126	8	8,200	21
St. Charles River.....	0.4			3	515	2	16	2	475	32
Huerfano River.....	4.5			11	2,070	6	36	6	2,045	40
Apishapa River.....	0.3			1	144	1	20	1	144	14
Purgatoire or Las Animas River.....	0.1			1		1	7	1	500	7
Other tributaries of Arkansas River.....	87.8	13	2,795	42	8,092	28	167	28	10,087	26
Rio Grande and tributaries.....	5.9	449	16,669	1		1		1		
Rio Grande direct.....		329	13,595							
Saguache River.....		83	2,672	1		1		1		
San Luis River.....	0.2	22	175							
Alamosa River.....	0.1	8	207							
Conejos River.....	0.1	1	20							
Trinchera River.....	4.0									
Other tributaries of Rio Grande.....	1.5	6								
San Juan River and tributaries.....	0.2	4	100			2	22	2	1,200	85
San Juan River direct.....	0.1					2	22	2	1,200	85
Los Pinos River.....	0.1									
Animas River.....		4	100							
Grand River and tributaries.....	45.3	1				26	3,516	36	22,876	32
Grand River direct.....	11.9					8	2,660	14	15,070	42
Muddy Creek.....	0.1									
Blue River.....	1.2									
Eagle River.....	5.2					2	33	2	1,000	58
Roaring Fork.....	0.3									
Plateau Creek.....	0.1									
Gunnison River and tributaries.....	18.1					17	822	19	6,806	22
Gunnison River direct.....	1.0					13	759	15	5,706	20
Tomichi Creek.....	0.4									
North Fork River.....	2.8					1	8	1	300	14
Smith Fork River.....	5.1									
Uncompahgre River.....	4.5					1	40	1		53
Other tributaries of Gunnison River.....	4.3					2	15	2	800	16
Rio Dolores.....	1.2					1	1	1		15
Other tributaries of Grand River.....	7.2	1								
Green River and tributaries.....	0.4					5	58	5	4,100	14
Yampa River and tributaries.....	0.2					4	48	4	3,200	15
Yampa River direct.....						4	48	4	3,200	15
Other tributaries of Yampa River.....	0.2									
White River.....	0.2					1	10	1	900	10

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					Unit.	QUANTITY HARVESTED.				
	1919		1909		Per cent of increase. <sup>1</sup>		1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	52,617	7.0	25,705	7.9	104.7	Bu.....	1,316,478	13.0	567,151	11.6	132.1
2 Oats.....	97,618	86.0	192,311	69.7	-49.2	Bu.....	3,037,305	67.0	6,235,979	81.6	-51.3
3 Winter wheat.....	112,548	10.9	174,116	51.1	44.6	(Bu.....	2,577,277	18.8	4,727,359	65.4	17.9
4 Spring wheat.....	139,214	46.9	48,776	68.3	19.2	Bu.....	2,994,897	65.3	1,483,112	78.5	-6.7
5 Barley.....	68,125	2.1	898	5.7	207.0	Bu.....	1,383,519	49.4	14,135	7.1	142.1
6 Rye.....	2,757	76.4	45,029	87.4	-25.4	Tons.....	34,217	3.1	76,660	92.9	-39.3
<b>Hay and forage:</b>											
7 Timothy alone.....	33,588	85.4	24,049	53.4	84.5	Tons.....	46,568	37.7	47,007	55.5	301.3
8 Timothy and clover mixed.....	106,064	66.8	405	28.6	664.2	Tons.....	188,816	67.9	888	24.0	451.0
9 Clover alone.....	3,095	84.4	52,844	51.3	-12.7	Tons.....	4,893	46.1	95,119	66.4	-36.3
10 Alfalfa.....	659,912	33.8	48,171	64.2	-25.2	Tons.....	1,568,038	80.8	70,057	74.3	-25.1
11 Other tame grasses.....	46,110	73.5	70.7	75.9	-3.0	Tons.....	60,585	30.5	283,536	78.3	-2.8
12 Annual legumes cut for hay.....	9,388	20.2	(?)	(?)	(?)	Tons.....	14,194	(?)	(?)	(?)	(?)
13 Small grains cut for hay.....	26,830	8.2	(?)	(?)	(?)	Tons.....	38,250	(?)	(?)	(?)	(?)
14 Wild, salt, or prairie grasses.....	290,693	33.9	(?)	(?)	(?)	Tons.....	280,332	(?)	(?)	(?)	(?)
15 Silage crops.....	18,015	8.2	(?)	(?)	(?)	Tons.....	119,650	(?)	(?)	(?)	(?)
16 Corn cut for forage.....	14,547	3.5	(?)	(?)	(?)	Tons.....	34,234	(?)	(?)	(?)	(?)
17 Kafir, sorghum, etc., for forage.....	12,123	41.4	(?)	(?)	(?)	Tons.....	24,349	(?)	(?)	(?)	(?)
18 Root crops for forage.....	633	65.5	59,221	69.0	-14.5	Tons.....	4,255	(?)	(?)	(?)	(?)
<b>Vegetables:</b>											
19 Potatoes.....	50,831	74.0	(?)	(?)	(?)	Bu.....	7,475,618	84.2	3,408,915	71.4	-11.1
20 Cabbages.....	2,791	88.1	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)
21 Cantaloupes.....	3,530	80.8	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)
22 Cucumbers.....	1,284	71.6	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)
23 Tomatoes.....	1,693	28.5	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)
<b>Fruits:</b>											
24 Grapes.....	35,688	49.4	(?)	(?)	(?)	Lbs.....	173,669	33.0	(?)	(?)	(?)
25 Apples.....	479,087	53.3	(?)	(?)	(?)	Bu.....	1,842,018	53.9	(?)	(?)	(?)
26 Peaches.....	238,370	71.8	(?)	(?)	(?)	Bu.....	460,404	63.8	(?)	(?)	(?)
27 Pears.....	97,923	33.2	(?)	(?)	(?)	Bu.....	210,944	78.3	(?)	(?)	(?)
28 Plums and prunes.....	27,043	55.7	(?)	(?)	(?)	Bu.....	19,264	42.9	(?)	(?)	(?)
29 Cherries.....	194,612	99.0	106,905	57.5	32.7	Tons.....	101,271	61.3	1,224,466	99.5	15.1
<b>Miscellaneous:</b>											
30 Sugar beets grown for sugar.....	137,329	77.3	4,483	49.7	324.4	Tons.....	1,409,560	78.4	9,628	53.4	121.9
31 Clover and alfalfa seed.....	5,949	16.0	2,504	49.7	324.4	Bu.....	21,363	28.2	82,444	60.2	271.8
32 Dry beans.....	10,627	89.4	15,687	64.1	59.9	Bu.....	120,629	89.8	199,045	77.4	32.8
33 Dry peas.....	24,841					Bu.....	265,440				

CROP.	Unit.	AVERAGE YIELD PER ACRE: 1919.					VALUE.				
		For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	13.4	12.6	25.0	186.6	108.4	\$1,843,069	13.0	\$370,400	13.9	897.6
2 Oats.....	Bu.....	26.0	19.6	31.1	119.6	158.7	2,885,440	67.0	3,456,308	82.8	-16.6
3 Winter wheat.....	Bu.....	13.1	12.1	22.9	172.2	189.3	6,308,191	18.8	4,852,823	67.8	163.7
4 Spring wheat.....	Bu.....	15.4	10.1	21.5	139.6	212.9	6,169,488	65.3	897,949	81.6	100.3
5 Barley.....	Bu.....	18.3	14.9	23.8	180.1	159.7	1,798,576	49.4	11,284	9.1	339.7
6 Rye.....	Bu.....	8.2	8.1	12.4	151.2	153.1	49,615	3.1	761,849	9.1	339.7
<b>Hay and forage:</b>											
7 Timothy alone.....	Tons.....	1.39	1.40	1.39	100.0	99.3	977,928	75.3	602,213	80.7	62.4
8 Timothy and clover mixed.....	Tons.....	1.72	1.46	1.77	102.9	121.2	4,149,552	87.7	355,529	51.9	657.7
9 Clover alone.....	Tons.....	1.56	1.50	1.58	101.3	105.3	83,181	67.9	7,864	27.0	657.7
10 Alfalfa.....	Tons.....	2.28	1.73	2.38	104.4	137.6	29,008,703	88.1	9,522,968	98.1	204.6
11 Other tame grasses.....	Tons.....	1.04	0.89	1.31	126.0	147.2	969,360	46.1	751,436	66.4	29.0
12 Annual legumes cut for hay.....	Tons.....	1.38	1.00	1.51	109.4	151.0	212,910	80.8	501,204	59.3	79.8
13 Small grains cut for hay.....	Tons.....	0.95	0.82	1.44	151.6	175.6	638,500	30.5	2,444,558	79.2	100.7
14 Wild, salt, or prairie grasses.....	Tons.....	0.89	0.70	0.96	107.9	137.1	4,905,810	76.8	(?)	(?)	(?)
15 Silage crops.....	Tons.....	4.26	3.20	6.29	148.0	196.6	1,196,560	50.2	(?)	(?)	(?)
16 Corn cut for forage.....	Tons.....	1.03	0.96	2.35	217.6	244.8	445,042	17.9	(?)	(?)	(?)
17 Kafir, sorghum, etc., for forage.....	Tons.....	1.29	1.26	2.01	155.8	159.5	316,537	5.5	(?)	(?)	(?)
18 Root crops for forage.....	Tons.....	4.86	3.55	6.72	138.3	189.3	65,315	67.2	(?)	(?)	(?)
<b>Vegetables:</b>											
19 Potatoes.....	Bu.....	114.8	52.4	147.6	128.6	281.7	16,446,360	84.2	2,880,789	73.0	469.1
20 Cabbages.....	(?)	(?)	(?)	(?)	(?)	(?)	544,640	73.1	(?)	(?)	(?)
21 Cantaloupes.....	(?)	(?)	(?)	(?)	(?)	(?)	616,437	89.2	(?)	(?)	(?)
22 Cucumbers.....	(?)	(?)	(?)	(?)	(?)	(?)	198,241	83.2	(?)	(?)	(?)
23 Tomatoes.....	(?)	(?)	(?)	(?)	(?)	(?)	234,779	67.3	(?)	(?)	(?)
<b>Fruits:</b>											
24 Grapes.....	Lbs.....	4.2	3.9	4.9	116.7	125.6	13,894	33.0	(?)	(?)	(?)
25 Apples.....	Bu.....	1.9	1.8	2.1	110.5	116.7	3,039,330	53.9	(?)	(?)	(?)
26 Peaches.....	Bu.....	1.6	1.3	1.9	118.8	146.2	851,747	63.8	(?)	(?)	(?)
27 Pears.....	Bu.....	2.0	1.5	2.2	110.0	145.7	464,077	78.3	(?)	(?)	(?)
28 Plums and prunes.....	Bu.....	0.6	0.5	0.7	116.7	140.0	46,234	42.9	(?)	(?)	(?)
29 Cherries.....	Bu.....	0.5	0.4	0.5	100.0	125.0	329,131	61.3	(?)	(?)	(?)
<b>Miscellaneous:</b>											
30 Sugar beets grown for sugar.....	Tons.....	10.00	8.72	10.26	102.6	117.7	14,800,380	85.0	9,055,382	99.9	144.4
31 Clover and alfalfa seed.....	Bu.....	3.5	3.4	3.6	102.9	105.9	491,349	78.4	83,070	60.5	491.5
32 Dry beans.....	Bu.....	6.5	5.5	11.4	175.4	207.3	410,139	28.2	90,652	70.4	352.4
33 Dry peas.....	Bu.....	10.6	10.2	10.7	100.9	104.9	663,622	89.8	282,065	71.0	125.2

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1909.  
<sup>3</sup> Number of vines of bearing age.

<sup>4</sup> Number of trees of bearing age.  
<sup>5</sup> Not including red clover seed.

<sup>6</sup> Yield per vine.  
<sup>7</sup> Yield per tree.

IRRIGATION—COLORADO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	THE STATE.	Adams. <sup>1</sup>	Alamosa. <sup>2</sup>	Arapahoe. <sup>1</sup>	Archuleta.	Baca.	Bent.	Boulder.	Chaffee.	
1	Number of all farms in 1920.....	59,924	1,753	302	1,025	420	1,858	1,056	1,420	326
2	Number of farms irrigated in 1919.....	28,758	740	281	477	185	23	438	1,200	513
3	Per cent of all farms.....	48.0	42.2	93.0	46.5	44.0	1.2	41.5	84.5	98.0
4	Number of farms irrigated in 1909.....	25,857	726		493	206	8	404	1,118	212
5	Per cent of increase, 1909-1919.....	11.2	1.9		-3.2	-10.2		8.4	7.3	47.6
<b>LAND AND FARM AREA.</b>										
6	Approximate land area..... acres..	66,341,120	807,680	465,280	538,880	780,800	1,633,280	975,360	488,060	693,120
7	All land in farms..... acres..	24,462,014	452,115	236,847	343,005	146,028	1,051,279	433,970	221,202	65,407
8	Improved land in farms..... acres..	7,744,757	229,192	60,952	113,662	28,234	380,974	102,037	119,530	25,926
9	Area irrigated in 1919..... acres..	3,348,385	66,407	89,805	25,674	11,923	2,287	128,712	159,781	29,623
10	Per cent of improved land in farms.....	43.2	29.0	147.3	22.6	42.3	0.6	126.1	133.7	114.3
11	Area irrigated in 1909..... acres..	2,792,032	67,339		26,341	15,008	211	59,497	113,724	16,142
12	Per cent of increase, 1909-1919.....	19.9	-1.4		-2.5	-20.5		983.9	116.3	83.5
13	Area enterprises were capable of irrigating in 1920..... acres..	3,855,348	68,065	168,626	26,137	13,289	12,020	133,372	174,736	30,113
14	Area enterprises were capable of irrigating in 1910..... acres..	3,990,166	81,826		35,997	23,230	351	69,497	169,040	32,383
15	Per cent of increase, 1910-1920.....	-3.4	-16.8		-27.4	-42.8		91.9	8.4	-7.0
16	Area included in enterprises in 1920..... acres..	5,220,588	114,266	186,258	62,128	18,188	12,500	145,866	188,485	38,277
17	Area included in enterprises in 1910..... acres..	5,917,457	103,065		57,784	24,812	959	97,731	172,235	42,605
18	Per cent of increase, 1910-1920.....	-11.8	10.9		7.5	-24.7		49.3	9.4	-10.2
19	Area of irrigated land reported as available for settlement..... acres..	274,282		72,000				6,540		
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	6,634	59	57	37	97	7	30	151	157
21	Number, 1910.....	9,065	89		62	136	8	50	270	208
Main ditches:										
22	Number, 1920.....	8,887	41	61	33	116	5	34	157	206
23	Number, 1910.....	8,405	70		38	135	1	52	265	187
24	Length, 1920..... miles..	19,022	238	183	105	179	8	280	1,147	392
25	Length, 1910..... miles..	17,564	174		198	211	2	240	570	311
26	Capacity, 1920..... second-feet..	119,558	2,067	2,073	903	369	271	3,679	4,812	1,000
27	Capacity, 1910..... second-feet..	148,483	3,453		2,192	767	20	3,269	6,256	1,486
Laterals:										
28	Number, 1920.....	6,185	63	41	32	128	32	450	205	95
29	Number, 1910.....	5,612	18		8	31		313	49	39
30	Length, 1920..... miles..	8,571	128	178	113	6	19	830	320	47
31	Length, 1910..... miles..	5,006	26		11			929	73	29
Reservoirs:										
32	Number, 1920.....	979	11	2	6	5	4	17	44	3
33	Number, 1910.....	1,084	81		18	4		15	69	2
34	Capacity, 1920..... acre-feet..	2,406,372	68,561	12,527	73,866	665	33,726	339,402	33,282	20
35	Capacity, 1910..... acre-feet..	2,646,593	38,151		796,094	627		131,842	30,220	5
Flowing wells:										
36	Number, 1920.....	476	1	119	2		8			
37	Number, 1910.....	313	7		2					
38	Capacity, 1920..... gallons per minute..	20,139	40	5,085	130		1,725			
39	Capacity, 1910..... gallons per minute..	41,989	703		36					
Pumped wells:										
40	Number, 1920.....	527	28		3		4	11	1	
41	Number, 1910.....	121	10		8		10			
42	Capacity, 1920..... gallons per minute..	210,094	8,217		750		52	8,250		
43	Capacity, 1910..... gallons per minute..	53,564	2,067		2,425		2,882			
Pumping plants:										
44	Number, 1920.....	406	29		3	2	3	8	2	
45	Number, 1910.....	206	10		9	1	5	1	1	
46	Engine capacity, 1920..... horsepower..	8,635	168		22	22		197	30	
47	Engine capacity, 1910..... horsepower..	7,969	35		145	2		10	3	
48	Pump capacity, 1920..... gallons per minute..	299,726	8,217		750	1,200	52	5,350	1,000	
49	Pump capacity, 1910..... gallons per minute..	206,937	2,097		8,375	128	2,882	470	200	
50	Average lift, 1920..... feet..	23	27		17	85	100	24	8	
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920..... dollars..	88,302,442	2,436,771	416,305	597,099	168,635	572,553	2,773,601	1,774,922	261,368
52	Capital invested to July 1, 1910..... dollars..	56,636,443	1,211,609		745,517	112,168	2,473	989,211	837,060	54,949
53	Per cent of increase, 1910-1920.....	55.9	101.1		-19.9	50.3		180.4	112.0	376.7
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	22.90	35.80	2.47	23.84	12.69	47.63	30.80	10.16	8.68
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	14.19	14.81		20.71	4.83	7.05	14.23	4.95	1.79
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920..... dollars..	95,198,423	2,557,121	458,952	600,299	170,285	572,553	2,797,201	1,850,662	265,088
57	Estimated final cost of existing enterprises in 1910..... dollars..	76,448,239	1,417,109		745,517	112,168	2,473	989,211	901,143	54,949
58	Per cent of increase, 1910-1920.....	24.5	80.4		-19.5	51.8		182.8	105.4	382.4
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	18.24	22.38	2.46	9.66	9.36	45.80	19.18	9.82	8.93
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	12.02	13.75		12.90	4.82	2.58	10.12	5.23	1.29

<sup>1</sup> Adams and Denver Counties organized from parts of Arapahoe County in 1903; parts of Adams and Arapahoe Counties annexed to Washington County and to Yuma County in 1903; and part of Denver County annexed to Adams County in 1909.  
<sup>2</sup> Alamosa County organized from parts of Conejos and Costilla Counties in 1913.



IRRIGATION—COLORADO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Conejos. <sup>1</sup>	Costilla. <sup>1</sup>	Crowley. <sup>2</sup>	Custer.	Delta.	Denver. <sup>3</sup>	Dolores.	Douglas.	Eagle.
1 Number of all farms in 1920.....	814	443	743	253	1,707	239	185	462	301
2 Number of farms irrigated in 1919.....	784	431	447	165	1,680	118	21	108	277
3 Per cent of all farms.....	90.2	97.3	60.2	45.7	98.4	49.4	11.3	23.4	92.0
4 Number of farms irrigated in 1909.....	737	350		142	1,709	72	30	157	218
5 Per cent of increase, 1909-1919.....				16.2	-1.7			-31.2	27.1
<b>LAND AND FARM AREA.</b>									
6 Approximate land area.....acres.....	801,280	758,400	517,120	478,080	768,640	37,120	687,520	540,800	1,036,800
7 All land in farms.....acres.....	231,938	434,410	263,265	197,360	109,768	4,287	57,689	362,033	80,874
8 Improved land in farms.....acres.....	128,018	46,598	130,645	36,896	74,473	3,672	7,278	56,701	28,607
9 Area irrigated in 1919.....acres.....	139,504	36,771	57,789	24,241	93,509	4,000	1,023	8,696	30,025
10 Per cent of improved land in farms.....	109.0	78.9	44.2	65.7	125.6	108.9	14.1	15.3	105.3
11 Area irrigated in 1909.....acres.....	138,788	57,832		29,248	62,411	1,337	1,139	13,768	22,578
12 Per cent of increase, 1909-1919.....				-17.1	49.8	199.2	-10.2	-36.8	33.0
13 Area enterprises were capable of irrigating in 1920.....acres.....	152,346	43,908	58,735	33,548	127,469	4,000	2,361	10,391	31,073
14 Area enterprises were capable of irrigating in 1910.....acres.....	282,040	106,745		33,610	99,185	1,338	2,042	24,624	28,116
15 Per cent of increase, 1910-1920.....				-0.2	28.5	199.0	15.6	-57.8	10.5
16 Area included in enterprises in 1920.....acres.....	207,519	102,960	71,974	39,463	156,624	4,877	23,601	15,089	48,026
17 Area included in enterprises in 1910.....acres.....	335,253	255,486		34,610	174,830	1,338	2,052	25,405	32,925
18 Per cent of increase, 1910-1920.....				14.0	-10.4	264.5		-40.6	45.9
19 Area of irrigated land reported as available for settlement.....acres.....			5,000		9,040		20,000		
<b>IRRIGATION WORKS.</b>									
Independent enterprises:									
20 Number, 1920.....	159	46	24	202	298	4	22	94	186
21 Number, 1910.....	812	70		464	329	10	31	145	188
Main ditches:									
22 Number, 1920.....	172	67	23	440	309	4	25	123	245
23 Number, 1910.....	235	71		464	291	3	31	141	171
24 Length, 1920.....miles.....	533	334	93	323	738	20	56	191	385
25 Length, 1910.....miles.....	609	212		415	819	6	33	186	300
26 Capacity, 1920.....second-feet.....	5,000	997	2,059	784	3,245	70	298	554	855
27 Capacity, 1910.....second-feet.....	8,542	2,681		791	3,474	20	139	764	794
Laterals:									
28 Number, 1920.....	99	17	93	32	222		4	9	91
29 Number, 1910.....	93	47		622	89	4		8	97
30 Length, 1920.....miles.....	150	203	119	15	259		2	22	62
31 Length, 1910.....miles.....	320	68		106	175	1		40	43
Reservoirs:									
32 Number, 1920.....	6	6	18	1	115		4	17	15
33 Number, 1910.....	10	6			123		1	14	5
34 Capacity, 1920.....acre-feet.....	34,968	132,860	8,593	5	39,284		19,630	4,287	1,468
35 Capacity, 1910.....acre-feet.....	50,693	132,248			62,688	1	40	12,025	73
Flowing wells:									
36 Number, 1920.....	2		1						1
37 Number, 1910.....	111	3							
38 Capacity, 1920.....gallons per minute.....	70		700						
39 Capacity, 1910.....gallons per minute.....	24,587	1,792							
Pumped wells:									
40 Number, 1920.....			48					3	
41 Number, 1910.....								1	
42 Capacity, 1920.....gallons per minute.....			22,576					406	
43 Capacity, 1910.....gallons per minute.....								100	
Pumping plants:									
44 Number, 1920.....			25		6			3	3
45 Number, 1910.....					21	4		1	
46 Engine capacity, 1920.....horsepower.....			299		21			20	33
47 Engine capacity, 1910.....horsepower.....					131	3		21	
48 Pump capacity, 1920.....gallons per minute.....			23,505		881			412	1,000
49 Pump capacity, 1910.....gallons per minute.....					15,242	11		100	
50 Average lift, 1920.....feet.....			28		13			22	45
<b>CAPITAL INVESTED.</b>									
51 Capital invested to Jan. 1, 1920.....dollars.....	1,155,162	1,889,816	2,587,043	75,431	4,168,137	47,386	549,070	207,786	285,282
52 Capital invested to July 1, 1910.....dollars.....	927,647	2,090,999		137,565	1,568,770	21,581	12,671	581,214	133,956
53 Per cent of increase, 1910-1920.....				-45.2	165.7	119.6		-64.2	113.0
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars.....	7.58	31.65	44.05	2.25	32.70	11.85	232.56	20.00	9.18
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars.....	3.54	19.59		4.09	15.62	16.13	6.21	23.60	4.76
<b>ESTIMATED FINAL COST.</b>									
56 Estimated final cost of existing enterprises in 1920.....dollars.....	1,156,632	1,403,066	2,593,508	76,596	4,320,091	47,386	729,020	208,286	307,432
57 Estimated final cost of existing enterprises in 1910.....dollars.....	1,026,897	2,177,966		137,565	2,261,610	21,581	12,671	589,878	133,956
58 Per cent of increase, 1910-1920.....				-44.3	91.0	119.6		-64.7	129.5
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars.....	5.57	13.63	36.03	1.94	27.58	9.72	30.89	13.80	6.40
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars.....	3.06	8.52		3.97	12.94	16.13	6.17	23.22	4.07

<sup>1</sup> Parts of Conejos and Costilla Counties taken to form Alamosa County in 1913.  
<sup>2</sup> Crowley County organized from part of Otero County in 1911.  
<sup>3</sup> Organized from part of Arapahoe County in 1902. A part of Denver County annexed to Adams County in 1909.

IRRIGATION—COLORADO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	El Paso.	Elbert.	Fremont.	Garfield.	Grand.	Gunnison.	Hinsdale.	Huerfano.	Jackson. <sup>1</sup>	Jefferson. <sup>2</sup>
1 Number of all farms in 1920.....	1,571	1,308	1,014	930	265	376	40	954	182	1,446
2 Number of farms irrigated in 1919.....	143	12	827	829	237	335	29	418	156	1,141
3 Per cent of all farms.....	9.1	0.9	81.6	89.1	89.4	89.1	72.5	43.8	85.7	78.9
4 Number of farms irrigated in 1909.....	174	24	839	868	226	261	22	350	163	1,161
5 Per cent of increase, 1909-1919.....	-17.8	.....	-1.4	-4.5	4.9	28.4	.....	19.4	-4.3	-1.0
<b>LAND AND FARM AREA.</b>										
6 Approximate land area.....acres..	1,357,440	1,188,480	995,480	1,988,480	1,194,240	2,034,560	621,440	960,000	1,044,480	517,120
7 All land in farms.....acres..	919,013	1,011,533	229,397	211,875	119,436	121,579	10,633	386,354	234,214	249,922
8 Improved land in farms.....acres..	208,517	206,021	31,484	74,214	32,766	49,351	3,742	50,130	93,468	69,625
9 Area irrigated in 1919.....acres..	18,143	1,175	29,884	73,473	39,857	48,280	3,675	29,081	136,942	70,788
10 Per cent of improved land in farms.....	8.7	0.6	94.9	99.0	121.6	97.8	98.2	49.2	146.5	101.7
11 Area irrigated in 1909.....acres..	21,354	7,628	24,737	61,617	42,194	55,848	2,924	26,598	151,850	57,336
12 Per cent of increase, 1909-1919.....	-15.0	-84.6	20.8	19.2	-5.5	-13.6	25.7	9.3	-9.8	23.5
13 Area enterprises were capable of irrigating in 1920.....acres..	22,047	1,790	35,997	93,614	43,092	52,487	3,880	32,119	149,325	73,636
14 Area enterprises were capable of irrigating in 1910.....acres..	28,214	11,286	37,136	95,281	77,672	59,700	3,354	35,690	199,457	142,236
15 Per cent of increase, 1910-1920.....	-21.9	-84.1	-3.9	-1.5	-44.5	-12.1	15.7	-10.0	-25.1	-48.2
16 Area included in enterprises in 1920.....acres..	35,450	6,720	44,059	117,618	85,504	67,925	4,065	43,274	229,203	77,937
17 Area included in enterprises in 1910.....acres..	41,438	20,361	42,414	133,321	98,299	73,895	5,220	66,878	244,967	293,163
18 Per cent of increase, 1910-1920.....	-14.5	-87.0	3.9	-11.8	-13.0	-8.1	-22.1	-35.3	-6.4	-73.4
19 Area of irrigated land reported as available for settlement.....acres..	2,200	1,800	4,550	6,000	800	.....	.....	2,520	27,640	.....
<b>IRRIGATION WORKS.</b>										
<b>Independent enterprises:</b>										
20 Number, 1920.....	63	22	179	323	166	382	52	267	145	105
21 Number, 1910.....	99	37	413	440	328	507	41	263	328	163
<b>Main ditches:</b>										
22 Number, 1920.....	72	30	267	392	314	528	52	321	355	133
23 Number, 1910.....	85	30	366	374	326	448	31	268	326	164
24 Length, 1920.....miles..	176	31	229	730	542	702	104	475	779	289
25 Length, 1910.....miles..	193	30	337	870	497	466	28	427	743	640
26 Capacity, 1920.....second-feet..	833	158	901	2,563	2,037	4,236	519	1,907	5,129	2,093
27 Capacity, 1910.....second-feet..	1,157	427	1,058	4,401	3,508	6,934	183	1,609	6,896	4,623
<b>Laterals:</b>										
28 Number, 1920.....	44	24	190	283	89	30	.....	458	21	88
29 Number, 1910.....	24	60	363	89	173	41	6	187	142	31
30 Length, 1920.....miles..	17	31	101	512	37	34	.....	146	43	92
31 Length, 1910.....miles..	14	4	122	54	94	7	2	106	79	67
<b>Reservoirs:</b>										
32 Number, 1920.....	29	5	31	26	25	6	2	34	9	25
33 Number, 1910.....	15	8	26	14	21	1	.....	37	6	79
34 Capacity, 1920.....acre-feet..	13,103	6,755	6,972	7,594	3,137	460	43,500	12,027	15,169	8,178
35 Capacity, 1910.....acre-feet..	12,247	1,456	18,879	5,049	3,344	125	.....	12,714	2,150	130,519
<b>Flowing wells:</b>										
36 Number, 1920.....	3	.....	3	.....	.....	.....	.....	.....	.....	.....
37 Number, 1910.....	30	.....	60	.....	.....	.....	.....	.....	.....	.....
38 Capacity, 1920.....gallons per minute..	30	.....	115	.....	.....	.....	.....	.....	.....	.....
39 Capacity, 1910.....gallons per minute..	1,064	.....	1,371	.....	.....	.....	.....	.....	.....	.....
<b>Pumped wells:</b>										
40 Number, 1920.....	1	3	9	.....	.....	.....	.....	2	.....	.....
41 Number, 1910.....	1	.....	5	.....	.....	.....	.....	1	.....	3
42 Capacity, 1920.....gallons per minute..	.....	1,300	267	.....	.....	.....	.....	70	.....	.....
43 Capacity, 1910.....gallons per minute..	360	.....	1,169	.....	.....	.....	.....	1,300	.....	355
<b>Pumping plants:</b>										
44 Number, 1920.....	1	3	10	2	.....	4	.....	4	.....	1
45 Number, 1910.....	1	.....	9	.....	.....	1	.....	1	.....	7
46 Engine capacity, 1920.....horsepower..	.....	12	309	10	.....	112	.....	11	.....	7
47 Engine capacity, 1910.....horsepower..	8	.....	225	.....	.....	56	.....	10	.....	26
48 Pump capacity, 1920.....gallons per minute..	.....	1,200	6,962	350	.....	3,800	.....	45	.....	.....
49 Pump capacity, 1910.....gallons per minute..	380	.....	8,921	.....	.....	3,600	.....	1,200	.....	929
50 Average lift, 1920.....feet..	.....	29	38	29	.....	18	.....	52	.....	40
<b>CAPITAL INVESTED.</b>										
51 Capital invested to Jan. 1, 1920.....dollars..	901,461	25,561	1,761,518	1,134,502	534,913	462,748	395,752	1,061,777	784,326	1,231,205
52 Capital invested to July 1, 1910.....dollars..	187,211	35,215	1,505,440	1,458,678	432,231	207,622	11,047	257,959	275,899	4,300,958
53 Per cent of increase, 1910-1920.....	381.5	-27.4	17.0	-22.2	23.8	122.9	.....	11.6	184.3	-71.4
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	40.89	14.28	49.35	12.09	12.41	8.82	102.00	33.06	5.25	16.72
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	6.64	3.12	40.54	15.31	5.56	3.48	3.29	7.23	1.38	30.28
<b>ESTIMATED FINAL COST.</b>										
56 Estimated final cost of existing enterprises in 1920.....dollars..	921,461	36,961	1,889,558	1,170,827	547,713	472,998	395,752	1,063,232	1,043,826	1,268,125
57 Estimated final cost of existing enterprises in 1910.....dollars..	187,211	35,215	1,583,971	1,498,678	504,654	207,622	11,047	273,959	275,899	5,170,968
58 Per cent of increase, 1910-1920.....	392.2	13.5	18.9	-21.9	8.5	127.8	.....	265.4	378.3	-75.5
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	25.99	5.95	42.89	9.95	6.41	6.06	97.36	25.08	4.55	16.37
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	4.53	1.73	37.46	11.24	5.13	2.81	2.13	4.10	1.13	17.64

<sup>1</sup> Jackson County organized from part of Larimer County in 1909.  
<sup>2</sup> Part of Jefferson County annexed to Park County in 1908.

# IRRIGATION—COLORADO.

**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Kiowa.	La Plata.	Lake.	Larimer. <sup>1</sup>	Las Animas.	Logan.	Mesa.	Mineral.	Moffat. <sup>2</sup>	Montezuma.
1 Number of all farms in 1920.....	668	1,069	30	1,921	2,286	1,874	2,207	34	1,023	904
2 Number of farms irrigated in 1919.....	12	860	29	1,486	530	397	2,060	28	103	616
3 Per cent of all farms.....	1.8	80.4	96.7	77.4	23.2	21.2	93.3	82.4	10.1	68.1
4 Number of farms irrigated in 1909.....	6	634	43	1,491	447	272	2,238	28	.....	516
5 Per cent of increase, 1909-1919.....	.....	35.6	.....	-0.3	18.6	46.0	-8.0	.....	.....	19.4
<b>LAND AND FARM AREA.</b>										
6 Approximate land area..... acres..	1,150,720	1,184,640	237,440	1,682,560	3,077,760	1,166,080	2,024,320	554,240	2,981,120	1,312,640
7 All land in farms..... acres..	430,985	805,003	12,862	780,533	1,302,849	857,359	232,225	17,129	461,777	192,703
8 Improved land in farms..... acres..	61,782	76,019	5,151	192,976	133,084	416,120	99,682	5,458	75,225	57,904
9 Area irrigated in 1919..... acres..	418	63,755	5,897	169,356	40,400	85,079	102,607	6,865	17,439	44,083
10 Per cent of improved land in farms.....	0.7	83.9	124.2	87.8	30.4	20.4	103.0	125.8	23.2	76.1
11 Area irrigated in 1909..... acres..	1,460	40,840	10,967	170,600	26,093	63,166	71,942	7,762	.....	27,176
12 Per cent of increase, 1909-1919.....	-71.4	56.1	-41.7	-0.7	54.8	34.7	42.6	-11.6	.....	62.2
13 Area enterprises were capable of irrigating in 1920..... acres..	2,033	78,227	7,088	188,047	43,857	105,916	140,104	9,960	24,224	44,795
14 Area enterprises were capable of irrigating in 1910..... acres..	1,460	109,479	11,647	178,992	32,566	65,345	92,092	9,370	.....	62,757
15 Per cent of increase, 1910-1920.....	42.7	-28.5	-39.1	5.1	34.7	62.1	52.1	6.2	.....	-28.6
16 Area included in enterprises in 1920..... acres..	17,283	111,462	10,449	196,330	50,987	124,415	185,177	14,770	32,337	80,216
17 Area included in enterprises in 1910..... acres..	2,310	151,387	16,360	316,992	35,149	87,301	182,942	10,590	.....	67,538
18 Per cent of increase, 1910-1920.....	648.2	-26.4	-36.2	-38.1	45.1	42.5	1.2	39.5	.....	18.8
19 Area of irrigated land reported as available for settlement..... acres..	.....	7,907	.....	.....	.....	.....	39,200	.....	.....	13,000
<b>IRRIGATION WORKS.</b>										
<b>Independent enterprises:</b>										
20 Number, 1920.....	6	211	30	171	176	39	213	42	127	102
21 Number, 1910.....	6	262	55	221	139	35	275	46	.....	141
<b>Main ditches:</b>										
22 Number, 1920.....	3	239	59	228	184	39	239	45	135	123
23 Number, 1910.....	4	257	39	217	88	35	259	44	.....	150
24 Length, 1920..... miles..	18	580	52	564	373	396	686	60	362	265
25 Length, 1910..... miles..	7	489	71	758	161	215	692	47	.....	268
26 Capacity, 1920..... second-feet..	2,585	2,018	298	6,968	1,618	3,376	4,721	355	888	965
27 Capacity, 1910..... second-feet..	22	2,862	530	7,176	1,193	2,566	5,000	217	.....	1,590
<b>Laterals:</b>										
28 Number, 1920.....	4	109	.....	238	41	105	398	59	118	39
29 Number, 1910.....	.....	52	9	136	16	8	62	12	.....	38
30 Length, 1920..... miles..	34	124	.....	418	28	125	326	22	334	159
31 Length, 1910..... miles..	.....	125	16	368	7	.....	150	8	.....	158
<b>Reservoirs:</b>										
32 Number, 1920.....	4	5	.....	69	21	7	60	2	18	9
33 Number, 1910.....	1	7	.....	84	7	4	42	0	.....	11
34 Capacity, 1920..... acre-feet..	32,118	15	.....	181,515	429,105	116,103	19,201	2,311	1,569	17,680
35 Capacity, 1910..... acre-feet..	1	7,456	.....	263,388	427	1,929	10,172	.....	.....	37,600
<b>Flowing wells:</b>										
36 Number, 1920.....	1	4	.....	1	.....	.....	.....	.....	.....	.....
37 Number, 1910.....	1	4	.....	.....	.....	.....	.....	.....	.....	.....
38 Capacity, 1920..... gallons per minute..	.....	100	.....	60	.....	.....	.....	.....	.....	.....
39 Capacity, 1910..... gallons per minute..	10	89	.....	.....	.....	.....	.....	.....	.....	.....
<b>Pumped wells:</b>										
40 Number, 1920.....	6	.....	.....	28	.....	40	.....	.....	.....	.....
41 Number, 1910.....	2	.....	.....	2	.....	1	2	.....	.....	.....
42 Capacity, 1920..... gallons per minute..	2,985	.....	.....	8,095	.....	6,600	.....	.....	.....	.....
43 Capacity, 1910..... gallons per minute..	4	.....	.....	857	.....	600	60	.....	.....	.....
<b>Pumping plants:</b>										
44 Number, 1920.....	5	.....	.....	22	1	10	11	.....	4	.....
45 Number, 1910.....	2	2	.....	5	.....	1	81	.....	.....	.....
46 Engine capacity, 1920..... horsepower..	57	.....	.....	374	7	241	3,299	.....	48	.....
47 Engine capacity, 1910..... horsepower..	1	136	.....	80	.....	10	5,991	.....	.....	.....
48 Pump capacity, 1920..... gallons per minute..	2,985	.....	.....	14,376	500	11,600	16,845	.....	3,200	.....
49 Pump capacity, 1910..... gallons per minute..	4	2,716	.....	1,659	.....	600	178,273	.....	.....	.....
50 Average lift, 1920..... feet..	20	.....	.....	21	7	15	36	.....	15	.....
<b>CAPITAL INVESTED.</b>										
51 Capital invested to Jan. 1, 1920..... dollars..	251,500	938,864	33,666	6,236,866	401,720	3,593,889	7,319,055	81,683	366,301	1,846,679
52 Capital invested to July 1, 1910..... dollars..	7,975	689,774	46,196	5,576,639	155,583	388,862	3,024,019	19,514	.....	1,026,977
53 Per cent of increase, 1910-1920.....	.....	36.3	-27.1	11.8	158.2	824.2	142.0	318.6	.....	79.8
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	120.74	12.00	4.75	33.17	9.16	33.93	52.24	8.21	15.12	41.23
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	5.46	6.29	8.97	31.16	4.78	5.95	32.84	2.08	.....	16.38
<b>ESTIMATED FINAL COST.</b>										
56 Estimated final cost of existing enterprises in 1920..... dollars..	337,200	978,214	33,666	6,473,663	455,470	3,596,039	8,155,335	102,243	386,226	2,446,679
57 Estimated final cost of existing enterprises in 1910..... dollars..	7,975	855,311	46,196	9,026,639	155,583	388,862	6,745,382	19,514	.....	1,091,974
58 Per cent of increase, 1910-1920.....	.....	14.4	-27.1	-28.3	192.8	824.3	20.9	423.9	.....	124.1
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	19.51	8.78	3.22	32.97	9.93	28.90	44.04	6.92	11.95	30.50
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	3.45	5.65	2.82	28.48	4.43	4.45	36.57	1.84	.....	16.17

<sup>1</sup> Part of Larimer County taken to form Jackson County in 1909.  
<sup>2</sup> Moffat County organized from part of Routt County in 1911.

IRRIGATION—COLORADO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Montrose.	Morgan.	Otero. <sup>1</sup>	Ourray. <sup>2</sup>	Park. <sup>3</sup>	Pitkin.	Prowers.	Pueblo.	Rio Blanco.	Rio Grande.
1 Number of all farms in 1920.....	1,368	1,720	1,486	180	285	179	1,469	1,826	537	603
2 Number of farms irrigated in 1919.....	1,294	777	1,157	142	122	153	660	995	278	584
3 Per cent of all farms.....	94.6	45.2	77.9	78.9	42.7	85.5	44.9	54.5	51.8	96.8
4 Number of farms irrigated in 1909.....	1,042	581	1,310	184	162	182	546	753	285	517
5 Per cent of increase, 1909-1919.....	24.2	38.5			-24.7	-15.9	20.9	32.1	-2.5	13.0
<b>LAND AND FARM AREA.</b>										
6 Approximate land area.....acres..	1,448,960	823,040	805,760	332,160	1,434,880	652,160	1,043,200	1,557,120	2,082,720	574,720
7 All land in farms.....acres..	218,255	555,890	334,293	73,010	239,862	49,389	689,262	993,226	223,649	199,231
8 Improved land in farms.....acres..	88,096	237,374	94,201	17,098	113,452	16,345	188,230	146,972	54,900	115,044
9 Area irrigated in 1919.....acres..	94,757	132,231	120,198	14,016	49,793	12,994	76,322	75,454	28,048	206,258
10 Per cent of improved land in farms.....	107.6	55.7	127.6	82.0	43.9	79.5	40.5	51.3	51.1	179.3
11 Area irrigated in 1909.....acres..	55,993	97,849	122,457	15,821	64,824	15,152	71,684	50,718	32,830	107,551
12 Per cent of increase, 1909-1919.....	69.2	35.1			-23.2	-14.2	6.5	48.8	-14.6	91.8
13 Area enterprises were capable of irrigating in 1920.....acres..	123,905	153,796	124,879	23,092	52,029	15,172	81,508	83,699	32,742	227,167
14 Area enterprises were capable of irrigating in 1910.....acres..	92,194	114,933	195,450	20,337	65,384	29,719	74,632	69,442	37,353	295,021
15 Per cent of increase, 1910-1920.....	34.4	33.8			-20.4	-48.9	9.2	27.7	-12.3	-23.8
16 Area included in enterprises in 1920.....acres..	173,162	166,670	183,077	24,017	55,449	21,295	99,213	142,594	45,579	298,162
17 Area included in enterprises in 1910.....acres..	254,132	259,590	250,766	25,463	68,969	39,497	130,596	174,518	53,169	353,637
18 Per cent of increase, 1910-1920.....	-31.9	-35.8			-19.6	-46.1	-24.0	-18.3	-14.3	-17.1
19 Area of irrigated land reported as available for settlement.....acres..	13,500							31,585		
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20 Number, 1920.....	103	39	26	96	213	76	29	264	189	159
21 Number, 1910.....	200	49	47	137	282	165	25	190	202	213
Main ditches:										
22 Number, 1920.....	113	84	27	124	359	96	27	273	299	198
23 Number, 1910.....	192	45	37	138	276	124	20	173	191	229
24 Length, 1920.....miles..	431	308	329	213	440	191	180	525	458	348
25 Length, 1910.....miles..	541	537	327	252	363	253	218	436	354	537
26 Capacity, 1920.....second-feet..	2,437	3,771	5,537	642	2,705	655	1,573	5,316	2,908	3,347
27 Capacity, 1910.....second-feet..	3,983	6,454	6,553	1,085	4,241	1,002	2,286	5,181	1,129	6,755
Laterals:										
28 Number, 1920.....	187	69	404	4	53	74	153	370	113	184
29 Number, 1910.....	58	15	53	41	718	17	82	91	118	187
30 Length, 1920.....miles..	382	62	429		20	37	309	371	48	373
31 Length, 1910.....miles..	164	42	123	15	185	5	148	109	70	368
Reservoirs:										
32 Number, 1920.....	14	10	10		1	3	5	61	24	4
33 Number, 1910.....	15	17	40	7	1	9	7	54	10	1
34 Capacity, 1920.....acre-feet..	8,335	89,680	35,659		8	19	53,613	109,534	4,028	30,150
35 Capacity, 1910.....acre-feet..	119,381	181,673	130,504	441	1	1,874	183,381	106,307	364	261
Flowing wells:										
36 Number, 1920.....								3		172
37 Number, 1910.....								4		33
38 Capacity, 1920.....gallons per minute..								570		6,666
39 Capacity, 1910.....gallons per minute..								2,168		7,672
Pumped wells:										
40 Number, 1920.....		23	12				6	122		
41 Number, 1910.....	1	3	14			1		3		
42 Capacity, 1920.....gallons per minute..		26,590	11,088				1,205	37,869		
43 Capacity, 1910.....gallons per minute..	170	1,581	6,205			34		145		
Pumping plants:										
44 Number, 1920.....	2	17	11				7	66	1	
45 Number, 1910.....	1	3	15			1		4	9	
46 Engine capacity, 1920.....horsepower..	41	344	188				30	801	10	
47 Engine capacity, 1910.....horsepower..	3	25	87			1		9	87	
48 Pump capacity, 1920.....gallons per minute..		26,585	10,438				1,470	49,505	900	
49 Pump capacity, 1910.....gallons per minute..	170	1,581	15,185			34		165	4,329	
50 Average lift, 1920.....feet..	34	22	20				18	21	10	
<b>CAPITAL INVESTED.</b>										
51 Capital invested to Jan. 1, 1920.....dollars..	6,788,758	2,600,735	4,157,535	197,689	176,670	206,324	1,160,422	3,645,462	855,617	981,136
52 Capital invested to July 1, 1910.....dollars..	4,769,185	4,821,313	3,197,415	159,091	213,233	237,523	1,453,019	1,511,694	269,479	1,356,578
53 Per cent of increase, 1910-1920.....	42.3	-46.1			-17.6	-12.3	-20.1	141.3	32.0	-27.7
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	54.79	16.91	33.29	8.56	3.38	13.73	14.24	41.10	10.86	4.32
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	51.73	41.95	16.11	7.82	3.26	7.99	19.47	21.77	7.21	4.55
<b>ESTIMATED FINAL COST.</b>										
56 Estimated final cost of existing enterprises in 1920.....dollars..	7,286,466	2,604,785	4,438,935	197,758	176,080	214,324	1,163,412	3,919,262	372,882	982,914
57 Estimated final cost of existing enterprises in 1910.....dollars..	9,751,075	6,004,613	3,631,587	159,091	213,233	252,554	1,453,019	1,693,321	269,479	1,400,313
58 Per cent of increase, 1910-1920.....	-25.3	-56.6			-17.4	-15.1	-19.9	131.5	38.4	-29.8
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	42.08	15.63	24.25	8.23	3.18	10.06	11.73	27.49	8.18	3.35
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	38.37	23.13	14.48	6.25	3.09	6.39	11.13	9.70	5.07	3.90

<sup>1</sup> Part of Otero County taken to form Crowley County in 1911.  
<sup>2</sup> Part of San Miguel County annexed to Ourray County in 1917.  
<sup>3</sup> Part of Jefferson County annexed to Park County in 1908.

# IRRIGATION—COLORADO.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Routt. <sup>1</sup>	Saguache.	San Miguel. <sup>2</sup>	Sedgwick.	Summit.	Teller.	Washington. <sup>3</sup>	Weld.	Yuma. <sup>3</sup>	All other counties.	
1	Number of all farms in 1920.....	925	432	334	487	72	250	2,057	5,765	2,179	4,268
2	Number of farms irrigated in 1919.....	428	390	154	130	67	28	51	3,398	29	35
3	Per cent of all farms.....	46.2	90.3	46.1	26.7	93.1	10.4	2.5	58.9	1.3	0.8
4	Number of farms irrigated in 1909.....	588	338	121	141	90	32	47	2,578	23	12
5	Per cent of increase, 1909-1919.....		15.4		-7.8				31.8		
<b>LAND AND FARM AREA.</b>											
6	Approximate land area.....acres..	1,477,760	2,005,120	824,320	339,840	415,360	250,080	1,613,440	2,574,060	1,514,880	5,228,160
7	All land in farms.....acres..	360,787	436,024	128,492	234,537	26,155	122,631	1,088,706	1,756,973	1,203,781	2,758,803
8	Improved land in farms.....acres..	94,896	139,856	21,344	139,243	8,150	16,632	531,234	878,520	591,606	726,651
9	Area irrigated in 1919.....acres..	50,735	137,581	18,634	21,510	9,831	1,464	9,235	382,701	8,254	794
10	Per cent of improved land in farms.....	53.5	88.4	87.3	15.4	120.6	8.8	1.8	43.6	1.4	0.1
11	Area irrigated in 1909.....acres..	62,427	145,874	14,712	22,022	8,402	1,370	5,595	895,514	8,890	1,041
12	Per cent of increase, 1909-1919.....		-5.7		-2.8	17.0	6.9	66.8	-3.2	112.2	-23.7
13	Area enterprises were capable of irrigating in 1920.....acres..	61,123	153,891	22,811	23,050	10,986	1,540	10,095	395,444	10,182	1,304
14	Area enterprises were capable of irrigating in 1910.....acres..	110,569	150,943	20,421	28,260	11,739	1,435	6,027	434,068	6,290	1,191
15	Per cent of increase, 1910-1920.....		1.6		-0.9	-6.4	7.3	67.5	-8.9	61.9	17.0
16	Area included in enterprises in 1920.....acres..	92,148	271,932	44,749	24,050	15,222	1,944	10,095	567,392	15,242	2,324
17	Area included in enterprises in 1910.....acres..	157,298	157,568	21,653	53,620	16,489	1,664	7,969	629,433	8,275	1,518
18	Per cent of increase, 1910-1920.....		72.6		-55.1	-7.7	16.8	26.7	-9.9	84.2	53.1
19	Area of irrigated land reported as available for settlement.....acres..		8,000	3,000							
<b>IRRIGATION WORKS.</b>											
Independent enterprises:											
20	Number, 1920.....	310	212	67	7	79	25	8	238	26	17
21	Number, 1910.....	433	348	95	10	161	26	7	291	16	11
Main ditches:											
22	Number, 1920.....	421	576	74	7	133	35	8	204	31	14
23	Number, 1910.....	417	328	94	10	154	21	4	263	12	9
24	Length, 1920.....miles..	649	614	231	87	150	42	21	1,113	64	21
25	Length, 1910.....miles..	899	414	179	139	174	18	5	752	32	11
26	Capacity, 1920.....second-feet..	1,619	3,737	789	459	437	60	365	9,040	599	158
27	Capacity, 1910.....second-feet..	4,502	2,597	773	1,884	571	38	85	12,611	210	108
Laterals:											
28	Number, 1920.....	87	163	30	5	34	36	16	240	47	11
29	Number, 1910.....	171	888	2	20	26	2	2	250		4
30	Length, 1920.....miles..	38	249	182	7	7	41	39	877	39	10
31	Length, 1910.....miles..	106	174	5	10	12	1	2	182		2
Reservoirs:											
32	Number, 1920.....	50	14	3	2		1	3	103	4	7
33	Number, 1910.....	74	13	3	11	3		2	100	1	3
34	Capacity, 1920.....acre-feet..	5,432	8,854	5,066	27,219		40	268	310,059	30	737
35	Capacity, 1910.....acre-feet..	36,466	28	1,334	42,020	76		290	73,766	3	56
Flowing wells:											
36	Number, 1920.....		156								
37	Number, 1910.....		58								
38	Capacity, 1920.....gallons per minute..		4,848								
39	Capacity, 1910.....gallons per minute..		2,497								
Pumped wells:											
40	Number, 1920.....		1		1			4	149		12
41	Number, 1910.....								47		2
42	Capacity, 1920.....gallons per minute..				250			1,920	70,311		1,376
43	Capacity, 1910.....gallons per minute..								33,263		26
Pumping plants:											
44	Number, 1920.....		1		1			2	133		3
45	Number, 1910.....		1						54		2
46	Engine capacity, 1920.....horsepower..							30	1,846		37
47	Engine capacity, 1910.....horsepower..								686		1
48	Pump capacity, 1920.....gallons per minute..		135					1,920	99,953		1,475
49	Pump capacity, 1910.....gallons per minute..		7,225						40,285		26
50	Average lift, 1920.....feet..		170		30			13	23		14
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920.....dollars..	572,873	450,609	676,109	716,215	103,581	12,141	78,966	16,417,224	83,908	69,094
52	Capital invested to July 1, 1910.....dollars..	661,203	647,870	142,552	493,501	70,353	7,037	65,713	7,597,658	22,276	5,050
53	Per cent of increase, 1910-1920.....		-17.8		45.1	47.2	72.5	20.2	116.1	276.7	
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	9.37	2.94	29.64	31.07	9.43	7.83	7.82	41.52	8.24	63.91
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	5.98	3.63	6.68	21.22	5.99	4.90	10.90	17.51	3.54	4.94
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920.....dollars..	618,908	531,614	797,700	716,215	103,631	12,141	80,166	18,892,937	89,908	90,994
57	Estimated final cost of existing enterprises in 1910.....dollars..	1,099,590	647,870	142,552	1,130,501	70,353	7,037	65,713	9,847,658	22,276	5,050
58	Per cent of increase, 1910-1920.....		-3.0		-38.6	47.3	72.5	22.0	91.9	303.6	
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	6.66	1.95	17.83	29.78	6.81	6.25	7.94	33.30	5.11	39.15
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	6.99	3.48	6.53	21.08	4.27	4.23	8.25	15.64	2.69	3.23

<sup>1</sup> Part of Routt County taken to form Moffat County in 1911.  
<sup>2</sup> Part of San Miguel County annexed to Oury County in 1917.  
<sup>3</sup> Parts of Adams and Arapahoe Counties annexed to Washington and Yuma Counties in 1908.

# IDAHO.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Idaho collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of show-

ing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

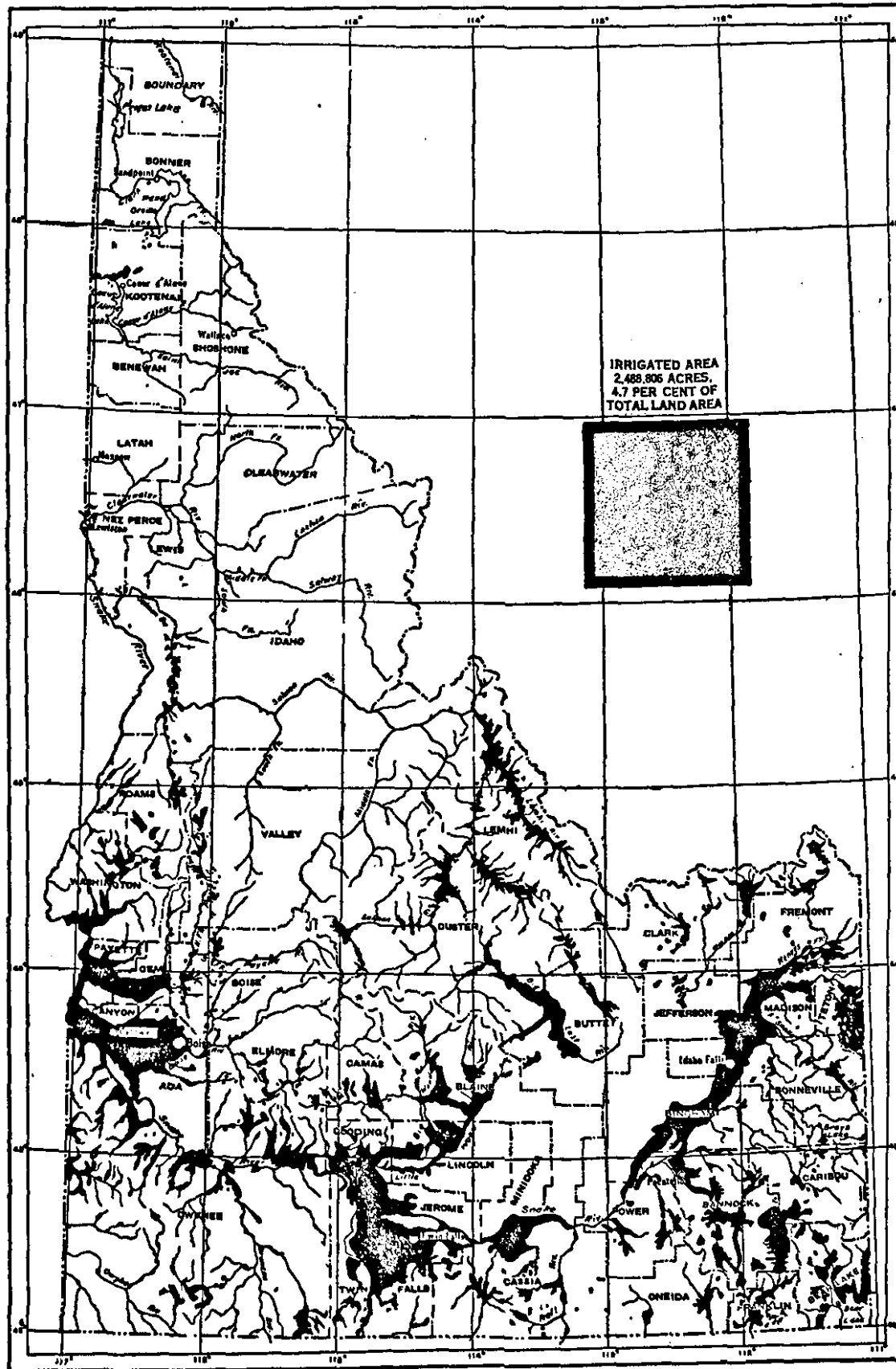
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	42, 106	30, 807	11, 299	36. 7
Approximate land area of the state..... acres..	53, 346, 560	53, 346, 560		
All land in farms..... acres..	8, 375, 873	5, 283, 604	3, 092, 269	58. 5
Improved land in farms..... acres..	4, 511, 680	2, 778, 740	1, 732, 940	62. 4
Number of farms irrigated.....	25, 283	16, 439	8, 844	53. 8
Area irrigated..... acres..	2, 488, 806	1, 430, 848	1, 057, 958	73. 9
Area enterprises were capable of irrigating..... acres..	3, 092, 810	2, 388, 959	703, 851	29. 5
Area included in enterprises..... acres..	3, 780, 048	3, 549, 573	230, 475	6. 5
Per cent irrigated:				
Number of all farms.....	60. 0	53. 4	6. 6	
Approximate land area of the state.....	4. 7	2. 7	2. 0	
Land in farms.....	29. 7	27. 1	2. 6	
Improved land in farms.....	55. 2	51. 5	3. 7	
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	604, 004	958, 111	-354, 107	-37. 0
Excess of area included in enterprises over area irrigated..... acres..	1, 291, 242	2, 118, 725	-827, 483	-39. 1
Area of irrigated land reported as available for settlement..... acres..	118, 334	( <sup>2</sup> )		
Capital invested.....	\$91, 501, 009	\$40, 977, 688	\$50, 523, 321	123. 3
Average per acre enterprises were capable of irrigating.....	\$29. 59	\$17. 15	\$12. 44	72. 5
Estimated final cost of existing enterprises.....	\$97, 019, 717	\$58, 451, 106	\$38, 568, 611	68. 0
Average per acre included in enterprises.....	\$25. 67	\$16. 47	\$9. 20	55. 9
Average cost of operation and maintenance per acre.....	\$1. 17	\$0. 63	\$0. 54	85. 7
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	3, 629	3, 092	537	17. 4
Number of main ditches.....	4, 553	3, 209	1, 344	41. 9
Length of main ditches..... miles..	11, 144	7, 662	3, 482	45. 4
Capacity of main ditches..... second-feet..	86, 273	80, 458	5, 815	7. 2
Number of lateral ditches.....	5, 265	3, 359	1, 906	56. 7
Length of lateral ditches..... miles..	6, 154	5, 097	1, 057	20. 7
Number of reservoirs.....	249	243	6	2. 5
Capacity of reservoirs..... acre-feet..	3, 493, 511	1, 742, 303	1, 751, 208	100. 5
Number of flowing wells.....	142	62	80	129. 0
Capacity of flowing wells..... gallons per minute..	15, 133	7, 200	7, 933	110. 2
Number of pumped wells.....	53	24	29	120. 8
Capacity of pumped wells..... gallons per minute..	17, 749	2, 826	14, 923	528. 1
Number of pumping plants.....	143	58	85	146. 6
Engine capacity..... horsepower..	28, 364	7, 065	21, 299	301. 5
Pump capacity..... gallons per minute..	1, 397, 681	278, 569	1, 119, 112	401. 7
Average lift..... feet..	29	( <sup>2</sup> )	29	

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not reported in 1910.

# IDAHO

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.





## CLIMATIC CONDITIONS.

The climatic conditions determining the necessity for irrigation are the amount and the seasonal distribution of precipitation, especially rainfall. With reference to precipitation Idaho is divided into two quite distinct zones. The southern and southeastern parts of the state are dry, while the northern part is wet. Expressed in another way, the drainage basin of Snake River from the point where this river enters the state on the eastern border to the northern boundary of Washington County, on the western border of the state, is dry, while the remainder of the state, except for a small area on the headwaters of Salmon River, is wet. In Snake River Valley, the normal annual precipitation at the eastern border of the state is about 20 inches; it decreases to the westward, falling below 10 inches in the vicinity of Twin Falls, or about midway of the state, and remaining below 10 inches to the western border of the state. From the vicinity of Caldwell northward the rainfall increases, reaching 20 inches at about the northern boundary of Washington County. A second zone that receives less than 10 inches of annual precipitation extends from Snake River in the vicinity of American Falls northward into the valleys of the headwaters of Salmon River and reaches the mountains forming the boundary between Idaho and Montana. The region, thus described, that receives less than 20 inches of precipitation annually constitutes about two-thirds of the area of the state, and contains most of the irrigated land. Crops are grown without irrigation in this section, on the high lands away from the rivers, where the precipitation is heavier. Throughout this section the period of lowest precipitation is the growing season—June, July, August, and September.

The part of the state receiving more than 20 inches of precipitation annually comprises all of the northern part of the state and the mountainous section extending southward between the dry section in Snake River Valley and that in Salmon River Valley. Small areas are irrigated in this humid part of the state, but generally crops are grown without irrigation.

In 1919 there was a serious deficiency of precipitation during the growing season. There was a pronounced shortage in the spring and summer rains in all sections, and this drouth continued until October. The local representative of the United States Weather Bureau in his annual report speaks of this drouth as follows:

It was without precedent both in duration and intensity and its destructive effects were apparent in the failure of dry farm crops and pastures; the drying up of the range; rapid and stubborn spread of forest fires; the failure of mountain streams, and the shortage, in some districts total failure, of irrigation water.

Aside from shortage of water the season was very favorable, and where water for irrigation was available unusually good crops were harvested.

## WATER SUPPLY FOR IRRIGATION.

In the northern part of the state, where the precipitation is heavy and the acreage irrigated is small, the streams supply far more water than is needed for the irrigation of the small areas that are watered or for any additional areas on which irrigation is likely to be practiced.

With the exception of a small area in the southeast corner of the state, all the southern part of Idaho, from the eastern border to the western border, is watered by Snake River and its tributaries. The South Fork of Snake River rises in lakes in Yellowstone National Park, flows southward into Wyoming, where it passes through Jackson Lake, and continues southward for about 60 miles, then turns westward into Idaho. From that point Snake River forms a long loop extending first southwesterly and then northwesterly, entirely across the state, after which it flows in a northerly direction, forming the western boundary of Idaho for about 200 miles.

From the junction of the North and South Fork to the point where the Snake reaches the western boundary of the state there are no important tributaries from the north. Numerous streams head in the mountains to the north of the river, but their waters are lost before reaching the river. There are, however, large springs discharging into the river from the north, producing quite an increase in the flow of the river. From the south, on the other hand, there are tributaries reaching the river at intervals throughout its course across the state. The most important of these, in order from east to west, are Blackfoot, Port Neuf, Raft, Salmon Falls, Bruneau, and Owyhee Rivers.

Entering Snake River from the east, in that section where it forms the western boundary of the state, are the Boise, Payette, and Weiser Rivers. All of the tributaries are used for irrigation, but the larger part of the irrigated land is supplied with water from Snake River itself.

Water for use in Idaho is stored in Jackson Lake in Wyoming and to some extent in reservoirs in the valley in Idaho. Any large extension of irrigation from Snake River in Idaho will require storage, and plans for such storage are being investigated by the United States Reclamation Service and other agencies.

Large storage reservoirs have been built on the Boise River by the United States Reclamation Service, from which water is supplied to lands in Oregon as well as in Idaho. There is storage on other tributaries also.

The southeastern corner of the state is watered from Bear River and its tributaries. The normal flow of this stream is largely utilized, and large increase in irrigation will require storage. Rights to water from Bear River are in conflict with rights in Utah, and the rights in the two states have been involved in litigation for many years.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	25,233	53.8	60.0	2,488,806	73.9	4.7	29.7	55.2
1910.....	16,439	78.9	53.4	1,430,848	135.1	2.7	27.1	51.6
1900.....	9,188	112.5	52.6	608,718	180.5	1.1	19.0	43.1
1890.....	4,323		68.6	217,005		0.4	18.7	35.8

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISE SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	3,629	3,780,048	2,488,806	65.8	3,092,810
Before 1860.....	10	2,374	931	39.2	1,271
1860-1869.....	86	69,498	48,536	69.8	51,143
1870-1879.....	277	183,670	144,031	78.4	157,604
1880-1889.....	1,013	998,737	755,533	75.6	880,378
1890-1899.....	618	567,955	353,053	67.4	520,789
1900-1904.....	420	775,464	619,677	79.9	716,405
1905-1909.....	368	727,788	354,143	48.7	544,285
1910-1914.....	372	206,879	90,870	43.9	118,532
1915-1919.....	316	202,003	60,355	29.9	67,599
Not reported.....	149	45,684	31,677	69.3	36,774

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Acres.	Per cent.		
Total.....	2,488,806	1,430,848	1,057,958	73.9	3,062,810	3,780,048
Streams, gravity.....	2,374,959	1,383,718	991,241	64.4	2,800,479	3,351,426
Streams, pumped.....	107,181	18,085	88,496	473.6	131,569	166,026
Streams, pumped and gravity.....	1,870	( <sup>2</sup> )	1,870	.....	4,470	5,670
Wells, pumped.....	414	705	-291	-41.3	513	903
Wells, flowing.....	1,131	1,172	-41	-3.5	1,241	3,492
Lakes, gravity.....	2,492	4,622	-2,130	-48.1	4,030	38,773
Lakes, pumped.....	4,912	1,535	3,377	230.0	9,206	11,991
Springs.....	33,337	19,679	13,658	69.4	48,461	80,566
Stored storm water.....	2,590	732	1,858	253.8	4,420	9,480
Sewage.....	80	( <sup>2</sup> )	80	.....	150	150
Streams, gravity, and pumped wells.....	357	( <sup>2</sup> )	357	.....	358	383
Streams, gravity, and flowing wells.....	1,927	( <sup>2</sup> )	1,927	.....	1,937	2,388
Other mixed.....	54,601	( <sup>2</sup> )	54,601	.....	82,906	118,590
Other and not reported.....	2,955	( <sup>2</sup> )	2,955	.....	3,050	3,210

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

The original irrigation district law in Idaho was enacted in 1895, and it has been amended from time to time since that date. Generally, in Idaho, irrigation districts have not built irrigation works, but have been organized to take over works built by other agencies. Some of the larger commercial enterprises

reported in 1910 have been taken over by districts, and this accounts for the decrease in the acreage reported for commercial enterprises. Much of the land served by the United States Reclamation Service has been organized into districts, but the acreage is credited to the Reclamation Service because the Government constructed the works and still controls them to a large extent. The Reclamation Service also supplies stored water to about 650,000 acres of land in other enterprises under the terms of the Warren Act (act of Congress, Feb. 21, 1911) and other special arrangements.

The state of Idaho accepted the terms of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1895, and this law has been amended from time to time. Some enterprises originally begun under this act have been reorganized in other forms and are reported under these in Table 5.

The small acreage credited to the state belongs to a state institution, and does not represent a scheme of state construction of irrigation works.

TABLE 5.—ACREAGE CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Percent.
ACREAGE IRRIGATED.				
Total.....	2,488,806	1,430,848	1,057,958	73.9
Individual and partnership.....	513,350	403,600	109,750	27.2
Cooperative.....	938,421	628,102	310,319	49.4
Irrigation district.....	358,995	140,930	218,065	152.6
Carey Act.....	383,833	162,418	221,415	136.3
Commercial.....	6,508	44,872	-38,369	-85.5
U. S. Reclamation Service.....	*253,759	47,600	206,259	434.2
U. S. Indian Service.....	36,775	3,426	33,349	973.4
State.....	10	( <sup>2</sup> )	10	.....
City.....	160	( <sup>2</sup> )	160	.....
ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.				
Total.....	3,092,810	2,388,959	703,851	29.5
Individual and partnership.....	639,002	483,946	155,056	32.0
Cooperative.....	1,190,422	782,603	407,819	52.1
Irrigation district.....	400,382	177,900	222,482	125.1
Carey Act.....	523,090	742,618	-219,528	-29.6
Commercial.....	7,747	67,352	-59,605	-88.5
U. S. Reclamation Service.....	*286,992	113,000	173,992	156.6
U. S. Indian Service.....	42,005	21,540	20,465	95.0
State.....	10	( <sup>2</sup> )	10	.....
City.....	160	( <sup>2</sup> )	160	.....
ACREAGE INCLUDED IN ENTERPRISES.				
Total.....	3,780,048	3,549,573	230,475	6.5
Individual and partnership.....	850,215	676,508	173,707	25.7
Cooperative.....	1,442,477	993,746	448,731	45.2
Irrigation district.....	463,839	329,796	134,043	40.6
Carey Act.....	664,404	1,068,661	-404,257	-39.5
Commercial.....	8,551	104,322	-95,771	-91.8
U. S. Reclamation Service.....	*295,992	295,000	992	0.3
U. S. Indian Service.....	54,240	51,540	2,700	5.2
State.....	10	( <sup>2</sup> )	10	.....
City.....	320	( <sup>2</sup> )	320	.....

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Does not include about 650,000 acres to which stored water is supplied under Warren Act.

<sup>3</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The territory of Idaho was organized under the act of March 3, 1863, and the state was admitted to the Union in 1890.

Rights to water from streams and other sources are subject to control by the state. The laws of Idaho

relating to water rights are summarized in the following paragraphs:

During the territorial period, in 1881, a law was passed recognizing the right to take or "appropriate" water from streams for useful or beneficial purposes, and providing that the appropriator must post a notice of the intended appropriation at the point of diversion and must file a copy of the notice in the county records. Laws passed in 1895 and 1899 retained this provision for posting and filing, and the act of 1899 provided further that all claimants to water must file statements of their claims within six months after the passage of the act. These provisions were in effect until 1903.

The act of March 11, 1903, provided that any party wishing to acquire a right to water must apply to the state engineer for a permit, and must, later, submit proof of having built works and put the water to use in accordance with the terms of the permit, and that, if the applicant complied with the terms of the permit the state engineer should issue a certificate of completion of works, and a license defining the rights acquired. This law is still in effect.

The act of March 11, 1903, provided, further, for the appointment of state officials to distribute water to those entitled to its use, and for the bringing of suits by these officials for the defining of rights to water, that is for adjudication of rights by the courts. The latter provision of the law was declared unconstitutional (Bear Lake v. Budge, 9 Idaho, 703). Rights are adjudicated in ordinary suits between claimants, but these can be begun only by claimants.

Article 15 of the state constitution, adopted August 6, 1889, provides that "the right to divert and appropriate the unappropriated waters of any natural stream to beneficial uses shall never be denied."

Riparian rights are not recognized in Idaho.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	2,488,806	100.0	100.0
Appropriation and use.....	130,774	5.3	18.9
Notice filed and posted.....	238,637	9.6	25.4
Adjudicated by court.....	1,104,607	44.4	38.9
Permit from state.....	490,979	19.6	18.6
Certificate or license from state.....	338,858	13.6	0.1
Riparian rights.....	18,889	0.6	0.1
Underground.....	1,534	( <sup>1</sup> )	( <sup>2</sup> )
Other and mixed.....	55,895	2.3	( <sup>3</sup> )
Not reported.....	109,033	4.6	( <sup>3</sup> )

<sup>1</sup> Less than one-tenth of 1 per cent.  
<sup>2</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	2,488,806	713,595	28.8	3,780,048	3,092,810
Bear River and tributaries.....	214,106	99,691	114.8	321,804	247,166
Bear River direct.....	107,063	15,912	572.8	149,901	127,642
Thomas Fork.....	8,905	6,116	45.6	8,929	8,905
Mill Creek.....	2,973	6,561	-54.7	10,028	5,238
Little Malad Creek.....	16,679	9,024	84.8	43,404	17,128
Other tributaries of Bear River.....	78,486	* 62,078	26.4	109,542	88,253
Snake River and tributaries.....	2,163,892	569,286	280.1	3,102,573	2,660,929
Snake River direct.....	710,908	64,832	.....	889,892	849,610
Henry's Fork.....	208,534	85,793	143.1	325,114	286,514
South Fork of Snake River.....	151,597	52,326	189.7	207,292	192,473
Blackfoot River.....	53,910	9,035	496.7	77,255	60,225
Port Neuf River.....	37,996	18,528	105.1	75,928	59,270
Raft River.....	23,620	23,793	-0.7	42,906	26,436
Salmon Falls River.....	41,330	( <sup>4</sup> )	.....	87,260	49,920
Little Wood River.....	30,153	( <sup>4</sup> )	.....	97,867	55,475
Big Wood River.....	117,748	33,961	246.7	203,795	178,497
Bruneau River.....	21,301	12,865	65.6	35,043	23,511
Owyhee River.....	10,903	( <sup>4</sup> )	.....	17,241	11,760
Boise River.....	328,395	84,438	288.9	388,313	368,854
Payette River.....	123,072	50,893	141.8	165,142	117,011
Wesler River.....	58,869	26,769	119.9	79,928	69,718
Salmon River.....	116,108	46,243	148.9	224,627	163,096
Clearwater River.....	4,623	1,944	137.8	5,777	5,545
Coeur d'Alene Lake and River.....	4,161	( <sup>4</sup> )	.....	10,469	5,681
Other tributaries of Snake River.....	115,664	* 57,866	99.9	168,832	137,393
Other tributaries of Columbia River.....	895	* 607	47.4	2,420	1,904
Independent streams.....	109,913	44,011	149.7	358,251	182,811
Camas Creek.....	17,490	4,107	325.9	95,199	46,190
Beaver Creek.....	1,502	2,330	-35.5	2,590	1,970
Medicine Lodge.....	5,019	3,225	55.6	12,445	8,390
Little Lost River.....	11,552	6,825	69.3	31,452	18,732
Big Lost River.....	72,788	23,547	209.1	204,845	106,727
Other independent streams.....	1,582	* 3,977	-60.7	6,720	1,802

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells. <sup>3</sup> Not reported separately in 1902.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$91,501,009	123.3	\$29.59	72.5
1910.....	40,977,688	700.3	17.15	352.5
1900.....	5,120,399	397.6	3.79	-30.0
1890.....	1,029,000	.....	4.74	.....

<sup>1</sup> A minus sign (-) denotes decrease.

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$91,501,009	100.0	\$29.59
Before 1860.....	3,137	( <sup>1</sup> )	2.47
1860-1869.....	881,963	1.0	17.25
1870-1879.....	1,024,629	1.1	6.50
1880-1889.....	13,791,700	15.1	15.67
1890-1899.....	9,088,738	9.9	17.45
1900-1904.....	25,892,006	28.3	36.14
1905-1909.....	34,081,217	37.3	62.62
1910-1914.....	3,795,869	4.1	32.56
1915-1919.....	2,227,426	2.4	32.95
Not reported.....	714,324	0.8	19.42

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$91,501,009	100.0	\$29.59	2,105,336	\$1.17
Streams, gravity.....	81,823,379	89.4	29.22	1,920,057	1.02
Streams, pumped.....	5,108,912	5.6	38.83	99,378	3.43
Streams, pumped and gravity.....	168,200	0.2	37.63	1,320	8.30
Wells, flowing.....	24,835	(*)	48.61	250	8.35
Wells, pumped.....	33,652	(*)	27.12	271	0.85
Lakes, pumped.....	544,981	0.6	59.20	3,412	8.72
Lakes, gravity.....	276,837	0.3	68.69	2,162	1.76
Springs.....	980,189	1.1	20.23	24,889	0.90
Stored storm water.....	246,257	0.3	55.71	2,245	1.99
Sewage.....	200	(*)	1.33	80	0.21
Streams, gravity and pumped wells.....	59,700	0.1	166.76	4	1.00
Streams, gravity and flowing wells.....	39,150	(*)	19.90	1,745	0.47
Other mixed.....	2,181,887	2.4	26.32	46,668	1.99
Other and not reported.....	12,730	(*)	4.17	2,855	0.41

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$91,501,009	\$6,190,071	\$85,310,938	.....
Bear River and tributaries.....	3,328,007	504,511	2,823,496	559.7
Bear River direct.....	2,066,991	98,080	1,968,911	.....
Thomas Fork.....	25,389	16,210	9,179	56.6
Mill Creek.....	21,012	18,640	2,372	12.7
Little Malad Creek.....	332,175	30,945	301,230	973.4
Other tributaries of Bear River.....	882,440	* 340,636	541,804	159.1
Snake River and tributaries.....	84,817,216	5,529,006	79,288,211	.....
Snake River direct.....	35,847,491	553,796	35,293,695	.....
Henrys Fork.....	2,001,841	428,430	1,573,411	367.3
South Fork of Snake River.....	6,193,701	633,698	5,560,003	877.4
Blackfoot River.....	1,022,276	43,690	978,586	.....
Port Neuf River.....	1,141,528	58,255	1,083,273	.....
Raft River.....	100,828	49,635	51,193	116.4
Salmon Falls River.....	4,152,745	(*)	4,152,745	.....
Little Wood River.....	1,018,699	(*)	1,018,699	.....
Big Wood River.....	5,398,133	239,228	5,158,905	.....
Bruneau River.....	532,745	234,250	298,495	127.4
Owyhee River.....	64,467	(*)	64,467	.....
Boise River.....	16,013,724	1,674,583	14,339,141	856.3
Payette River.....	2,015,780	685,232	2,230,548	326.5
Waiser River.....	2,018,459	116,601	1,901,849	.....
Salmon River.....	1,175,362	212,668	962,694	452.7
Clearwater River.....	298,755	90,685	208,170	229.8
Coeur d'Alene Lake and River.....	576,674	(*)	576,674	.....
Other tributaries of Snake River.....	3,846,907	* 511,354	3,335,553	652.7
Other tributaries of Columbia River.....	27,180	5,395	21,785	403.8
Independent streams.....	3,828,606	151,160	3,677,446	.....
Camas Creek.....	578,627	6,263	572,364	.....
Beaver Creek.....	7,259	4,290	2,969	89.2
Medicine Lodge.....	31,690	3,800	27,890	773.9
Little Lost River.....	474,465	32,710	441,755	.....
Big Lost River.....	2,709,698	79,717	2,629,981	.....
Other independent streams.....	26,867	* 24,380	2,487	10.2

<sup>1</sup> Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Not reported separately in 1902.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of most of the other classes shown in the table and a part of its expenditure is properly

chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$91,501,009	100.0	2,105,336	\$1.17
Individual and partnership.....	5,747,004	6.3	383,430	0.75
Cooperative.....	26,576,664	40.0	780,006	0.72
Irrigation district.....	11,954,046	13.1	287,415	2.11
Commercial.....	693,179	0.8	5,503	2.68
Carey Act.....	17,772,590	19.4	360,063	1.23
U. S. Reclamation Service.....	17,804,839	19.6	253,759	1.98
U. S. Indian Service.....	922,387	0.8	35,000	1.55
City.....	14,300	(*)	160	1.56
State.....	1,000	(*)	.....	.....

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	206
Acreage included in enterprises reporting land drained or needing drainage.....	734,405
Acreage for which drains have been installed.....	81,187
Additional acreage needing drainage.....	94,934
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	11.1
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	2.1
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	4.7

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume entering canals..... second-feet.....	43,481	35,669	7,812
Area irrigated in 1919..... acres.....	1,750,265	1,472,586	277,679
Average number of acres per second-foot.....	40	41	36
Total quantity entering canals..... acre-feet.....	11,142,792	9,571,753	1,571,039
Area irrigated in 1919..... acres.....	1,734,581	1,465,482	269,099
Average quantity per acre..... acre-feet.....	6.5	6.5	6.1
Total quantity delivered..... acre-feet.....	2,200,233	2,045,769	223,464
Area irrigated in 1919..... acres.....	886,659	841,667	95,022
Average quantity per acre..... acre-feet.....	2.4	2.4	2.4

IRRIGATION—IDAHO.

IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2, 872	288	4, 553	86, 273	11, 144	5, 265	6, 154	249	3, 498, 511
Before 1860.....	5	2	10	33	13	29	7	8	551
1860-1869.....	144	22	147	1, 883	279	98	119	2	1, 206
1870-1879.....	268	10	276	4, 348	686	245	208	15	5, 278
1880-1889.....	917	46	1, 304	28, 264	3, 267	1, 141	1, 188	25	34, 526
1890-1899.....	490	38	850	16, 320	2, 099	698	855	22	213, 783
1900-1904.....	282	43	507	14, 326	1, 423	291	1, 555	39	1, 540, 723
1905-1909.....	270	49	447	13, 412	1, 816	2, 130	1, 843	55	1, 408, 309
1910-1914.....	226	38	452	4, 498	859	325	237	41	104, 507
1915-1919.....	179	38	287	2, 276	470	247	95	25	184, 604
Not reported.....	91	4	173	933	252	71	47	7	25

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).
Total.....	180.6	142	15, 133	53	17, 749	143	23, 864
Before 1860.....		2	150				
1860-1869.....	21.4	4	188			5	1
1870-1879.....	0.3	84	5, 115			10	1
1880-1889.....	7.8	8	1, 090			798	7
1890-1899.....	7.2	16	2, 276	2	125	7	64
1900-1904.....	81.3	15	2, 909	1	27	10	9, 805
1905-1909.....	35.9	9	1, 206	4	1, 290	28	3, 276
1910-1914.....	25.7	20	211	18	11, 260	33	12, 880
1915-1919.....	16.8	28	1, 900	27	5, 057	49	1, 544
Not reported.....	34.2	6	90	1		7	294

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2, 872	288	4, 553	86, 273	11, 144	5, 265	6, 154	249	3, 498, 511
Individual and partnership.....	2, 445	187	3, 945	23, 948	5, 505	2, 198	821	164	41, 247
Cooperative.....	341	70	481	37, 081	5, 251	1, 249	2, 181	58	1, 075, 464
Irrigation district.....	48	10	79	10, 051	927	186	698	9	168, 500
Carey Act.....	27	12	31	10, 802	1, 047	221	1, 655	9	479, 600
Commercial.....	5	3	6	144	18	56	35	3	33, 000
U. S. Reclamation Service.....	4	5	6	3, 437	339	1, 290	604	6	1, 493, 700
U. S. Indian Service.....	1	1	3	728	57	40	150	2	200, 000
State.....									
Other and not reported.....	1		2	34	3	25	10		

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).
Total.....	180.6	142	15, 133	53	17, 749	143	23, 864
Individual and partnership.....	67.1	135	12, 682	50	8, 689	96	1, 297
Cooperative.....	52.8	7	2, 451			22	4, 621
Irrigation district.....	83.8			2	9, 000	21	13, 190
Carey Act.....	8.9					1	746
Commercial.....	1.7						
U. S. Reclamation Service.....	8.9					2	3, 500
U. S. Indian Service.....	0.8						
State.....	0.1			1	60	1	10
Other and not reported.....	2.0						



# IRRIGATION—IDAHO.

## CROPS.

**TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.**

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	10,994	47.2	2,041	22.2	438.7	Bu.....	383,740	53.9	63,490	21.5	460.3
2 Oats.....	42,487	30.0	147,827	48.8	-71.3	Bu.....	1,232,898	40.2	5,667,718	50.0	-78.2
3 Winter wheat.....	20,306	4.6	106,923	26.8	199.0	Bu.....	360,211	5.8	2,860,976	27.9	170.0
4 Spring wheat.....	299,360	42.5	13,287	10.0	48.0	Bu.....	7,364,943	63.1	428,775	9.3	26.1
5 Barley.....	19,667	20.0	365	11.1	561.4	Bu.....	540,749	40.1	19,751	24.1	4,688
6 Rye.....	2,414	20.2	(3)	(3)	(3)	Bu.....	19,751	24.1	(3)	(3)	(3)
<b>Other grains and seeds:</b>											
7 Red clover seed.....	14,859	87.2	(3)	(3)	(3)	Bu.....	57,195	91.1	(3)	(3)	(3)
8 Other clover and alfalfa seed.....	8,955	66.8	(3)	(3)	(3)	Bu.....	33,442	74.9	(3)	(3)	(3)
9 Timothy seed.....	537	16.6	215	14.3	149.8	Bu.....	1,286	11.4	1,387	13.9	-7.3
10 Dry beans, navy, etc.....	10,150	29.9	298	15.6	(3)	Bu.....	188,086	54.6	2,983	8.8	(3)
11 Dry peas, Canada.....	8,443	47.9	68	29.1	(3)	Bu.....	153,017	60.9	1,860	37.9	(3)
<b>Hay and forage:</b>											
12 Timothy alone.....	17,686	21.4	24,842	24.2	-28.8	Tons.....	22,360	80.8	47,386	33.8	-52.8
13 Timothy and clover mixed.....	48,063	47.6	33,418	61.0	45.4	Tons.....	52,019	52.2	63,068	63.2	-1.7
14 Clover alone.....	14,716	72.2	6,978	79.0	110.9	Tons.....	23,743	78.2	18,997	89.3	27.0
15 Alfalfa.....	515,301	79.1	276,460	89.5	85.4	Tons.....	1,510,380	86.7	903,291	93.6	67.2
16 Other tame grasses.....	8,782	41.5	18,803	47.3	-53.4	Tons.....	13,066	52.0	39,739	55.2	-67.1
17 Small grains cut for hay.....	13,402	8.0	7,395	7.6	81.2	Tons.....	17,056	12.2	8,857	6.3	92.6
18 Wild, salt, or prairie grasses.....	53,371	44.1	80,329	71.7	-38.2	Tons.....	53,515	46.0	108,869	76.7	-50.8
19 Corn cut for forage.....	1,527	18.6	(3)	(3)	(3)	Tons.....	4,969	29.9	(3)	(3)	(3)
20 Silage crops.....	4,453	52.2	(3)	(3)	(3)	Tons.....	37,908	68.6	(3)	(3)	(3)
21 Annual legumes cut for hay.....	544	14.0	(3)	(3)	(3)	Tons.....	762	21.8	(3)	(3)	(3)
<b>Miscellaneous:</b>											
22 Potatoes.....	32,044	74.2	1,011	87.8	682.7	Bu.....	5,409,108	85.8	66,351	68.3	(3)
23 Sugar beets grown for sugar.....	32,270	85.4	4,128	92.8	(3)	Tons.....	222,123	85.3	47,175	95.1	370.9
<b>Fruits:</b>											
24 Grapes.....	* 10,809	14.6	(3)	(3)	(3)	Lbs.....	104,156	20.0	(3)	(3)	(3)
25 Apples.....	* 852,307	35.8	(3)	(3)	(3)	Bu.....	1,211,790	33.2	(3)	(3)	(3)
26 Peaches.....	* 71,890	40.3	(3)	(3)	(3)	Bu.....	138,442	40.6	(3)	(3)	(3)
27 Pears.....	* 20,290	28.9	(3)	(3)	(3)	Bu.....	15,455	32.3	(3)	(3)	(3)
28 Plums and prunes.....	* 278,303	49.5	(3)	(3)	(3)	Bu.....	291,495	60.1	(3)	(3)	(3)
29 Cherries.....	* 31,136	26.5	(3)	(3)	(3)	Bu.....	19,789	22.0	(3)	(3)	(3)

CROP.	AVERAGE YIELD PER ACRE, 1919.					VALUE.					
	Unit.	For state.	On non-irrigated land.	On irrigated land.		1919		1909		Per cent of increase. <sup>1</sup>	
				Average.	Per cent of average for state.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.		
<b>Cereals:</b>											
1 Corn.....	Bu.....	27.5	20.9	34.9	126.9	167.0	\$652,358	59.9	\$63,548	28.0	-52.6
2 Oats.....	Bu.....	21.7	18.5	29.0	133.6	156.8	1,294,540	40.2	2,728,832	53.9	(3)
3 Winter wheat.....	Bu.....	14.2	10.6	17.7	124.6	126.4	738,433	5.8	2,377,367	28.3	566.1
4 Spring wheat.....	Bu.....	16.6	10.6	24.6	148.2	232.1	15,098,133	63.1	811,124	10.9	221.4
5 Barley.....	Bu.....	19.9	16.8	27.5	138.2	163.7	811,124	40.1	252,388	10.9	221.4
6 Rye.....	Bu.....	6.9	6.5	8.2	118.8	126.2	36,639	24.1	3,046	10.5	(3)
<b>Other grains and seeds:</b>											
7 Red clover seed.....	Bu.....	3.7	2.5	3.9	104.9	153.8	1,544,265	91.1	(3)	(3)	(3)
8 Other clover and alfalfa seed.....	Bu.....	3.3	2.5	3.7	112.0	148.0	766,166	74.9	(3)	(3)	(3)
9 Timothy seed.....	Bu.....	3.5	3.7	2.4	68.7	64.6	7,459	11.4	3,135	14.4	137.9
10 Dry beans, navy, etc.....	Bu.....	10.1	6.6	18.5	183.2	280.3	658,301	54.6	8,074	10.6	(3)
11 Dry peas, Canada.....	Bu.....	14.3	12.0	16.2	113.3	135.0	719,180	60.9	3,992	43.6	(3)
<b>Hay and forage:</b>											
12 Timothy alone.....	Tons.....	0.88	0.78	1.26	143.2	161.5	648,440	80.8	370,488	23.6	75.0
13 Timothy and clover mixed.....	Tons.....	1.16	1.06	1.23	110.3	120.8	1,612,260	52.2	541,229	56.8	197.9
14 Clover alone.....	Tons.....	1.49	1.17	1.61	108.1	137.6	474,880	78.2	130,069	85.5	265.1
15 Alfalfa.....	Tons.....	2.67	1.70	2.93	109.7	172.4	32,473,170	86.7	6,237,450	94.2	420.6
16 Other tame grasses.....	Tons.....	1.19	0.98	1.49	125.2	152.0	274,386	52.0	288,200	59.5	-4.8
17 Small grains cut for hay.....	Tons.....	0.83	0.80	1.27	153.0	158.8	469,040	12.2	88,874	6.2	427.8
18 Wild, salt, or prairie grasses.....	Tons.....	0.96	0.93	1.00	104.2	107.5	1,016,804	46.0	672,562	78.7	51.2
19 Corn cut for forage.....	Tons.....	2.03	1.74	3.25	186.1	196.8	54,659	29.9	(3)	(3)	(3)
20 Silage crops.....	Tons.....	6.48	4.26	8.51	131.3	199.8	379,080	68.6	(3)	(3)	(3)
21 Annual legumes cut for hay.....	Tons.....	0.90	0.82	1.40	165.6	170.7	16,002	21.8	(3)	(3)	(3)
<b>Miscellaneous:</b>											
22 Potatoes.....	Bu.....	145.9	80.0	168.8	115.8	211.2	11,629,582	85.8	74,885	76.0	(3)
23 Sugar beets grown for sugar.....	Tons.....	6.97	7.54	6.88	98.7	91.2	2,332,344	85.3	226,367	95.6	630.2
<b>Fruits:</b>											
24 Grapes.....	Lbs.....	* 0.1	* 0.1	* 0.1	142.9	142.9	7,291	20.0	(3)	(3)	(3)
25 Apples.....	Bu.....	* 1.5	* 1.6	* 1.4	92.8	89.3	2,120,632	33.2	(3)	(3)	(3)
26 Peaches.....	Bu.....	* 1.6	* 1.3	* 1.9	123.7	146.2	249,196	49.6	(3)	(3)	(3)
27 Pears.....	Bu.....	* 0.6	* 0.6	* 0.8	120.6	128.8	34,001	32.3	(3)	(3)	(3)
28 Plums and prunes.....	Bu.....	* 0.9	* 0.7	* 1.1	121.6	155.1	641,289	60.1	(3)	(3)	(3)
29 Cherries.....	Bu.....	* 0.8	* 0.8	* 0.6	81.8	77.8	68,268	22.0	(3)	(3)	(3)

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000. <sup>2</sup> Number of trees of bearing age. <sup>3</sup> Not reported separately in 1909. <sup>4</sup> Yield per vine. <sup>5</sup> Number of vines of bearing age. <sup>6</sup> Yield per tree.



IRRIGATION—IDAHO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (—) denotes decrease.]

	THE STATE.	Ada.	Adams. <sup>1</sup>	Bannock. <sup>2</sup>	Bear Lake.	Bingham. <sup>3</sup>	Blaine. <sup>4</sup>	
1	Number of all farms in 1920.....	42, 106	2, 198	484	1, 719	825	2, 144	478
2	Number of farms irrigated in 1919.....	25, 283	1, 938	267	1, 095	635	1, 831	347
3	Per cent of all farms.....	60. 0	88. 2	55. 2	63. 7	77. 0	85. 4	73. 4
4	Number of farms irrigated in 1909.....	16, 439	1, 315	.....	981	679	1, 883	550
5	Per cent of increase, 1909-1919.....	53. 8	47. 4	.....	.....	-6. 5	.....	.....
<b>LAND AND FARM AREA.</b>								
6	Approximate land area..... acres..	53, 246, 560	738, 560	874, 240	1, 175, 680	627, 200	1, 397, 760	1, 790, 060
7	All land in farms..... acres..	8, 375, 873	203, 651	156, 849	453, 710	202, 890	284, 924	134, 100
8	Improved land in farms..... acres..	4, 511, 680	131, 464	53, 984	270, 179	108, 466	169, 103	55, 491
9	Area irrigated in 1919..... acres..	2, 488, 806	121, 493	30, 900	137, 266	67, 202	177, 296	52, 090
10	Per cent of improved land in farms.....	55. 2	52. 4	57. 2	50. 8	62. 0	104. 8	93. 9
11	Area irrigated in 1909..... acres..	1, 430, 848	86, 494	.....	80, 648	58, 731	193, 741	68, 112
12	Per cent of increase, 1909-1919.....	73. 9	40. 5	.....	.....	14. 4	.....	.....
13	Area enterprises were capable of irrigating in 1920..... acres..	3, 092, 810	133, 763	32, 676	185, 316	72, 893	217, 200	77, 391
14	Area enterprises were capable of irrigating in 1910..... acres..	2, 388, 959	87, 511	.....	112, 288	59, 829	310, 908	87, 689
15	Per cent of increase, 1910-1920.....	29. 5	52. 9	.....	.....	21. 8	.....	.....
16	Area included in enterprises in 1920..... acres..	3, 780, 048	136, 790	42, 786	227, 586	63, 890	232, 923	97, 801
17	Area included in enterprises in 1910..... acres..	3, 549, 573	147, 330	.....	156, 037	74, 427	362, 034	203, 592
18	Per cent of increase, 1910-1920.....	6. 5	-7. 2	.....	.....	12. 7	.....	.....
19	Area of irrigated land reported as available for settlement..... acres..	118, 334	800	.....	16, 000	.....	12, 688	800
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20	Number, 1920.....	3, 629	50	121	242	95	68	129
21	Number, 1910.....	3, 092	46	.....	261	112	116	254
Main ditches:								
22	Number, 1920.....	4, 558	54	147	303	158	53	155
23	Number, 1910.....	3, 209	43	.....	252	131	124	257
24	Length, 1920..... miles..	11, 144	255	206	654	343	416	271
25	Length, 1910..... miles..	7, 662	213	.....	631	394	591	620
26	Capacity, 1920..... second-feet..	86, 273	2, 567	1, 015	3, 038	1, 522	5, 688	2, 716
27	Capacity, 1910..... second-feet..	80, 458	4, 267	.....	4, 036	2, 192	10, 383	4, 363
Laterals:								
28	Number, 1920.....	5, 265	264	50	127	161	95	.....
29	Number, 1910.....	3, 359	121	.....	137	37	205	256
30	Length, 1920..... miles..	6, 154	43	87	294	57	176	.....
31	Length, 1910..... miles..	5, 097	199	.....	261	29	351	376
Reservoirs:								
32	Number, 1920.....	249	10	3	17	13	6	1
33	Number, 1910.....	243	5	.....	14	14	8	14
34	Capacity, 1920..... acre-feet..	3, 493, 511	150, 536	1, 205	141, 216	5, 677	123, 610	.....
35	Capacity, 1910..... acre-feet..	1, 742, 303	8, 069	.....	176, 259	1, 158	4, 409	205, 835
Flowing wells:								
36	Number, 1920.....	142	7	.....	.....	.....	.....	.....
37	Number, 1910.....	62	9	.....	1	.....	.....	2
38	Capacity, 1920..... gallons per minute..	15, 133	45	.....	.....	.....	.....	.....
39	Capacity, 1910..... gallons per minute..	7, 200	370	.....	30	.....	.....	75
Pumped wells:								
40	Number, 1920.....	53	2	.....	.....	.....	1	.....
41	Number, 1910.....	24	.....	.....	.....	.....	.....	1
42	Capacity, 1920..... gallons per minute..	17, 749	900	.....	.....	.....	440	.....
43	Capacity, 1910..... gallons per minute..	2, 826	.....	.....	.....	.....	.....	600
Pumping plants:								
44	Number, 1920.....	143	6	.....	2	.....	2	.....
45	Number, 1910.....	58	2	.....	.....	.....	.....	1
46	Engine capacity, 1920..... horsepower..	28, 364	168	.....	23	.....	10	.....
47	Engine capacity, 1910..... horsepower..	7, 065	10	.....	.....	.....	.....	4
48	Pump capacity, 1920..... gallons per minute..	1, 397, 681	2, 250	.....	.....	.....	1, 440	.....
49	Pump capacity, 1910..... gallons per minute..	278, 569	308	.....	.....	.....	.....	600
50	Average lift, 1920..... feet..	29	32	.....	14	.....	18	.....
<b>CAPITAL INVESTED.</b>								
51	Capital invested to Jan. 1, 1920..... dollars..	91, 501, 009	5, 669, 338	394, 060	3, 106, 000	397, 393	3, 201, 889	736, 718
52	Capital invested to July 1, 1910..... dollars..	40, 977, 688	2, 404, 008	.....	806, 960	301, 672	3, 001, 533	2, 058, 383
53	Per cent of increase, 1910-1920.....	123. 3	135. 8	.....	.....	31. 7	.....	.....
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	29. 59	42. 38	12. 06	16. 76	5. 45	14. 74	9. 53
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	17. 15	27. 47	.....	7. 19	5. 04	9. 65	23. 47
<b>ESTIMATED FINAL COST.</b>								
56	Estimated final cost of existing enterprises in 1920..... dollars..	97, 019, 717	5, 669, 338	395, 910	3, 573, 940	430, 093	3, 654, 189	1, 120, 113
57	Estimated final cost of existing enterprises in 1910..... dollars..	59, 451, 106	5, 349, 208	.....	903, 812	304, 162	3, 068, 835	3, 797, 813
58	Per cent of increase, 1910-1920.....	66. 0	6. 0	.....	.....	41. 4	.....	.....
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	25. 67	41. 48	9. 25	15. 70	5. 13	15. 69	11. 45
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	16. 47	36. 31	.....	5. 79	4. 09	8. 53	18. 65

<sup>1</sup> Organized from part of Washington in 1911.  
<sup>2</sup> Part annexed to Franklin in 1918; part taken to form Caribou in 1919.  
<sup>3</sup> Part annexed to Fremont in 1905; part taken to form Bonneville in 1911; part taken to form part of Power in 1913; part taken to form part of Butte in 1917.  
<sup>4</sup> Part annexed to Elmore in 1911; part taken to form part of Power in 1913; parts taken to form Camas and part of Butte in 1917.

# IRRIGATION—IDAHO.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (—) denotes decrease.]

		Boise. <sup>1</sup>	Bonneville. <sup>2</sup>	Butte. <sup>3</sup>	Camas. <sup>4</sup>	Canyon. <sup>5</sup>	Caribou. <sup>6</sup>	Cassia. <sup>7</sup>	Clark. <sup>8</sup>
1	Number of all farms in 1920.....	238	1,480	432	354	2,660	368	1,568	398
2	Number of farms irrigated in 1919.....	143	1,080	327	97	2,477	91	1,257	99
3	Per cent of all farms.....	60.1	73.0	75.7	27.4	93.1	24.7	80.2	24.9
4	Number of farms irrigated in 1909.....	242				2,238		582	
5	Per cent of increase, 1909-1919.....								
<b>LAND AND FARM AREA.</b>									
6	Approximate land area..... acres..	1,177,600	1,218,580	1,310,720	684,800	378,880	808,320	1,660,800	1,137,920
7	All land in farms..... acres..	81,636	286,877	80,851	132,963	199,427	122,803	285,214	183,006
8	Improved land in farms..... acres..	16,462	176,091	50,911	72,308	167,486	52,783	178,679	56,673
9	Area irrigated in 1919..... acres..	7,608	110,953	39,583	13,272	201,718	23,825	113,537	18,851
10	Per cent of improved land in farms.....	46.2	68.0	77.7	18.4	123.1	45.1	63.5	33.9
11	Area irrigated in 1909..... acres..	25,052				133,046		59,510	
12	Per cent of increase, 1909-1919.....								
13	Area enterprises were capable of irrigating in 1920..... acres..	8,569	123,043	66,140	14,516	228,032	25,908	129,619	28,467
14	Area enterprises were capable of irrigating in 1910..... acres..	32,359				182,585		94,244	
15	Per cent of increase, 1910-1920.....								
16	Area included in enterprises in 1920..... acres..	14,239	135,021	134,858	21,284	234,582	29,102	149,035	45,794
17	Area included in enterprises in 1910..... acres..	41,488				356,722		163,561	
18	Per cent of increase, 1910-1920.....								
19	Area of irrigated land reported as available for settlement..... acres..	193						3,181	3,130
<b>IRRIGATION WORKS.</b>									
<b>Independent enterprises:</b>									
20	Number, 1920.....	111	85	76	58	29	61	157	100
21	Number, 1910.....	180				109		171	
<b>Main ditches:</b>									
22	Number, 1920.....	172	115	107	105	30	91	201	190
23	Number, 1910.....	202				103		176	
24	Length, 1920..... miles..	224	852	296	71	388	150	411	200
25	Length, 1910..... miles..	251				533		286	
26	Capacity, 1920..... second-feet..	568	4,558	1,509	186	3,619	1,139	2,039	2,160
27	Capacity, 1910..... second-feet..	933				7,159		3,086	
<b>Laterals:</b>									
28	Number, 1920.....	14	49	132	12	462	154	378	287
29	Number, 1910.....	76				247		364	
30	Length, 1920..... miles..	6	259	72	1	144	48	385	138
31	Length, 1910..... miles..	34				427		424	
<b>Reservoirs:</b>									
32	Number, 1920.....	10	6	5	6	1	5	5	5
33	Number, 1910.....	18				13		7	
34	Capacity, 1920..... acre-feet..	27	147	103,680	708	422,257	163	442,767	36,947
35	Capacity, 1910..... acre-feet..	80				186,244		73,056	
<b>Flowing wells:</b>									
36	Number, 1920.....					1		11	
37	Number, 1910.....	1				12			
38	Capacity, 1920..... gallons per minute..					30		2,700	
39	Capacity, 1910..... gallons per minute..	42				276			
<b>Pumped wells:</b>									
40	Number, 1920.....								
41	Number, 1910.....					2			
42	Capacity, 1920..... gallons per minute..								
43	Capacity, 1910..... gallons per minute..					60			
<b>Pumping plants:</b>									
44	Number, 1920.....	1				3		1	
45	Number, 1910.....					4		1	
46	Engine capacity, 1920..... horsepower..	2				156		3,300	
47	Engine capacity, 1910..... horsepower..					17		5,400	
48	Pump capacity, 1920..... gallons per minute..					7,400		330,000	
49	Pump capacity, 1910..... gallons per minute..					185		226,000	
50	Average lift, 1920..... feet..	15				27		14	
<b>CAPITAL INVESTED.</b>									
51	Capital invested to Jan. 1, 1920..... dollars..	148,484	3,045,291	3,034,313	117,777	10,223,513	236,538	4,610,590	138,592
52	Capital invested to July 1, 1910..... dollars..	160,487				4,507,866		2,403,581	
53	Per cent of increase, 1910-1920.....								
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	17.33	24.75	45.88	8.07	44.83	9.13	35.57	5.24
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	4.96				24.66		25.50	
<b>ESTIMATED FINAL COST.</b>									
56	Estimated final cost of existing enterprises in 1920..... dollars..	150,519	3,130,091	4,846,413	117,777	10,223,513	238,188	4,618,640	140,318
57	Estimated final cost of existing enterprises in 1910..... dollars..	160,487				8,855,666		4,074,824	
58	Per cent of increase, 1910-1920.....								
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	10.57	23.18	26.22	5.53	43.58	8.18	30.99	3.06
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	3.87				24.83		24.91	

<sup>1</sup> Part taken to form part of Gem in 1915; part taken to form part of Valley in 1917.

<sup>2</sup> Organized from part of Bingham in 1911.

<sup>3</sup> Organized from parts of Bingham, Blaine, and Jefferson in 1917.

<sup>4</sup> Organized from part of Blaine in 1917.

<sup>5</sup> Part taken to form part of Gem in 1915; part taken to form Payette in 1917.

<sup>6</sup> Organized from part of Bannock in 1919.

<sup>7</sup> Part taken to form Twin Falls in 1907; part taken to form part of Power in 1913.

<sup>8</sup> Organized from part of Fremont in 1919.

IRRIGATION—IDAHO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease.]

	Custer.	Elmore. <sup>1</sup>	Franklin. <sup>2</sup>	Fremont. <sup>3</sup>	Gem. <sup>4</sup>	Gooding. <sup>5</sup>	Idaho. <sup>6</sup>	Jefferson. <sup>7</sup>
1 Number of all farms in 1920.....	379	502	910	1,101	770	874	1,067	1,071
2 Number of farms irrigated in 1910.....	349	313	737	635	598	81.	85	888
3 Per cent of all farms.....	92.1	62.4	81.0	57.7	77.8	93.7	5.1	82.9
4 Number of farms irrigated in 1909.....	277	276		2,221			129	
5 Per cent of increase, 1909-1910.....	26.0							
<b>LAND AND FARM AREA.</b>								
6 Approximate land area.....acres..	3,149,440	1,707,120	555,840	1,183,260	362,890	473,600	5,484,960	700,160
7 All land in farms.....acres..	99,265	121,830	173,790	278,738	143,144	104,491	604,468	160,948
8 Improved land in farms.....acres..	49,461	38,958	104,241	172,078	56,134	76,379	218,562	99,744
9 Area irrigated in 1919.....acres..	80,141	28,844	87,480	130,044	51,007	45,408	2,593	149,151
10 Per cent of improved land in farms.....	162.0	74.0	86.9	75.6	90.9	60.2	1.2	149.5
11 Area irrigated in 1909.....acres..	41,889	17,751		303,163			3,372	
12 Per cent of increase, 1909-1919.....	91.3							
13 Area enterprises were capable of irrigating in 1920.....acres..	112,244	37,641	39,279	191,572	55,836	83,662	3,103	211,515
14 Area enterprises were capable of irrigating in 1910.....acres..	54,505	27,403		409,757			3,990	
15 Per cent of increase, 1910-1920.....	105.9							
16 Area included in enterprises in 1920.....acres..	144,041	60,252	54,967	222,235	59,852	91,523	3,943	258,608
17 Area included in enterprises in 1910.....acres..	75,788	105,688		466,112			5,546	
18 Per cent of increase, 1910-1920.....	90.1							
19 Area of irrigated land reported as available for settlement.....acres..	1,476	2,185						12,225
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
20 Number, 1920.....	284	138	77	108	42	79	86	72
21 Number, 1910.....	192	134		384			122	
<b>Main ditches:</b>								
22 Number, 1920.....	331	150	79	143	37	55	119	62
23 Number, 1910.....	215	134		410			126	
24 Length, 1920.....miles..	735	233	212	527	135	167	103	344
25 Length, 1910.....miles..	549	266		1,071			116	
26 Capacity, 1920.....second-feet..	3,202	1,117	859	9,597	2,109	2,756	151	3,364
27 Capacity, 1910.....second-feet..	2,112	838		21,720			281	
<b>Laterals:</b>								
28 Number, 1920.....	358	217	40	106	31	150	8	198
29 Number, 1910.....	160	119		291			29	
30 Length, 1920.....miles..	78	108	89	252	119	232		591
31 Length, 1910.....miles..	112	88		428			8	
<b>Reservoirs:</b>								
32 Number, 1920.....	7	18	6	19	1	5	5	6
33 Number, 1910.....	13	22		32				
34 Capacity, 1920.....acre-feet..	16,708	35,109	7,903	8,422	3	6,405	79	35,874
35 Capacity, 1910.....acre-feet..	3,417	51,053		41,535				
<b>Flowing wells:</b>								
36 Number, 1920.....		1			1			
37 Number, 1910.....		11						
38 Capacity, 1920.....gallons per minute..					36			
39 Capacity, 1910.....gallons per minute..		1,470						
<b>Pumped wells:</b>								
40 Number, 1920.....		17						
41 Number, 1910.....		5						
42 Capacity, 1920.....gallons per minute..		2,132						
43 Capacity, 1910.....gallons per minute..		690						
<b>Pumping plants:</b>								
44 Number, 1920.....	1	22	6			3		11
45 Number, 1910.....		12		1			1	
46 Engine capacity, 1920.....horsepower..	33	2,397	568			706		626
47 Engine capacity, 1910.....horsepower..		9		200			25	
48 Pump capacity, 1920.....gallons per minute..	10,800	13,996	14,915			33,794		96,250
49 Pump capacity, 1910.....gallons per minute..		1,043		1,000			225	
50 Average lift, 1920.....feet..	94	23	10			50		11
<b>CAPITAL INVESTED.</b>								
51 Capital invested to Jan. 1, 1920.....dollars..	778,848	1,606,335	322,981	1,712,611	1,492,550	6,960,473	109,506	6,308,032
52 Capital invested to July 1, 1910.....dollars..	305,140	1,008,403		1,759,052			74,316	
53 Per cent of increase, 1910-1920.....	155.2							
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	6.94	42.68	20.95	8.94	26.73	83.20	35.29	29.82
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	5.60	36.80		4.29			18.63	
<b>ESTIMATED FINAL COST.</b>								
56 Estimated final cost of existing enterprises in 1920.....dollars..	813,848	1,876,777	834,781	1,964,211	1,695,559	7,028,095	109,506	6,463,412
57 Estimated final cost of existing enterprises in 1910.....dollars..	303,340	1,508,408		1,791,082			74,316	
58 Per cent of increase, 1910-1920.....	163.9							
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	5.65	31.15	15.19	8.84	28.33	76.79	28.49	
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	4.07	14.27		3.84			13.40	24.99

<sup>1</sup> Part of Blaine annexed in 1911.  
<sup>2</sup> Organized from part of Oneida in 1913; part of Bannock annexed in 1918.  
<sup>3</sup> Parts taken to form Jefferson and Madison in 1914; part taken to form Clark in 1919.  
<sup>4</sup> Organized from parts of Boise and Canyon in 1915.

<sup>5</sup> Organized from part of Lincoln in 1913; part taken to form part of Jerome in 1919.  
<sup>6</sup> Boundary between Idaho and Lemhi changed in 1911; part of Idaho taken to form part of Valley in 1917.  
<sup>7</sup> Organized from part of Fremont in 1914; part taken to form part of Butte in 1917.

IRRIGATION—IDAHO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease.]

	Jerome. <sup>1</sup>	Kootenai. <sup>2</sup>	Lemhi. <sup>3</sup>	Lincoln. <sup>4</sup>	Madison. <sup>5</sup>	Minidoka. <sup>6</sup>	Nes Perce. <sup>7</sup>	Oneida. <sup>8</sup>
1 Number of all farms in 1920.....	685	1,396	535	418	928	1,024	1,291	1,041
2 Number of farms irrigated in 1919.....	662	195	509	397	665	901	184	415
3 Per cent of all farms.....	96.2	14.0	95.1	95.0	71.7	88.0	14.3	39.9
4 Number of farms irrigated in 1909.....		185	317	1,433			99	535
5 Per cent of increase, 1909-1919.....								
<b>LAND AND FARM AREA.</b>								
6 Approximate land area.....acres	887,840	801,920	2,942,080	760,320	307,840	483,840	544,040	773,760
7 All land in farms.....acres	76,488	221,151	169,192	64,784	217,591	91,028	417,461	308,414
8 Improved land in farms.....acres	62,229	79,017	77,423	42,899	155,145	68,051	190,875	176,774
9 Area irrigated in 1919.....acres	85,000	4,000	65,905	69,620	54,637	55,259	5,018	20,314
10 Per cent of improved land in farms.....	136.6	5.1	86.4	162.3	35.2	61.2	2.6	11.5
11 Area irrigated in 1909.....acres		2,984	37,916	82,684			5,360	43,856
12 Per cent of increase, 1909-1919.....								
13 Area enterprises were capable of irrigating in 1920.....acres	110,000	5,495	96,451	121,304	60,784	65,228	5,901	21,625
14 Area enterprises were capable of irrigating in 1910.....acres		10,126	41,108	456,852			9,317	45,282
15 Per cent of increase, 1910-1920.....								
16 Area included in enterprises in 1920.....acres	110,000	10,214	136,052	125,376	68,267	65,228	6,135	48,782
17 Area included in enterprises in 1910.....acres		18,125	61,677	514,955			29,896	98,022
18 Per cent of increase, 1910-1920.....								
19 Area of irrigated land reported as available for settlement.....acres	17,647		8,650	26,250		176		
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20 Number, 1920.....	1	19	404	44	37	1	59	69
21 Number, 1910.....		20	247	100			50	105
Main ditches:								
22 Number, 1920.....	1	13	584	42	44	2	31	18
23 Number, 1910.....		17	272	105			49	104
24 Length, 1920.....miles	22	15	825	170	132	29	33	1,391
25 Length, 1910.....miles		33	411	407			42	340
26 Capacity, 1920.....second-feet	2,072	98	2,691	3,027	2,768	480	75	1,000
27 Capacity, 1910.....second-feet		129	1,363	7,000			127	1,323
Laterals:								
28 Number, 1920.....	220	18	596	78	51	330	15	74
29 Number, 1910.....		28	64	645			12	53
30 Length, 1920.....miles	485	22	244	406	87	309	8	59
31 Length, 1910.....miles		32	32	1,298			38	102
Reservoirs:								
32 Number, 1920.....	1	1	4	1	1	2	6	10
33 Number, 1910.....		2	1	8			11	25
34 Capacity, 1920.....acre-feet	850,000	600	397	190,000	5,000	499,733	4	19,391
35 Capacity, 1910.....acre-feet			1	379,024			30,033	26,006
Flowing wells:								
36 Number, 1920.....							3	57
37 Number, 1910.....								9
38 Capacity, 1920.....gallons per minute								7,468
39 Capacity, 1910.....gallons per minute							400	1,487
Pumped wells:								
40 Number, 1920.....				1			27	2
41 Number, 1910.....							12	
42 Capacity, 1920.....gallons per minute				2,500			2,690	
43 Capacity, 1910.....gallons per minute		180					1,290	6
Pumping plants:								
44 Number, 1920.....	3	6	1	1		1	38	
45 Number, 1910.....		10	1				14	2
46 Engine capacity, 1920.....horsepower	1,290	992	5	2		5,200	404	
47 Engine capacity, 1910.....horsepower		979	189				59	2
48 Pump capacity, 1920.....gallons per minute	62,956	50,041	75	50		520,000	9,935	
49 Pump capacity, 1910.....gallons per minute		34,270	5,400				1,410	6
50 Average lift, 1920.....feet	50	51	19	10		16	22	
<b>CAPITAL INVESTED.</b>								
51 Capital invested to Jan. 1, 1920.....dollars	11,663,236	561,842	720,647	4,258,895	667,126	3,090,849	313,781	471,910
52 Capital invested to July 1, 1910.....dollars		771,904	199,731	10,265,589			837,603	1,585,759
53 Per cent of increase, 1910-1920.....								
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars	106.03	102.25	7.47	35.11	10.98	47.39	53.17	21.82
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars		76.23	4.86	22.47			89.90	35.02
<b>ESTIMATED FINAL COST.</b>								
56 Estimated final cost of existing enterprises in 1920.....dollars	11,663,236	811,842	744,797	4,259,215	699,726	3,090,849	717,171	471,910
57 Estimated final cost of existing enterprises in 1910.....dollars		771,904	203,216	11,776,548			1,614,603	1,817,108
58 Per cent of increase, 1910-1920.....								
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars	106.03	79.43	5.47	33.97	10.25	47.39	116.90	9.67
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars		42.59	3.29	22.87			54.01	19.53

<sup>1</sup> Organized from parts of Gooding, Lincoln, and Minidoka in 1919.  
<sup>2</sup> Part taken to form Bonner in 1907; part taken to form Benewah in 1915.  
<sup>3</sup> Boundary between Lemhi and Idaho changed in 1911.  
<sup>4</sup> Parts taken to form Gooding and Minidoka in 1913; part taken to form part of Jerome in 1919.  
<sup>5</sup> Organized from part of Fremont in 1914; part taken to form Teton in 1915.

<sup>6</sup> Organized from part of Lincoln in 1913; part taken to form part of Jerome in 1919.  
<sup>7</sup> Part of Shoshone annexed in 1905; parts of Nes Perce taken to form Clearwater and Lewis in 1911.  
<sup>8</sup> Part taken to form Franklin in 1913; part taken to form part of Power in 1913; part organized to Power in 1916.

IRRIGATION—IDAHO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1920; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.]

	Owyhee.	Payette. <sup>1</sup>	Power. <sup>2</sup>	Teton. <sup>3</sup>	Twin Falls.	Valley. <sup>4</sup>	Washington. <sup>5</sup>	Other counties.
1	785	763	784	541	2,746	309	1,119	5,126
2	642	700	179	318	2,609	107	610	91
3	81.8	91.7	22.8	58.8	95.0	34.6	54.5	1.8
4	247				1,203		716	30
5	169.9				116.9			
<b>LAND AND FARM AREA.</b>								
6	5,091,640	264,960	890,240	296,320	1,252,480	2,418,560	946,560	6,714,880
7	140,464	72,254	311,571	130,756	276,179	87,038	299,526	1,006,271
8	64,682	41,054	217,046	84,354	232,533	49,278	122,633	483,665
9	62,933	52,423	11,264	41,385	261,622	15,591	41,423	1,185
10	97.3	127.7	5.2	49.1	112.5	31.6	83.8	0.2
11	21,771				100,545		57,299	895
12	189.1				180.2			
13	74,494	30,653	17,186	57,422	271,443	24,148	52,065	2,221
14	44,240				246,625		71,445	901
15	68.4				10.1			
16	119,061	71,455	19,496	62,459	312,121	31,934	59,610	2,806
17	162,111				384,590		124,964	1,907
18	-26.6				-18.8			
19	3,958	5,356			7,430		1,500	
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20	259	40	58	99	85	73	89	30
21	146				37		286	19
Main ditches:								
22	426	41	57	103	132	79	97	26
23	137				32		299	21
24	583	268	97	164	219	130	326	17
25	302				172		423	11
26	2,338	1,497	325	1,498	6,046	572	1,158	204
27	2,249				4,924		1,818	166
Laterals:								
28	193	9	31	200	72	9	36	50
29	158				257		99	11
30	142	13	27	129	985	2	35	4
31	66				762		86	4
Reservoirs:								
32	22	7	12	1	6	2	8	5
33	14				2		12	8
34	20,324	63,050	712	40	206,600	205	94,596	416
35	50,779				492,000		13,354	2
Flowing wells:								
36	61				3			
37	9				5			
38	2,954				1,900			
39	80				2,970			
Pumped wells:								
40	1	3						1
41								
42	27	9,000						60
43								
Pumping plants:								
44	18	10	1		4		6	1
45	5						4	
46	9,526	606	40		1,552		748	10
47	118						103	
48	169,213	18,256	110		23,840		32,230	160
49	4,615						4,505	
50	45	30	40		39		56	50
<b>CAPITAL INVESTED.</b>								
51	2,309,967	1,209,175	270,888	157,976	8,984,389	147,110	1,774,135	47,847
52	1,274,833				6,653,172		581,099	16,567
53	51.2				35.0			
54	31.01	39.45	15.76	2.75	33.10	6.09	34.08	21.54
55	28.82				26.98		8.13	
<b>ESTIMATED FINAL COST.</b>								
56	2,535,156	1,300,375	287,138	163,176	9,166,578	177,160	1,874,135	53,022
57	4,034,943				7,415,142		584,084	16,567
58	-37.2				23.6			
59	21.29	16.92	14.73	2.61	29.37	5.54	31.44	18.90
60	24.89				19.28		4.67	8.69

<sup>1</sup> Organized from part of Canyon in 1917.  
<sup>2</sup> Organized from parts of Bingham, Blaine, Cassia, and Oneida in 1913; part of Oneida annexed in 1916.

<sup>3</sup> Organized from part of Madison in 1915.  
<sup>4</sup> Organized from parts of Boise and Idaho in 1917.  
<sup>5</sup> Part taken to form Adams in 1911.

# KANSAS.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Kansas collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of show-

ing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	165,286	177,841	-12,555	-7.1
Approximate land area of the state.....acres..	52,395,360	52,335,360	60,000	0.1
All land in farms.....acres..	45,425,179	43,384,799	2,040,380	4.7
Improved land in farms.....acres..	30,600,760	29,904,067	696,693	2.3
Number of farms irrigated.....	504	1,006	-502	-49.9
Area irrigated.....acres..	47,312	37,479	9,833	26.2
Area enterprises were capable of irrigating.....acres..	67,853	139,995	-72,142	-51.5
Area included in enterprises.....acres..	102,562	161,300	-58,738	-36.4
Per cent irrigated:				
Number of all farms.....	0.3	0.6	-0.3	-50.0
Approximate land area of the state.....	0.1	0.1	0.0	0.0
Land in farms.....	0.1	0.1	0.0	0.0
Improved land in farms.....	0.2	0.1	0.1	100.0
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	20,541	102,516	-81,975	-80.0
Excess of area included in enterprises over area irrigated.....acres..	55,250	123,821	-68,571	-55.4
Capital invested.....	\$2,067,381	\$1,365,563	\$701,818	51.4
Average per acre enterprises were capable of irrigating.....	\$30.47	\$9.75	\$20.72	212.5
Estimated final cost of existing enterprises.....	\$2,195,981	\$1,365,563	\$830,418	60.8
Average per acre included in enterprises.....	\$21.41	\$3.47	\$12.94	152.8
Average cost of operation and maintenance per acre.....	\$3.29	\$1.59	\$1.70	106.9
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	209	716	-507	-70.8
Number of main ditches.....	139	89	50	56.2
Length of main ditches.....miles..	271	274	-3	-1.1
Capacity of main ditches.....second-feet..	1,667	2,600	-933	-35.9
Number of lateral ditches.....	374	39	335	859.0
Length of lateral ditches.....miles..	147	42	105	250.0
Number of reservoirs.....	36	42	-6	-14.3
Capacity of reservoirs.....acre-feet..	391	31,024	-30,633	-98.7
Number of flowing wells.....	6	3	3	100.0
Capacity of flowing wells.....gallons per minute..	500	30	470	(2)
Number of pumped wells.....	710	939	-229	-24.4
Capacity of pumped wells.....gallons per minute..	266,797	73,362	193,435	263.7
Number of pumping plants.....	198	698	-500	-71.6
Engine capacity.....horsepower..	6,946	1,517	5,429	357.9
Pump capacity.....gallons per minute..	297,975	128,276	169,699	132.3
Average lift.....feet..	30	(2)	30	100.0

<sup>1</sup> A minus sign (-) denotes decrease.

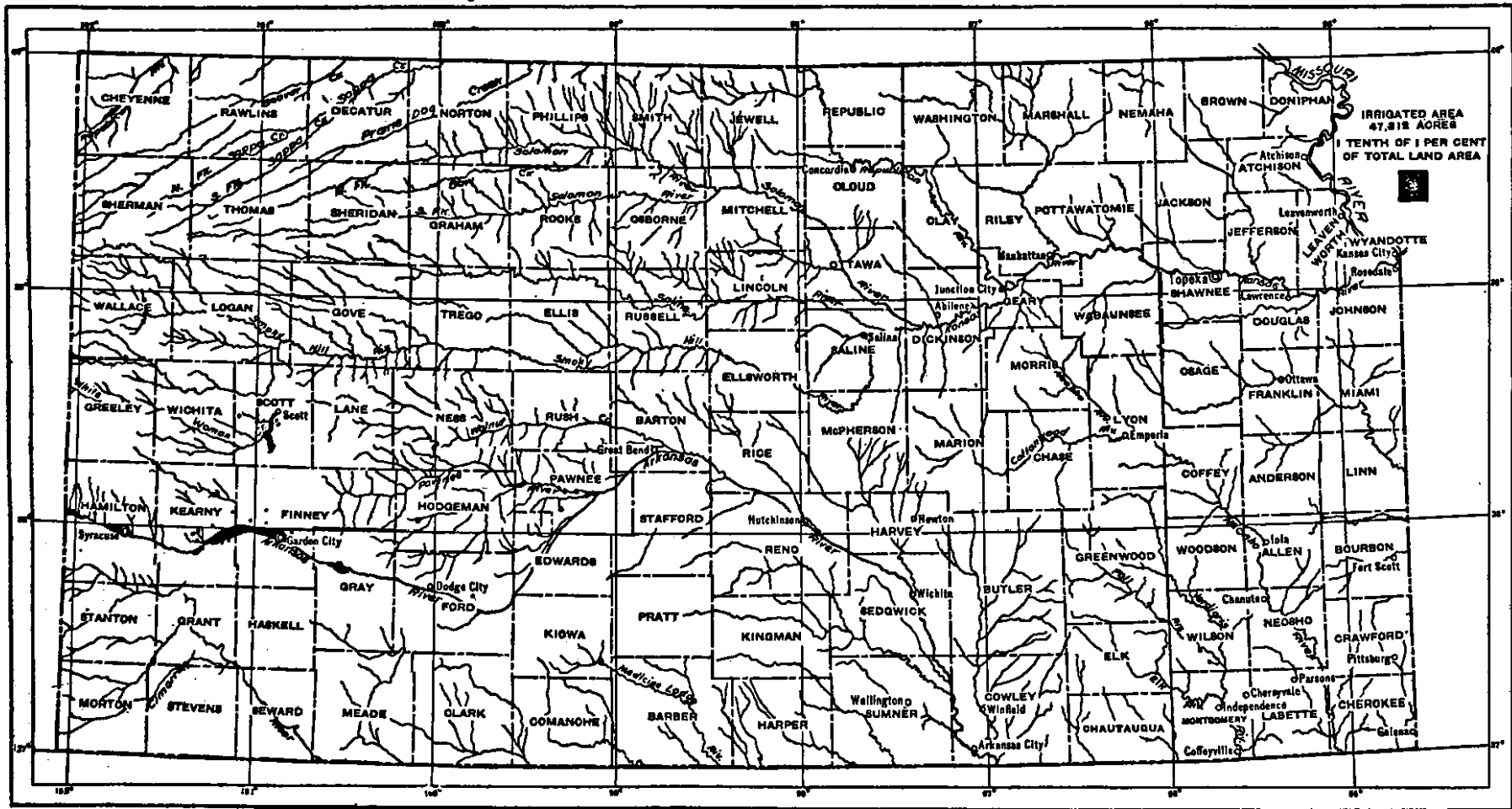
<sup>2</sup> Per cent not shown when more than 1,000.

<sup>3</sup> Not reported in 1910.

# KANSAS

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.

(178)





CLIMATIC CONDITIONS.

The usual climatic conditions determining the necessity for irrigation are the amount and the seasonal distribution of precipitation. In Kansas the wind movement also must be taken into consideration, because of its effect on evaporation.

Precipitation decreases with remarkable regularity from 42 inches in the southeastern counties of the state to just a little more than 15 inches at the Colorado line.

About 75 per cent of the annual precipitation falls during the six crop-growing months, April to September. In the western part of the state, during the late summer, the large amount of sunshine and the hot drying winds cause a rapid evaporation that increases the water requirements of vegetation and the necessity for irrigation.

The precipitation in the western part of the state in 1919 was above the normal and it is probable that some land was not irrigated that would be in a drier season.

WATER SUPPLY FOR IRRIGATION.

In the eastern part of Kansas the rainfall is sufficient for the growing of crops, and the streams carry an abundance of water. In the western part of the state the streams, with the exception of the Arkansas River, rise on the plains, and depend mostly on local precipitation for their summer flow, consequently they carry little water except during storms.

The Arkansas River rises in the main range of the Rocky Mountains and receives water from melting snows, but losses from evaporation and seepage and diversions in Colorado exhaust the summer flow of the river, except such as comes from local precipitation and seepage from irrigated land in Colorado. None of the streams in the part of the state where irrigation is needed affords any large supply of water during the summer, but the streams afford a good supply in the spring. There is opportunity for storage of the winter and flood flow, but little storage has been provided.

In the stream valleys there is abundant ground water at shallow depths, and more than one-fourth of the land irrigated in the state is supplied from this source. On the high plains there is ground water, but it occurs at such great depths that the cost of pumping is too great to permit of a large use of water from wells.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	504	-49.9	0.8	47,312	28.2	0.1	0.1	0.2
1910.....	1,008	8.3	0.8	37,479	58.7	0.1	0.1	0.1
1900.....	929	79.0	0.6	25,620	13.5	(*)	0.1	0.1
1890.....	519		(*)	20,818		(*)	0.1	0.1

<sup>1</sup> A minus sign (-) denotes decrease. \* Less than one-tenth of 1 per cent.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	209	102,562	47,312	46.1	67,853
1870-1879.....	2	145	80	55.2	145
1880-1889.....	7	23,386	15,413	65.9	23,386
1890-1899.....	7	15,786	13,226	83.8	15,786
1905-1909.....	30	13,103	3,617	27.6	5,317
1910-1914.....	62	7,027	3,719	52.9	6,485
1915-1919.....	78	37,452	7,109	18.5	11,405
Not reported.....	23	6,663	4,143	78.2	5,329

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	47,312	37,479	9,833	26.2	67,853	102,562
Streams, gravity.....	30,807	35,469	-4,662	-13.1	41,803	41,435
Streams, pumped.....	730	20	710		1,541	2,105
Streams, pumped and gravity.....	600		600		850	850
Wells, pumped.....	13,235	1,959	11,276	575.6	20,519	54,974
Wells, flowing and pumped.....	50	2	48		60	60
Lakes, pumped.....					100	100
Springs.....		27	-27			
Stored storm water.....		2	-2			
Streams, gravity, and pumped wells.....	1,540		1,540		2,330	2,618
Other mixed.....	350		350		350	420

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.

## ACREAGE, BY CHARACTER OF ENTERPRISE.

Kansas enacted an irrigation district law in 1891 but no districts are reported in the state.

The state has never accepted the conditions of the Federal Carey Act (act of Aug. 18, 1894).

The United States Reclamation Service undertook one project in Kansas, but this has been disposed of.

The small acreage credited to the state in Table 5 belongs to a state institution, and does not represent a scheme of state construction.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	47,312	37,479	9,833	26.2
Individual and partnership.....	14,546	3,154	11,392	361.2
Cooperative.....	32,516	27,372	5,144	18.8
Commercial.....	150		150	
U. S. Reclamation Service.....		8,953	-8,953	
State.....	100	( <sup>2</sup> )	100	
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	67,853	139,995	-72,142	-51.5
Individual and partnership.....	26,614	4,795	21,819	455.0
Cooperative.....	40,719	135,200	-94,481	-69.9
Commercial.....	320		320	
U. S. Reclamation Service.....				
State.....	200	( <sup>2</sup> )	200	
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	102,562	161,300	-58,738	-36.4
Individual and partnership.....	38,643	6,423	30,220	470.5
Cooperative.....	68,399	144,200	-75,801	-54.6
Commercial.....	320		320	
U. S. Reclamation Service.....		10,677	-10,677	
State.....	200	( <sup>2</sup> )	200	

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

## ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of the state of Kansas relating to water rights are summarized in the following paragraphs:

The state of Kansas enacted in 1886 a law declaring that rights to the use of water may be acquired by appropriation, and that between appropriations the first in time is the first in right. This law required any party wishing to appropriate water to post a notice at the point of intended diversion and file a copy of the notice with the county clerk.

A law enacted in 1891 contained the following sections relating to water rights:

"In all that portion of the state of Kansas situated west of the ninety-ninth meridian, all natural waters, whether standing or running, and whether surface or subterranean, shall be devoted, first, to purposes of irrigation in aid of agriculture, subject to ordinary domestic uses, and secondly to other industrial purposes, and may be diverted from natural beds, basins, or channels for such purposes and uses. *Provided*, That no such diversion shall interfere with, diminish, or divest any prior vested right of appropriation for the same or a higher purpose than that for which such diversion is sought to be made, without due legal condemnation of, and compensation for the same; and natural lakes and ponds of surface water having no outlets shall be deemed parcel of the lands wherein the same may be situated, and only the proprietors of such land shall be entitled to draw off the same.

"Waters flowing in well-defined subterranean channels and courses, or flowing or standing in subterranean sheets, shall be subject to appropriation with the same effect as water of superficial channels."

This law prescribes no procedure for acquiring rights, or for recording them, and the law of 1886 requiring posting and filing of claims is still in effect.

Conflicting rights are defined in ordinary suits between rival claimants.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	47,312	100.0	100.0
Appropriation and use.....	26,435	55.9	73.6
Notice filed and posted.....	4,218	8.9	26.3
Adjudicated by court.....	458	0.9	
Riparian rights.....	30	0.1	0.1
Underground.....	13,480	28.5	( <sup>1</sup> )
Other and mixed.....	838	2.0	( <sup>1</sup> )
Not reported.....	1,753	3.7	( <sup>1</sup> )

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

## ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1902 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	47,312	28,922	63.6	102,562	67,853
Tributaries of Kansas River.....	773	2,792	-72.3	3,590	3,396
Republican River.....	510	1,470	-65.3	2,090	2,090
Smoky Hill River.....	248	770	-67.8	1,420	1,236
Other tributaries of Kansas River.....	15	552	-97.3	70	70
Arkansas River and tributaries....	46,539	* 26,130	78.1	98,982	64,457
Arkansas River direct.....	30,130	22,253	36.4	38,533	38,533
Cimarron River.....		1,910		210	210
Other tributaries of Arkansas River.....	16,409	* 1,967	734.2	60,239	25,714

<sup>1</sup> A minus sign (-) denotes decrease. \* Includes springs and wells.

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.**

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$2,067,381	51.4	\$30.47	212.5
1910.....	1,365,583	157.8	9.75	-56.5
1900.....	529,755	525.2	22.43	451.1
1890.....	84,729		4.07	

<sup>1</sup> A minus sign (-) denotes decrease.

**TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$2,067,381	100.0	\$30.47
1870-1879.....	736	0.1	5.03
1880-1889.....	1,058,982	51.2	45.28
1890-1899.....	88,719	4.3	5.62
1900-1909.....	200,085	9.7	37.68
1910-1914.....	178,286	8.5	27.18
1915-1919.....	407,876	19.7	85.76
Not reported.....	134,697	6.5	25.28

**TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$2,067,381	100.0	\$30.47	28,583	\$3.20
Streams, gravity.....	1,184,074	57.3	28.48	17,957	0.92
Streams, pumped.....	22,142	1.1	14.37	645	7.57
Streams, pumped and gravity.....	50,000	2.4	53.82	600	20.00
Wells, pumped.....	741,583	35.9	36.14	8,481	6.96
Wells, flowing and pumped.....	4,000	0.2	68.67		
Lakes, gravity.....	1,000	(*)	10.00	50	1.00
Streams, gravity, and pumped wells.....	50,532	2.4	17.86	620	1.55
Other mixed.....	13,450	0.7	38.43	230	1.83

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.**

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$2,067,381	\$590,098	\$1,468,283	245.1
Tributaries of Kansas River.....	50,311	139,742	-89,431	-64.0
Republican River.....	15,816	107,450	-91,634	-85.3
Smoky Hill River.....	33,763	3,410	30,343	899.8
Other tributaries of Kansas River.....	742	28,882	-28,140	-97.4
Arkansas River and tributaries.....	3,017,070	459,356	1,557,714	339.1
Arkansas River direct.....	1,153,205	363,775	784,430	212.7
Cimarron River.....	18,000	21,100	-3,100	-28.9
Other tributaries of Arkansas River.....	848,865	69,481	779,384	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

**TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$2,067,381	100.0	28,583	\$3.20
Individual and partnership.....	775,095	37.5	8,817	6.07
Cooperative.....	1,289,737	62.4	19,666	1.99
Commercial.....	1,549	0.1		
State.....	1,000	(*)	100	12.00

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**DRAINAGE OF IRRIGATED LAND.**

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

**TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.**

Number of enterprises reporting land drained or needing drainage.....	5
Acreage included in enterprises reporting land drained or needing drainage.....	3,610
Acreage for which drains have been installed.....	250
Additional acreage needing drainage.....	1,320
Per cent that area for which drains have been installed is of total area included in enterprises reporting drainage.....	6.9
Per cent that area for which drains have been installed is of total area included in irrigation enterprises in the state.....	0.2
Per cent that area for which drains have been installed plus that needing drainage is of total area included in irrigation enterprises in the state.....	1.5

**QUANTITY OF WATER USED.**

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

**TABLE 14.—QUANTITY OF WATER USED IN 1919.**

ITEM.	Total.	Measured.	Not measured.
Average volume entering canals.....second-feet.....	455	854	101
Area irrigated in 1919.....acres.....	20,900	19,925	975
Average number of acres per second-foot.....	45.9	56.3	8.8
Total quantity of water entering canals.....acre-feet.....	35,139	18,402	16,737
Area irrigated in 1919.....acres.....	21,210	20,235	975
Average quantity per acre.....acre-feet.....	1.7	0.9	17.2
Total quantity of water delivered.....acre-feet.....	14,275	13,718	557
Area irrigated in 1919.....acres.....	20,855	20,055	800
Average quantity per acre.....acre-feet.....	0.7	0.7	0.7

IRRIGATION—KANSAS.

IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	10	13	139	1,067	271	374	147	36	391
1870-1879.....	2	1	2	2	2	8	1		
1880-1889.....	3		7	489	107	48	45		
1890-1899.....	3	1	7	328	51	12	3	2	40
1900-1909.....			15	271	34	52	4	10	24
1910-1914.....		5	55	202	38	134	61	11	122
1915-1919.....	2	6	51	368	26	114	32	12	206
Not reported.....			2	9	15	6	1	1	

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	28	6	500	710	266,797	198	6,946	288	297,975
1890-1899.....				1		1		2	
1900-1909.....	0.3	6	500	116	26,666	29	1,483	67	30,635
1910-1914.....	0.3			158	60,884	65	1,701	85	78,409
1915-1919.....	0.4			313	104,742	79	3,222	108	114,825
Not reported.....	1.8			122	74,606	24	540	26	74,106

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	10	13	139	1,067	271	374	147	36	391
Individual and partnership.....	7	6	129	817	112	288	81	30	336
Cooperative.....	3	6	8	774	154	71	58	6	5
Commercial.....			1	6	1				
State.....		1	1	70	4	15	8		

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	2.8	6	500	710	266,797	198	6,946	288	297,975
Individual and partnership.....	2.7	6	500	687	245,297	194	6,411	269	272,275
Cooperative.....				17	19,000	3	1,450	17	19,000
Commercial.....						1	25	1	2,500
State.....	0.1			6	3,500	1	60	1	4,200

IRRIGATION—KANSAS.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	10	13	139	1,667	271	374	147	36	391
Tributaries of Kansas River.....	5	1	14	50	18	14	1		
Republican River.....			4	34	12				
Smoky Hill River.....	5	1	9	15	6	14	1		
Other tributaries of Kansas River.....			1	1					
Arkansas River and tributaries.....	5	12	125	1,617	253	360	145	36	391
Arkansas River direct.....	3		8	774	154	54	48		3
Cimarron River.....			18	8	6			2	3
Other tributaries of Arkansas River.....	2	11	99	835	93	306	98	34	388

DRAINAGE BASIN.	Pipeline, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	2.8	6	500	710	266,797	198	6,946	288	297,975	30
Tributaries of Kansas River.....				32	2,600	8	383	23	6,700	37
Republican River.....				1	500	1	60	1	500	100
Smoky Hill River.....				31	2,100	6	303	21	5,350	29
Other tributaries of Kansas River.....						1	20	1	650	25
Arkansas River and tributaries.....	2.8	6	500	678	264,197	190	6,563	265	261,275	29
Arkansas River direct.....				1		1	10	1		12
Cimarron River.....		6	500	5	2,800	3	156	3	2,800	12
Other tributaries of Arkansas River.....	2.8			672	261,397	188	6,397	261	258,475	30

IRRIGATION—KANSAS.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of in-crease. <sup>1</sup>	Unit.	1919		1909		Per cent of in-crease. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	238	( <sup>2</sup> ) 0.1	745	( <sup>2</sup> ) 0.1	-68.1	Bu.....	4,090	( <sup>2</sup> ) 0.1	16,892	( <sup>2</sup> )	-75.8
2 Oats.....	1,238	( <sup>2</sup> )	437	( <sup>2</sup> )	164.2	Bu.....	24,022	( <sup>2</sup> ) 0.1	10,525	( <sup>2</sup> )	128.2
3 Winter wheat.....	4,029	( <sup>2</sup> )	930	( <sup>2</sup> )	358.4	Bu.....	45,340	( <sup>2</sup> )	19,121	( <sup>2</sup> )	150.7
4 Spring wheat.....	234	1.0				Bu.....	2,592	1.3			
5 Barley.....	1,370	0.8	356	0.2	284.8	Bu.....	18,483	0.2	6,145	0.3	200.8
<b>Hay and forage:</b>											
6 Alfalfa.....	14,962	1.1	10,470	1.1	42.9	Tons...	30,397	1.2	21,699	1.1	40.1
7 Wild, salt, or prairie grasses.....	615	0.1	541	( <sup>2</sup> )	13.7	Tons...	1,146	0.1	527	( <sup>2</sup> )	117.5
8 Silage crops.....	491	0.2	( <sup>2</sup> )			Tons...	2,668	0.2	( <sup>2</sup> )		
9 Corn cut for forage.....	186	( <sup>2</sup> )	( <sup>2</sup> )			Tons...	500	( <sup>2</sup> )	( <sup>2</sup> )		
10 Kafir, sorghum, etc., for forage.....	1,238	0.1	( <sup>2</sup> )			Tons...	3,033	0.2	( <sup>2</sup> )		
<b>Seeds:</b>											
11 Kafir, milo, feterita, durra.....	2,050	0.4	( <sup>2</sup> )			Bu.....	36,835	0.5	( <sup>2</sup> )		
<b>Miscellaneous:</b>											
12 Sugar beets grown for sugar.....	851	50.6	5,638	96.4	-84.9	Tons...	4,036	50.8	45,346	89.4	-91.1

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of in-crease. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average for non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	16.2	16.2	17.2	106.2	106.2	\$5,930	( <sup>2</sup> )	\$9,748	( <sup>2</sup> )	-39.2
2 Oats.....	Bu.....	26.0	26.0	19.4	74.6	74.6	19,218	0.1	4,942	0.1	288.9
3 Winter wheat.....	Bu.....	13.2	13.2	11.3	85.6	85.6	97,934	( <sup>2</sup> )	17,708	( <sup>2</sup> )	484.7
4 Spring wheat.....	Bu.....	8.5	8.5	11.1	130.6	130.6	5,599	1.3			
5 Barley.....	Bu.....	21.0	21.1	13.5	64.3	64.0	19,407	0.2	3,281	0.3	491.5
<b>Hay and forage:</b>											
6 Alfalfa.....	Tons...	1.89	1.89	2.03	107.4	107.4	531,948	1.2	153,250	1.1	247.1
7 Wild, salt, or prairie grasses.....	Tons...	1.06	1.06	1.86	175.5	175.5	14,325	0.1	3,099		362.2
8 Silage crops.....	Tons...	4.21	4.21	5.43	129.0	129.0	21,344	0.2	( <sup>2</sup> )		
9 Corn cut for forage.....	Tons...	1.50	1.50	2.69	179.3	179.3	4,000	( <sup>2</sup> )	( <sup>2</sup> )		
10 Kafir, sorghum, etc., for forage.....	Tons...	1.86	1.86	2.45	131.7	131.7	30,330	0.2	( <sup>2</sup> )		
<b>Seeds:</b>											
11 Kafir, milo, feterita, durra.....	Bu.....	13.9	13.9	18.0	129.5	129.5	49,727	0.5	( <sup>2</sup> )		
<b>Miscellaneous:</b>											
12 Sugar beets grown for sugar.....	Tons...	4.72	4.70	4.74	100.4	100.9	42,399	50.8	226,931	88.6	-81.3

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Less than one-tenth of 1 per cent.

<sup>3</sup> Not reported separately in 1909.

IRRIGATION—KANSAS.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	THE STATE.	Chey- anna.	Finney.	Gray.	Hamil- ton.	Kearny.	Pawnee.	Scott.	Wal- lace.	Other counties.	
1	Number of all farms in 1920.....	165,286	974	717	733	326	359	1,144	428	341	160,264
2	Number of farms irrigated in 1919.....	504	7	206	16	23	81	18	100	8	45
3	Per cent of all farms.....	0.3	0.7	28.7	2.2	7.1	22.6	1.6	23.4	2.3	-----
4	Number of farms irrigated in 1909.....	1,006	10	173	-----	54	121	-----	-----	-----	648
5	Per cent of increase, 1909-1919.....	-49.9	-----	19.1	-----	-----	-33.1	-----	-----	-----	-93.1
<b>LAND AND FARM AREA.</b>											
6	Approximate land area..... acres.....	52,335,960	645,120	816,640	548,490	629,760	545,920	474,880	456,960	589,440	47,628,160
7	All land in farms..... acres.....	45,425,179	570,222	629,119	423,068	262,213	213,685	456,771	335,360	336,271	42,198,470
8	Improved land in farms..... acres.....	30,600,760	407,959	158,264	228,277	64,261	80,723	407,567	150,808	101,883	29,011,518
9	Area irrigated in 1919..... acres.....	47,312	500	15,221	825	3,463	21,976	1,117	3,047	213	950
10	Per cent of improved land in farms.....	0.2	0.1	9.6	0.4	6.4	27.2	0.3	2.0	0.2	(1)
11	Area irrigated in 1909..... acres.....	27,479	1,515	17,285	60	2,366	15,168	-----	-----	251	634
12	Per cent of increase, 1909-1919.....	26.2	-87.0	-11.9	-----	46.4	44.9	-----	-----	-16.1	13.9
13	Area enterprises were capable of irrigating in 1920..... acres.....	67,853	2,080	18,655	1,000	6,266	29,367	2,366	5,045	1,018	2,056
14	Area enterprises were capable of irrigating in 1910..... acres.....	139,995	3,025	96,287	60	10,606	28,445	240	240	496	866
15	Per cent of increase, 1910-1920.....	-51.5	-31.2	-80.6	-----	-40.9	3.2	-----	-----	118.6	137.4
16	Area included in enterprises in 1920..... acres.....	102,562	2,080	19,209	1,000	6,266	37,897	2,630	30,163	1,018	2,299
17	Area included in enterprises in 1910..... acres.....	161,300	4,500	109,376	110	16,754	28,581	-----	480	621	878
18	Per cent of increase, 1910-1920.....	-36.4	-53.8	-82.4	900.0	-82.6	32.6	-----	-----	63.9	161.8
<b>IRRIGATION WORKS.</b>											
Independent enterprises:											
19	Number, 1920.....	209	3	85	1	9	31	16	12	7	45
20	Number, 1910.....	716	6	39	-----	11	10	-----	-----	-----	650
Main ditches:											
21	Number, 1920.....	139	3	72	1	4	6	15	2	7	29
22	Number, 1910.....	89	4	32	-----	8	5	-----	-----	-----	31
23	Length, 1920..... miles.....	271	12	48	50	28	90	21	1	6	15
24	Length, 1910..... miles.....	274	27	100	-----	33	65	-----	-----	10	38
25	Capacity, 1920..... second-feet.....	1,667	34	666	24	1	742	118	2	12	68
26	Capacity, 1910..... second-feet.....	2,600	125	1,400	-----	492	493	-----	6	14	70
Laterals:											
27	Number, 1920.....	374	-----	179	30	16	2	101	17	14	15
28	Number, 1910.....	39	1	11	-----	4	10	-----	-----	13	-----
29	Length, 1920..... miles.....	147	-----	43	18	6	8	49	10	1	12
30	Length, 1910..... miles.....	42	1	29	-----	5	3	-----	-----	4	-----
Reservoirs:											
31	Number, 1920.....	36	-----	13	-----	2	1	3	7	-----	10
32	Number, 1910.....	42	-----	31	-----	4	3	-----	-----	1	3
33	Capacity, 1920..... acre-feet.....	391	-----	237	-----	41	-----	101	9	-----	3
34	Capacity, 1910..... acre-feet.....	31,024	-----	31,019	-----	1	2	-----	-----	1	1
Flowing wells:											
35	Number, 1920.....	6	-----	-----	-----	-----	-----	-----	-----	-----	6
36	Number, 1910.....	3	-----	-----	-----	-----	-----	-----	-----	1	2
37	Capacity, 1920..... gallons per minute.....	500	-----	-----	-----	-----	-----	-----	-----	-----	500
38	Capacity, 1910..... gallons per minute.....	30	-----	-----	-----	-----	-----	-----	-----	10	20
Pumped wells:											
39	Number, 1920.....	710	-----	368	-----	11	165	7	54	24	81
40	Number, 1910.....	939	-----	252	3	7	75	-----	1	-----	601
41	Capacity, 1920..... gallons per minute.....	266,797	-----	102,611	-----	8,500	98,515	4,590	32,050	450	20,081
42	Capacity, 1910..... gallons per minute.....	73,362	-----	30,613	1,600	4,384	33,325	-----	3,000	-----	440
Pumping plants:											
43	Number, 1920.....	198	-----	81	-----	6	30	17	13	3	48
44	Number, 1910.....	698	-----	61	-----	9	19	-----	-----	-----	606
45	Engine capacity, 1920..... horsepower.....	6,946	-----	1,493	-----	126	2,085	397	1,930	75	840
46	Engine capacity, 1910..... horsepower.....	1,517	-----	992	-----	30	225	-----	35	-----	169
47	Pump capacity, 1920..... gallons per minute.....	297,975	-----	107,311	-----	9,200	97,615	21,390	32,350	3,300	26,809
48	Pump capacity, 1910..... gallons per minute.....	128,278	-----	80,113	1,600	6,384	33,725	-----	3,000	-----	3,454
49	Average lift, 1920..... feet.....	30	-----	26	-----	20	32	27	67	40	26
<b>CAPITAL INVESTED.</b>											
50	Capital invested to Jan. 1, 1920..... dollars.....	2,067,381	11,816	237,064	1,000,040	38,065	296,700	32,450	299,500	19,503	132,243
51	Capital invested to July 1, 1910..... dollars.....	1,365,563	6,384	1,089,048	5,600	25,908	218,694	-----	6,000	1,805	12,224
52	Per cent of increase, 1910-1920.....	51.4	85.1	-78.2	-----	46.9	35.7	-----	-----	980.5	981.8
53	Average cost per acre based on area enterprises were ca- pable of supplying with water in 1920..... dollars.....	30.47	5.68	12.71	1,000.04	6.07	10.10	13.72	59.37	19.16	64.32
54	Average cost per acre based on area enterprises were ca- pable of supplying with water in 1910..... dollars.....	9.75	2.11	11.31	91.67	2.44	7.69	-----	25.00	3.87	14.12
<b>ESTIMATED FINAL COST.</b>											
55	Estimated final cost of existing enterprises in 1920..... dollars.....	2,195,981	11,816	237,064	1,005,040	38,065	296,700	35,750	416,000	19,503	136,043
56	Estimated final cost of existing enterprises in 1910..... dollars.....	1,365,563	6,384	1,089,048	5,900	25,908	218,694	-----	6,000	3,357	10,272
57	Per cent of increase, 1910-1920.....	60.8	85.1	-78.2	-----	46.9	35.7	-----	-----	481.0	-----
58	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....	21.41	5.68	12.34	1,005.04	6.07	7.63	13.59	13.79	19.16	59.17
59	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....	8.47	1.42	9.96	53.64	1.55	7.65	-----	12.50	5.41	11.70

<sup>1</sup> Less than one-tenth of 1 per cent.



# LOUISIANA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Louisiana collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

Rice is the only crop grown under irrigation in Louisiana, and small areas of rice are grown without irrigation, although in general the crop is irrigated. For the state the acreage of rice harvested in 1919 was 456,726 acres, the quantity produced was 16,005,936 bushels, and the value \$42,735,849.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

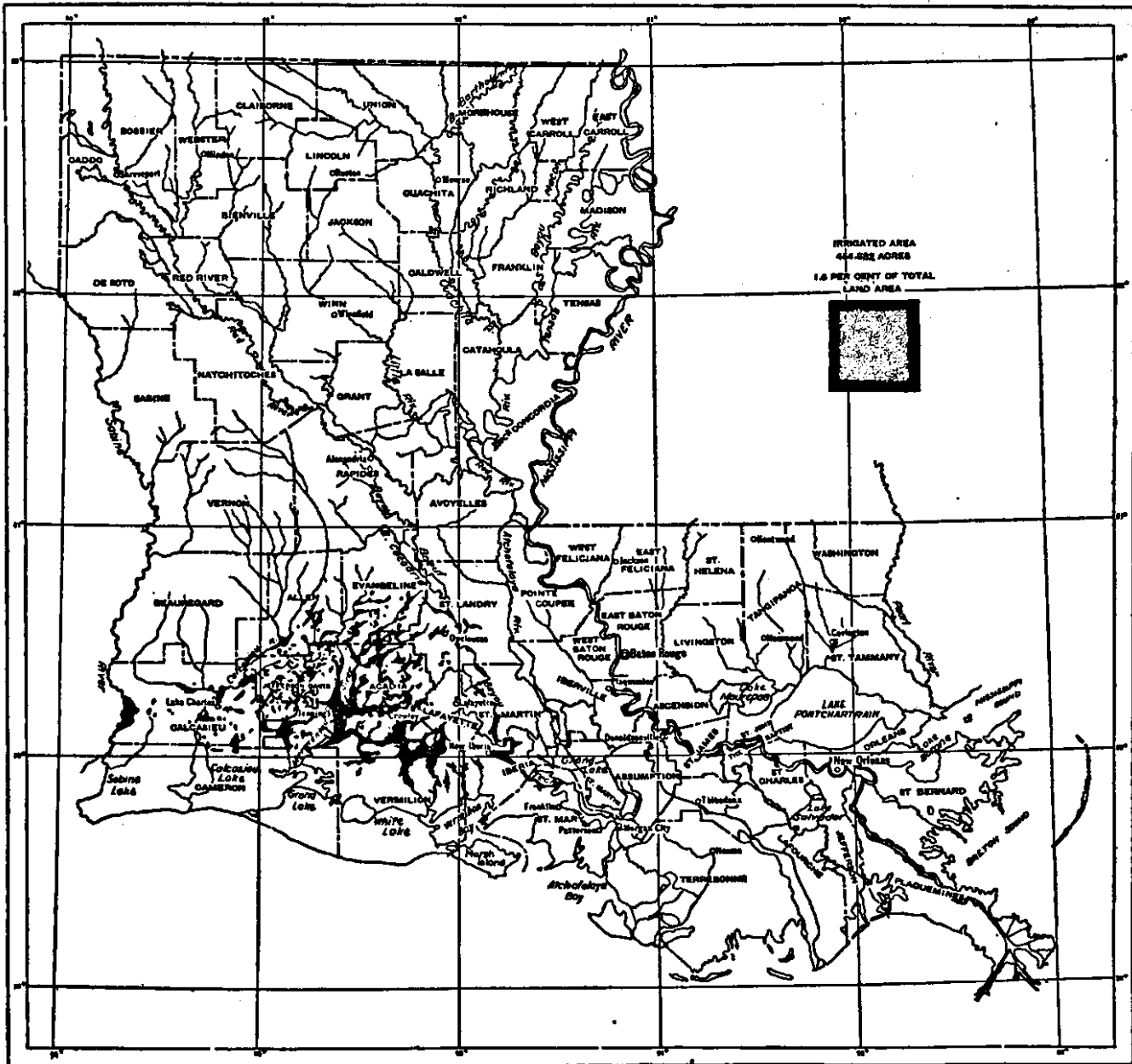
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	135,463	120,546	14,917	12.4
Approximate land area of the state..... acres..	29,061,760	29,061,760		
All land in farms..... acres..	10,019,822	10,439,481	-419,659	-4.0
Improved land in farms..... acres..	5,626,226	5,276,016	350,210	6.6
Number of farms irrigated.....	6,471	2,690	3,781	140.6
Area irrigated..... acres..	454,882	380,200	74,682	19.6
Area enterprises were capable of irrigating..... acres..	728,742	553,220	175,522	31.7
Area included in enterprises..... acres..	851,211	581,965	269,246	46.3
Per cent irrigated:				
Number of all farms.....	4.8	2.2	2.6	
Approximate land area of the state.....	1.6	1.3	0.3	
Land in farms.....	4.5	3.6	0.9	
Improved land in farms.....	8.1	7.2	0.9	
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	273,860	173,020	100,840	58.3
Excess of area included in enterprises over area irrigated..... acres..	396,329	201,765	194,564	96.4
Capital invested.....	\$14,063,181	\$6,859,166	\$7,204,015	105.0
Average per acre enterprises were capable of irrigating.....	\$19.30	\$12.40	\$6.90	55.6
Estimated final cost of existing enterprises.....	\$14,264,178	\$6,914,166	\$7,350,012	106.3
Average per acre included in enterprises.....	\$18.76	\$11.88	\$4.88	41.1
Average cost of operation and maintenance per acre.....	\$7.01	( <sup>2</sup> )		
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	1,373	1,237	136	11.0
Number of main ditches.....	1,298	515	783	152.0
Length of main ditches..... miles..	1,584	729	855	117.3
Capacity of main ditches..... second-feet..	11,889	( <sup>2</sup> )	11,889	
Number of lateral ditches.....	3,908	180	3,728	
Length of lateral ditches..... miles..	1,659	439	1,220	277.9
Number of reservoirs.....	74	104	-30	-28.8
Capacity of reservoirs..... acre-feet..	7,632	19,482	-11,850	-60.8
Number of flowing wells.....	9	( <sup>2</sup> )	9	
Capacity of flowing wells..... gallons per minute..	6,255	( <sup>2</sup> )	6,255	
Number of pumped wells.....	812	606	206	34.0
Capacity of pumped wells..... gallons per minute..	1,607,637	1,108,236	499,401	45.1
Number of pumping plants.....	1,250	1,007	243	24.1
Engine capacity..... horsepower..	85,628	57,426	28,202	49.1
Pump capacity..... gallons per minute..	4,968,686	5,064,173	-95,487	1.9
Average lift..... feet..	32	( <sup>2</sup> )	32	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Not reported in 1910.

# LOUISIANA

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



CLIMATIC CONDITIONS.

In Louisiana the normal rainfall is sufficient for the growing of general farm crops, the average annual rainfall for the state being about 54 inches. The rainfall in 1919 was far above the normal, the average for the state being about 69 inches.

Rice is the only crop irrigated, and some rice is grown without irrigation, although the area of rice grown in this way is small.

WATER SUPPLY FOR IRRIGATION.

The larger part of the land irrigated for rice growing in Louisiana consists of level prairie land located in the southwestern part of the state, near the coast of the Gulf of Mexico. In this section the principal sources of water supply are the streams flowing to the Gulf and wells, from both of which the water is pumped. The streams are but little, if any, above the level of the Gulf, and water is pumped to the level lands lying between the streams. Usually the supply of fresh water is sufficient for the land irrigated, but at times the draft upon the streams is so heavy as to exhaust the supply of fresh water and salt water backs into the streams from the Gulf. At such times it is necessary to stop pumping until the fresh water coming from higher levels forces the salt water out of the streams, and occasionally crops suffer from shortage of water or from the use of salt water. Usually the pumping plants and canals are operated by commercial companies furnishing water to farmers for some form of crop rental.

About one-third of the area of irrigated land in the state is supplied with water pumped from wells. Usually these are owned by individual farmers, who supply water to their own farms only.

A small part of the rice is grown on lands along Mississippi River, which lie below the level of the water in the river at ordinary stages. Water for these lands is taken from the river by siphons passing over the levees. When the water is too low to siphon over the levees, it is pumped from the river to small basins made on the water side of the levees, high enough to permit of its being siphoned over.

The area of land available for rice growing and the water supply are ample to permit of a large extension of the area devoted to this crop. Other conditions limit the area.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	6,471	140.6	4.8	454,882	19.6	1.6	4.5	8.1
1910.....	2,690	-40.6	2.2	380,200	88.5	1.3	3.6	7.2
1900.....	4,531		3.9	201,685	139.0	0.7	1.8	4.3
1890.....	(*)			84,377		0.3	0.9	2.2

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not reported.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	1,373	851,211	454,882	53.4	728,742
1870-1879.....	1	180	40	25.0	160
1880-1889.....	6	4,018	2,050	51.0	2,360
1890-1899.....	37	320,400	151,983	47.4	294,465
1900-1904.....	112	92,361	50,263	54.4	75,862
1905-1909.....	137	68,605	34,631	50.5	47,224
1910-1914.....	294	108,290	59,919	55.3	92,539
1915-1919.....	638	213,410	126,831	59.7	177,238
Not reported.....	148	44,967	29,165	64.9	38,994

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	454,882	380,200	74,682	19.6	728,742	851,211
Streams, gravity.....	10,226	1,012	9,214	910.5	12,393	15,225
Streams, pumped.....	248,306	211,959	36,347	17.1	437,475	488,611
Streams, pumped and gravity.....	12,620		12,620		27,675	30,800
Wells, pumped.....	154,304	109,547	44,757	40.9	209,698	258,680
Wells, flowing.....	196		196		292	292
Wells, flowing and pumped.....	1,075	(*)	1,075		1,325	2,175
Lakes, gravity.....	3,225	1,347	1,878	139.4	4,616	5,095
Lakes, pumped.....	6,966	5,202	1,764	33.9	10,140	11,100
Stored storm water.....	84	7,064	-6,970	-98.8	239	229
Streams, gravity, and pumped wells.....	10,045	(*)	10,045		12,994	25,984
Other mixed.....	7,835	44,079	-36,244	-82.2	11,905	13,020

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not included in classification in 1910.

**ACREAGE, BY CHARACTER OF ENTERPRISE.**

Neither the Federal Carey Act (act of Aug. 18, 1894) nor the reclamation act (act of June 17, 1902) applies to the state of Louisiana, and the state has no laws relating to organization for supplying water for irrigation.

The commercial enterprises, reported in Table 5, are usually corporations that put in pumping plants and canals to supply water to farmers for crop rentals. Many of them own lands also and supply both land and water for a share of the crop.

The cooperative enterprises are unimportant, since they supply water to less than 3 per cent of the land.

**TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.**

ITEM AND CLASS.	CENSUS OF—		INCREASE.	
	1920	1910	Amount.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	454,882	330,200	74,682	19.6
Individual and partnership.....	259,673	222,049	37,624	16.9
Cooperative.....	10,635	10,635	0	0
Commercial.....	184,574	158,151	26,423	16.7
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	728,742	553,220	175,522	31.7
Individual and partnership.....	375,917	267,620	108,297	40.5
Cooperative.....	20,325	20,325	0	0
Commercial.....	332,500	265,275	67,225	25.3
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	851,211	581,965	269,246	46.3
Individual and partnership.....	468,126	283,965	184,161	64.9
Cooperative.....	20,685	20,685	0	0
Commercial.....	362,400	277,315	85,085	30.7

**ACREAGE, BY DRAINAGE BASIN.**

For no previous census have the results for Louisiana been tabulated by drainage basins; consequently no comparative figures can be included in Table 6.

**TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919.**

DRAINAGE BASIN.	Area irrigated in 1919 (acres).	Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
Total.....	454,882	851,211	728,742
Sabine River and tributaries.....	13,035	20,850	20,850
Calcasieu Lake, River, and tributaries.....	54,318	169,193	137,178
Mermentau River and tributaries.....	263,840	458,463	352,755
Vermilion River and tributaries.....	74,034	138,066	126,649
Atchafalaya River and tributaries.....	23,342	31,920	30,886
Mississippi River direct.....	17,416	24,070	23,755
Tributaries of Mississippi River.....	2,853	6,358	3,473
Other Gulfstreams.....	1,044	3,291	3,197

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 7.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1900 TO 1920.**

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$14,063,181	105.0	\$19.30	55.6
1910.....	6,859,166	171.2	12.40	-1.1
1900.....	2,529,319		12.54	

<sup>1</sup> A minus sign (-) denotes decrease.

**TABLE 8.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$14,063,181	100.0	\$19.30
1870-1879.....	1,000	( <sup>1</sup> )	6.25
1880-1889.....	24,800	0.2	10.97
1890-1899.....	5,487,222	39.0	18.63
1900-1904.....	1,347,323	9.6	17.78
1905-1909.....	1,171,166	8.3	24.80
1910-1914.....	1,602,682	10.7	16.24
1915-1919.....	3,848,822	27.4	21.72
Not reported.....	680,167	4.8	17.44

<sup>1</sup> Less than one-tenth of 1 per cent.

**TABLE 9.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.**

(When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.)

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$14,063,181	100.0	\$19.30	431,413	\$7.01
Streams, gravity.....	318,934	2.3	25.74	9,937	3.69
Streams, pumped.....	7,338,964	52.2	16.78	242,282	7.76
Streams, pumped and gravity.....	172,000	1.2	6.21	12,550	6.06
Wells, pumped.....	5,366,948	38.2	26.59	140,659	5.95
Wells, flowing.....	5,000	( <sup>2</sup> )	17.12	189	2.25
Wells, flowing and pumped.....	22,500	0.2	16.98	1,075	4.19
Lakes, pumped.....	356,960	2.5	35.20	6,716	9.17
Lakes, gravity.....	112,740	0.8	24.42	2,480	3.21
Stored storm water.....	1,500	( <sup>2</sup> )	6.55	10	5.00
Streams, gravity, and pumped wells.....	247,595	1.8	19.05	9,115	10.69
Other mixed.....	120,050	0.9	10.08	6,400	8.67

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**TABLE 10.—CAPITAL INVESTED, 1920, CLASSIFIED BY DRAINAGE BASIN.**

DRAINAGE BASIN.	1920
Total.....	\$14,063,181
Sabine River and tributaries.....	328,000
Calcasieu Lake, River, and tributaries.....	1,816,380
Mermentau River and tributaries.....	7,713,797
Vermilion River and tributaries.....	3,355,827
Atchafalaya River and tributaries.....	407,956
Mississippi River direct.....	302,385
Tributaries of Mississippi River.....	28,696
Other Gulfstreams.....	110,650

## IRRIGATION—LOUISIANA.

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**TABLE 11.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$14,063,181	100.0	481,413	\$7.01
Individual and partnership.....	7,943,252	56.5	236,504	6.84
Cooperative.....	181,658	1.1	10,835	4.81
Commercial.....	5,938,271	42.4	184,274	7.35

<sup>1</sup> Based on area irrigated in 1919.

### DRAINAGE OF IRRIGATED LAND.

**TABLE 12.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.**

Number of enterprises reporting land drained or needing drainage.....	406
Acres included in enterprises reporting land drained or needing drainage..	283,470
Acres for which drains have been installed.....	167,138
Additional acreage needing drainage.....	21,202
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	59.0
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	19.6
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state..	22.1

The acreages reported in Table 12 relate to lands within the boundaries of irrigation projects, and do

not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

### QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 13. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

**TABLE 13.—QUANTITY OF WATER USED IN 1919.**

ITEM.	Total.	Meas-ured.	Not meas-ured.
Average volume of water entering canals.....second-feet..	5,042	34	5,008
Area irrigated in 1919.....acres..	20,783	780	20,002
Average number of acres per second-foot.....	4	23	4
Total quantity of water entering canals.....acre-feet..	198,942	7,022	191,920
Area irrigated in 1919.....acres..	66,424	780	64,644
Average quantity per acre.....acre-feet..	3.0	9.0	3.0
Total quantity of water delivered.....acre-feet..	16,497	.....	16,497
Area irrigated in 1919.....acres..	7,994	.....	7,944
Average quantity per acre.....acre-feet..	2.1	.....	2.1

## IRRIGATION WORKS.

**TABLE 14.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	419	63	1,298	11,889	1,584	3,908	1,659	74	7,632
1870-1879.....		1						1	400
1880-1889.....	11	3	7	33	9	1	1	1	60
1890-1899.....	68	2	37	3,008	411	1,493	1,011	1	6
1900-1904.....	57	2	100	1,515	166	336	113	3	85
1905-1909.....	77	14	146	675	131	363	92	4	30
1910-1914.....	198	38	283	2,633	248	496	124	17	2,275
1915-1919.....	8	3	648	3,787	635	1,145	290	38	4,776
Not reported.....			77	258	84	75	28	9	

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).
Total.....	50.1	9	6,255	812	1,607,637	1,250	85,623
1870-1879.....							
1880-1889.....	0.2			1	7,000	5	280
1890-1899.....	2.9			9	96,200	37	18,390
1900-1904.....	1.0			64	132,850	90	6,755
1905-1909.....	0.9			117	199,100	128	7,985
1910-1914.....	44.9	2	2,500	179	338,550	268	17,652
1915-1919.....	0.2	5	3,330	339	688,320	578	29,135
Not reported.....		2	425	103	146,617	146	6,031

IRRIGATION—LOUISIANA.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	419	63	1,298	11,839	1,584	3,908	1,659	74	7,632
Individual and partnership.....	419	62	1,264	8,773	1,110	2,388	522	74	7,632
Cooperative.....			6	35	19	35	33		
Commercial.....		1	28	3,081	455	1,490	1,104		

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).	
Total.....	50.1	9	6,255	812	1,607,637	1,250	85,628	1,941	4,968,686	32
Individual and partnership.....	50.1	9	6,255	805	1,588,837	1,212	82,658	1,855	2,611,886	41
Cooperative.....				2	7,500	10	1,205	12	106,500	30
Commercial.....				5	11,300	28	21,765	74	2,250,300	35

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	419	63	1,298	11,839	1,584	3,908	1,659	74	7,632
Sabine River and tributaries.....		2	1	111	40	25	25	1	
Calcasieu Lake, River, and tributaries.....	4	4	84	1,700	159	92	168	3	490
Mermentau River and tributaries.....	14	47	771	6,067	863	1,032	568	61	5,058
Vermilion River and tributaries.....			68	1,699	202	1,071	667	1	
Atchafalaya River and tributaries.....	17	1	91	728	109	62	42	1	2,041
Mississippi River direct.....	340		241	859	174	1,553	182	6	43
Tributaries of Mississippi River.....	39		37	707	29	58	2		
Other Gulf streams.....	5	9	5	8	8	15	5	1	

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).	
Total.....	50.1	9	6,255	812	1,607,637	1,250	85,628	1,941	4,968,686	32
Sabine River and tributaries.....				2	27,500	3	1,050	6	54,500	41
Calcasieu Lake, River, and tributaries.....	0.4	5	5,800	92	243,400	128	13,933	161	937,294	30
Mermentau River and tributaries.....	0.1			594	1,209,750	800	56,300	1,293	2,927,213	35
Vermilion River and tributaries.....		2	425	82	67,007	136	7,052	222	694,044	29
Atchafalaya River and tributaries.....	42.2	1		42	59,980	105	4,070	171	230,675	13
Mississippi River direct.....	6.2					67	2,846	74	162,500	12
Tributaries of Mississippi River.....	0.8					5	285	5	22,300	15
Other Gulf streams.....	0.4	1	30			6	92	9	160	8

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**PARISH TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.**

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.]

	THE STATE.	Acadia.	Allen. <sup>1</sup>	Ascension.	Assumption.	Calcasieu. <sup>2</sup>	Cameron.	
1	Number of all farms in 1920.....	135,463	3,088	753	1,630	438	922	620
2	Number of farms reporting irrigation for rice growing in 1919.....	6,471	1,678	165	74	13	377	192
3	Per cent of all farms.....	4.8	54.3	21.9	4.5	3.0	41.9	31.0
4	Number of farms reporting irrigation for rice growing in 1909.....	2,690	1,002	18	18	18	815	21
5	Per cent of increase, 1909-1919.....	140.6	87.5	—	—	—	—	—
<b>LAND AND FARM AREA.</b>								
6	Approximate land area..... acres.....	29,061,760	414,080	424,320	186,240	300,760	695,040	960,640
7	All land in farms..... acres.....	10,019,822	322,061	94,659	108,982	79,282	145,591	132,513
8	Improved land in farms..... acres.....	5,626,226	278,939	42,328	72,530	53,856	104,197	33,264
9	Area irrigated for rice growing in 1919..... acres.....	454,882	134,710	15,805	2,080	1,130	47,056	725
10	Per cent of improved land in farms.....	8.1	48.3	37.3	2.9	2.1	68.2	2.2
11	Area irrigated for rice growing in 1909..... acres.....	360,200	107,466	—	4,233	—	131,203	7,226
12	Per cent of increase, 1909-1919.....	19.6	26.4	—	-50.9	—	—	-90.0
13	Area enterprises were capable of irrigating in 1920..... acres.....	728,742	186,218	28,590	2,635	1,530	121,612	4,230
14	Area enterprises were capable of irrigating in 1910..... acres.....	563,220	167,809	—	4,233	—	191,752	11,190
15	Per cent of increase, 1910-1920.....	31.7	10.9	—	-37.8	—	—	-62.2
16	Area included in enterprises in 1920..... acres.....	851,211	208,799	30,705	2,635	1,530	147,115	4,310
17	Area included in enterprises in 1910..... acres.....	581,965	171,917	—	4,233	—	208,404	12,280
18	Per cent of increase, 1910-1920.....	46.3	21.5	—	-37.8	—	—	-64.9
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
19	Number, 1920.....	1,373	828	32	6	2	56	5
20	Number, 1910.....	1,237	272	—	7	—	358	8
Main ditches:								
21	Number, 1920.....	1,298	340	37	8	1	38	5
22	Number, 1910.....	615	110	—	4	—	101	4
23	Length, 1920..... miles.....	1,584	428	36	7	1	160	5
24	Length, 1910..... miles.....	729	220	—	3	—	243	14
25	Capacity, 1920..... second-feet.....	11,889	1,934	36	16	4	1,580	8
26	Capacity, 1910..... second-feet.....	(°)	—	—	—	—	—	—
Laterals:								
27	Number, 1920.....	3,908	604	19	1	—	77	12
28	Number, 1910.....	180	82	—	—	—	81	3
29	Length, 1920..... miles.....	1,659	390	41	1	—	145	5
30	Length, 1910..... miles.....	439	187	—	—	—	194	4
Reservoirs:								
31	Number, 1920.....	74	11	—	—	—	3	—
32	Number, 1910.....	104	—	—	1	—	9	1
33	Capacity, 1920..... acre-feet.....	7,632	2,170	—	—	—	460	—
34	Capacity, 1910..... acre-feet.....	19,482	—	—	2	—	4,671	1,800
Flowing wells:								
35	Number, 1920.....	9	—	—	—	—	5	—
36	Number, 1910.....	(°)	—	—	—	—	—	—
37	Capacity, 1920..... gallons per minute.....	6,255	—	—	—	—	5,800	—
38	Capacity, 1910..... gallons per minute.....	(°)	—	—	—	—	—	—
Pumped wells:								
39	Number, 1920.....	812	280	32	—	—	28	1
40	Number, 1910.....	606	180	—	—	—	323	5
41	Capacity, 1920..... gallons per minute.....	1,607,637	426,300	89,700	—	—	109,800	2,600
42	Capacity, 1910..... gallons per minute.....	1,108,236	313,727	—	—	—	586,470	12,000
Pumping plants:								
43	Number, 1920.....	1,250	347	45	7	2	57	5
44	Number, 1910.....	1,007	283	—	7	—	362	8
45	Engine capacity, 1920..... horsepower.....	85,628	27,279	5,580	275	155	7,047	187
46	Engine capacity, 1910..... horsepower.....	57,428	16,907	—	473	—	22,014	643
47	Pump capacity, 1920..... gallons per minute.....	4,068,688	1,509,335	161,100	9,500	11,000	745,200	93,094
48	Pump capacity, 1910..... gallons per minute.....	5,064,173	1,465,612	36	31,213	—	2,040,052	144,190
49	Average lift, 1920..... feet.....	32	37	36	15	22	21	17
<b>CAPITAL INVESTED.</b>								
50	Capital invested to Jan. 1, 1920..... dollars.....	14,063,181	3,732,648	309,450	44,100	12,500	1,667,236	59,570
51	Capital invested to July 1, 1910..... dollars.....	6,859,166	2,098,121	—	21,025	—	2,904,063	129,320
52	Per cent of increase, 1910-1920.....	105.0	77.9	—	109.8	—	—	-53.9
53	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars.....	19.30	20.04	10.82	16.74	8.17	13.71	14.08
54	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars.....	12.40	12.50	—	4.97	—	15.14	11.67
<b>ESTIMATED FINAL COST.</b>								
55	Estimated final cost of existing enterprises in 1920..... dollars.....	14,264,178	3,795,013	310,950	44,100	12,500	1,669,936	59,570
56	Estimated final cost of existing enterprises in 1910..... dollars.....	6,914,166	2,098,121	—	21,025	—	2,959,063	129,320
57	Per cent of increase, 1910-1920.....	106.3	80.9	—	109.8	—	—	-53.9
58	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....	16.76	18.18	10.13	16.74	8.17	11.35	13.89
59	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....	11.88	12.20	—	4.97	—	14.20	10.53

<sup>1</sup> Formed from part of Calcasieu Parish in 1913.

<sup>2</sup> Parts taken to form Allen, Beauregard, and Jefferson Davis Parishes in 1918.

<sup>°</sup> Not reported in 1910.



IRRIGATION—LOUISIANA.

PARISH TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	Evange- line. <sup>1</sup>	Iberia.	Iberville.	Jefferson Davis. <sup>2</sup>	Lafayette.	Flaque- mines.	Pointe Coupee.	St. Charles.	
1	Number of all farms in 1920.....	3,550	1,481	600	1,163	3,048	571	3,303	258
2	Number of farms reporting irrigation for rice growing in 1919.....	601	197	35	776	104	159	2	34
3	Per cent of all farms.....	16.9	13.3	5.2	66.7	3.4	27.8	0.1	13.2
4	Number of farms reporting irrigation for rice growing in 1909.....		29	13		23	150	10	39
5	Per cent of increase, 1909-1919.....						6.0		
<b>LAND AND FARM AREA.</b>									
6	Approximate land area.....acres..	616,060	376,960	373,780	466,580	173,580	644,480	368,640	188,800
7	All land in farms.....acres..	170,229	110,646	113,802	264,063	141,154	69,348	194,904	49,908
8	Improved land in farms.....acres..	140,969	95,037	72,434	231,970	128,626	22,419	120,636	24,740
9	Area irrigated for rice growing in 1919.....acres..	12,058	11,801	2,275	99,534	4,485	4,813	500	1,088
10	Per cent of improved land in farms.....	8.6	12.4	3.1	42.9	3.5	21.5	0.4	4.4
11	Area irrigated for rice growing in 1909.....acres..		3,865	7,922		2,212	6,375	3,205	4,878
12	Per cent of increase, 1909-1919.....		205.3	-71.3		102.8	-24.5	-84.4	-77.7
13	Area enterprises were capable of irrigating in 1920.....acres..	17,502	11,505	2,475	139,730	5,625	7,338	1,200	1,500
14	Area enterprises were capable of irrigating in 1910.....acres..		4,090	7,845		2,582	10,481	3,830	5,586
15	Per cent of increase, 1910-1920.....		181.8	-68.5		119.6	-30.0	-68.7	-73.1
16	Area included in enterprises in 1920.....acres..	18,812	12,035	2,540	191,889	5,725	9,473	1,200	1,500
17	Area included in enterprises in 1910.....acres..		4,090	7,845		3,402	12,516	3,830	5,706
18	Per cent of increase, 1910-1920.....		194.3	-67.6		68.3	-24.3	-68.7	-73.7
<b>IRRIGATION WORKS.</b>									
<b>Independent enterprises:</b>									
19	Number, 1920.....	83	43	7	269	14	157	1	6
20	Number, 1910.....		16	30		15	109	7	25
<b>Main ditches:</b>									
21	Number, 1920.....	59	37	1	231	19	231		1
22	Number, 1910.....		13	14		3	84	4	19
23	Length, 1920.....miles.....	35	42		303	12	150		9
24	Length, 1910.....miles.....		5	5		4	23	3	9
25	Capacity, 1920.....second-feet.....	127	381	9	1,850	53	726		12
26	Capacity, 1910.....second-feet.....								
<b>Laterals:</b>									
27	Number, 1920.....	70	35		184	32	1,551		
28	Number, 1910.....								
29	Length, 1920.....miles.....	21	25		110	12	159		
30	Length, 1910.....miles.....								
<b>Reservoirs:</b>									
31	Number, 1920.....	10	1	2	4				
32	Number, 1910.....			2				5	
33	Capacity, 1920.....acre-feet.....	255	2,041	43	55				
34	Capacity, 1910.....acre-feet.....			2				30	
<b>Flowing wells:</b>									
35	Number, 1920.....		1						
36	Number, 1910.....								
37	Capacity, 1920.....gallons per minute.....								
38	Capacity, 1910.....gallons per minute.....								
<b>Pumped wells:</b>									
39	Number, 1920.....	26	35		259	15			
40	Number, 1910.....					15			
41	Capacity, 1920.....gallons per minute.....	59,150	40,580		631,700	28,900			
42	Capacity, 1910.....gallons per minute.....					29,074			
<b>Pumping plants:</b>									
43	Number, 1920.....	57	46	9	282	14	14	2	6
44	Number, 1910.....		16	22		15	5	8	20
45	Engine capacity, 1920.....horsepower.....	2,451	1,826	435	21,565	880	169	225	230
46	Engine capacity, 1910.....horsepower.....		775	1,190		547	102	394	714
47	Pump capacity, 1920.....gallons per minute.....	71,070	99,275	25,900	1,063,050	28,900	3,300	21,000	5,500
48	Pump capacity, 1910.....gallons per minute.....		41,982	71,585		29,074	6,135	34,450	56,562
49	Average lift, 1920.....feet.....	34	19	13	38	36	5	25	10
<b>CAPITAL INVESTED.</b>									
50	Capital invested to Jan. 1, 1920.....dollars..	487,977	201,626	25,200	2,808,348	144,000	66,628	12,960	16,400
51	Capital invested to July 1, 1910.....dollars..		29,971	53,638		39,112	26,891	15,483	23,872
52	Per cent of increase, 1910-1920.....		572.7	-53.0		268.2	147.8	-16.3	-31.3
53	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	27.88	17.53	10.18	20.53	25.60	9.08	10.80	10.93
54	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..		7.33	6.84		15.27	2.57	4.04	4.27
<b>ESTIMATED FINAL COST.</b>									
55	Estimated final cost of existing enterprises in 1920.....dollars..	621,652	201,626	25,200	2,902,520	144,000	66,763	12,960	16,400
56	Estimated final cost of existing enterprises in 1910.....dollars..		29,971	53,638		39,112	26,891	15,483	23,872
57	Per cent of increase, 1910-1920.....		572.7	-53.0		268.2	148.3	-16.3	-31.3
58	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	27.73	16.75	9.92	15.13	25.15	7.05	10.80	10.93
59	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..		7.33	6.84		11.50	2.15	4.04	4.18

<sup>1</sup> Formed from part of St. Landry Parish in 1911.

<sup>2</sup> Formed from part of Calcasieu Parish in 1913.

IRRIGATION—LOUISIANA.

PARISH TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	St. James.	St. John the Baptist.	St. Landry. <sup>1</sup>	St. Martin.	St. Mary.	Vermilion.	All other parishes.
1 Number of all farms in 1920.....	289	227	6,675	2,006	410	2,958	101,504
2 Number of farms reporting irrigation for rice growing in 1919.....	86	52	198	203	29	1,481	36
3 Per cent of all farms.....	29.8	22.9	3.0	10.1	6.8	49.4	( <sup>2</sup> )
4 Number of farms reporting irrigation for rice growing in 1909.....	59	42	119			272	80
5 Per cent of increase, 1909-1919.....						437.1	
<b>LAND AND FARM AREA.</b>							
6 Approximate land area..... acres..	162,560	147,840	435,840	336,000	404,480	776,320	20,593,920
7 All land in farms..... acres..	54,324	31,610	302,175	103,673	122,944	258,103	7,140,701
8 Improved land in farms..... acres..	39,747	21,813	228,315	81,370	70,774	201,001	3,531,471
9 Area irrigated for rice growing in 1919..... acres..	5,221	3,214	10,258	6,287	3,040	87,830	994
10 Per cent of improved land in farms.....	13.1	14.7	4.5	7.7	4.3	43.7	( <sup>3</sup> )
11 Area irrigated for rice growing in 1909..... acres..	8,140	6,124	9,387	520	525	52,196	24,718
12 Per cent of increase, 1909-1919.....	-35.9	-47.5			479.0	63.3	-93.0
13 Area enterprises were capable of irrigating in 1920..... acres..	6,103	4,497	21,022	10,475	4,340	147,468	3,147
14 Area enterprises were capable of irrigating in 1910..... acres..	8,215	6,292	12,756	520	725	79,896	35,418
15 Per cent of increase, 1910-1920.....	-25.7	-28.5			493.6	84.6	-91.1
16 Area included in enterprises in 1920..... acres..	6,103	4,497	23,611	10,575	4,340	160,876	3,241
17 Area included in enterprises in 1910..... acres..	8,215	6,292	12,916	520	725	81,581	37,493
18 Per cent of increase, 1910-1920.....	-25.7	-28.5			498.6	96.9	-91.4
<b>IRRIGATION WORKS.</b>							
<b>Independent enterprises:</b>							
19 Number, 1920.....	21	11	116	32	13	165	6
20 Number, 1910.....	36	24	157			93	90
<b>Main ditches:</b>							
21 Number, 1920.....	28	9	122	29	13	85	4
22 Number, 1910.....	28	21	28		2	38	42
23 Length, 1920..... miles..	35	9	70	46	11	225	9
24 Length, 1910..... miles..	24	16	11		1	95	53
25 Capacity, 1920..... second-feet..	101	701	2,309	232	28	1,797	15
26 Capacity, 1910..... second-feet..							
<b>Laterals:</b>							
27 Number, 1920.....	71	3	123	12	5	1,109	
28 Number, 1910.....						14	
29 Length, 1920..... miles..	25	4	22	2	5	692	
30 Length, 1910..... miles..						54	
<b>Reservoirs:</b>							
31 Number, 1920.....		4	38				1
32 Number, 1910.....	4	3	69				10
33 Capacity, 1920..... acre-feet..			2,608				
34 Capacity, 1910..... acre-feet..	3	12	12,736				326
<b>Flowing wells:</b>							
35 Number, 1920.....						2	1
36 Number, 1910.....							
37 Capacity, 1920..... gallons per minute..						425	30
38 Capacity, 1910..... gallons per minute..							
<b>Pumped wells:</b>							
39 Number, 1920.....			28	4		104	
40 Number, 1910.....			10	1		65	7
41 Capacity, 1920..... gallons per minute..			51,600	15,000		155,307	
42 Capacity, 1910..... gallons per minute..			17,900	330		130,910	18,825
<b>Pumping plants:</b>							
43 Number, 1920.....	21	11	87	32	15	185	6
44 Number, 1910.....	28	20	40	3	2	92	76
45 Engine capacity, 1920..... horsepower..	990	572	4,320	1,236	470	8,654	72
46 Engine capacity, 1910..... horsepower..	958	742	1,003	74	95	5,506	5,259
47 Pump capacity, 1920..... gallons per minute..	44,800	800	124,200	98,100	12,900	809,502	3,150
48 Pump capacity, 1910..... gallons per minute..	57,301	66,135	76,230	5,720	5,250	528,719	405,963
49 Average lift, 1920..... feet..	13	14	56	20	15	19	9
<b>CAPITAL INVESTED.</b>							
50 Capital invested to Jan. 1, 1920..... dollars..	52,132	68,850	530,222	119,310	55,650	3,477,875	110,498
51 Capital invested to July 1, 1910..... dollars..	40,895	37,688	73,065	6,198	2,250	1,075,561	282,015
52 Per cent of increase, 1910-1920.....	27.5	82.7				223.4	-50.8
53 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	8.54	15.31	25.22	11.39	12.82	28.58	35.11
54 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	4.98	5.99	5.73	11.92	3.10	18.47	7.96
<b>ESTIMATED FINAL COST.</b>							
55 Estimated final cost of existing enterprises in 1920..... dollars..	52,132	68,850	548,022	120,810	55,650	3,479,026	156,498
56 Estimated final cost of existing enterprises in 1910..... dollars..	40,895	37,688	73,065	6,198	2,250	1,075,561	282,015
57 Per cent of increase, 1910-1920.....	27.5	82.7				223.5	-44.5
58 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	8.54	15.31	23.21	11.42	12.82	21.67	43.29
59 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	4.98	5.99	5.66	11.02	3.10	18.18	7.52

<sup>1</sup> Part taken to form Evangeline Parish in 1911.

<sup>2</sup> Less than one-tenth of 1 per cent.

# MONTANA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Montana collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of show-

ing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	57, 677	26, 214	31, 463	120. 0
Approximate land area of the state.....acres..	93, 523, 840	93, 568, 640	<sup>2</sup> -44, 800	( <sup>3</sup> )
All land in farms.....acres..	35, 070, 656	13, 545, 603	21, 525, 053	158. 9
Improved land in farms.....acres..	11, 007, 278	3, 640, 309	7, 366, 969	202. 4
Number of farms irrigated.....	10, 807	8, 970	1, 837	20. 5
Area irrigated.....acres..	1, 681, 729	1, 679, 084	2, 645	0. 2
Area enterprises were capable of irrigating.....acres..	2, 753, 498	2, 205, 155	548, 343	24. 9
Area included in enterprises.....acres..	4, 329, 148	3, 515, 602	813, 546	23. 1
Per cent irrigated:				
Number of all farms.....	18. 7	34. 2	-15. 5	
Approximate land area of the state.....	1. 8	1. 8		
Land in farms.....	4. 8	12. 4	-7. 6	
Improved land in farms.....	15. 3	46. 1	-30. 8	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	1, 071, 769	526, 071	545, 698	103. 7
Excess of area included in enterprises over area irrigated.....acres..	2, 647, 419	1, 836, 518	810, 901	44. 2
Area of irrigated land reported as available for settlement.....acres..	207, 530	( <sup>4</sup> )		
Capital invested.....	\$52, 143, 363	\$22, 970, 958	\$29, 172, 405	127. 0
Average per acre enterprises were capable of irrigating.....	\$18. 94	\$10. 42	\$8. 52	81. 8
Estimated final cost of existing enterprises.....	\$70, 079, 028	\$32, 382, 077	\$37, 696, 951	116. 4
Average per acre included in enterprises.....	\$16. 19	\$9. 21	\$6. 98	75. 8
Average cost of operation and maintenance per acre.....	\$1. 26	\$0. 89	\$0. 37	41. 6
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	6, 035	5, 534	501	9. 1
Number of main ditches.....	8, 819	6, 673	2, 146	32. 2
Length of main ditches.....miles..	16, 411	12, 990	3, 421	26. 3
Capacity of main ditches.....second-feet..	94, 429	83, 849	10, 580	12. 6
Number of lateral ditches.....	10, 680	8, 307	2, 373	28. 6
Length of lateral ditches.....miles..	6, 085	5, 944	141	2. 4
Number of reservoirs.....	468	827	-359	-43. 4
Capacity of reservoirs.....acre-feet..	1, 571, 720	580, 261	991, 459	170. 9
Number of flowing wells.....	41	15	26	173. 3
Capacity of flowing wells.....gallons per minute..	4, 608	22, 185	-17, 577	-79. 2
Number of pumped wells.....	22	10	12	120. 0
Capacity of pumped wells.....gallons per minute..	11, 085	5, 263	5, 822	110. 6
Number of pumping plants.....	253	125	128	102. 4
Engine capacity.....horsepower..	10, 341	3, 511	6, 830	94. 5
Pump capacity.....gallons per minute..	453, 231	281, 199	172, 032	61. 2
Average lift.....feet..	20	( <sup>4</sup> )	20	

<sup>1</sup> A minus sign (—) denotes decrease.

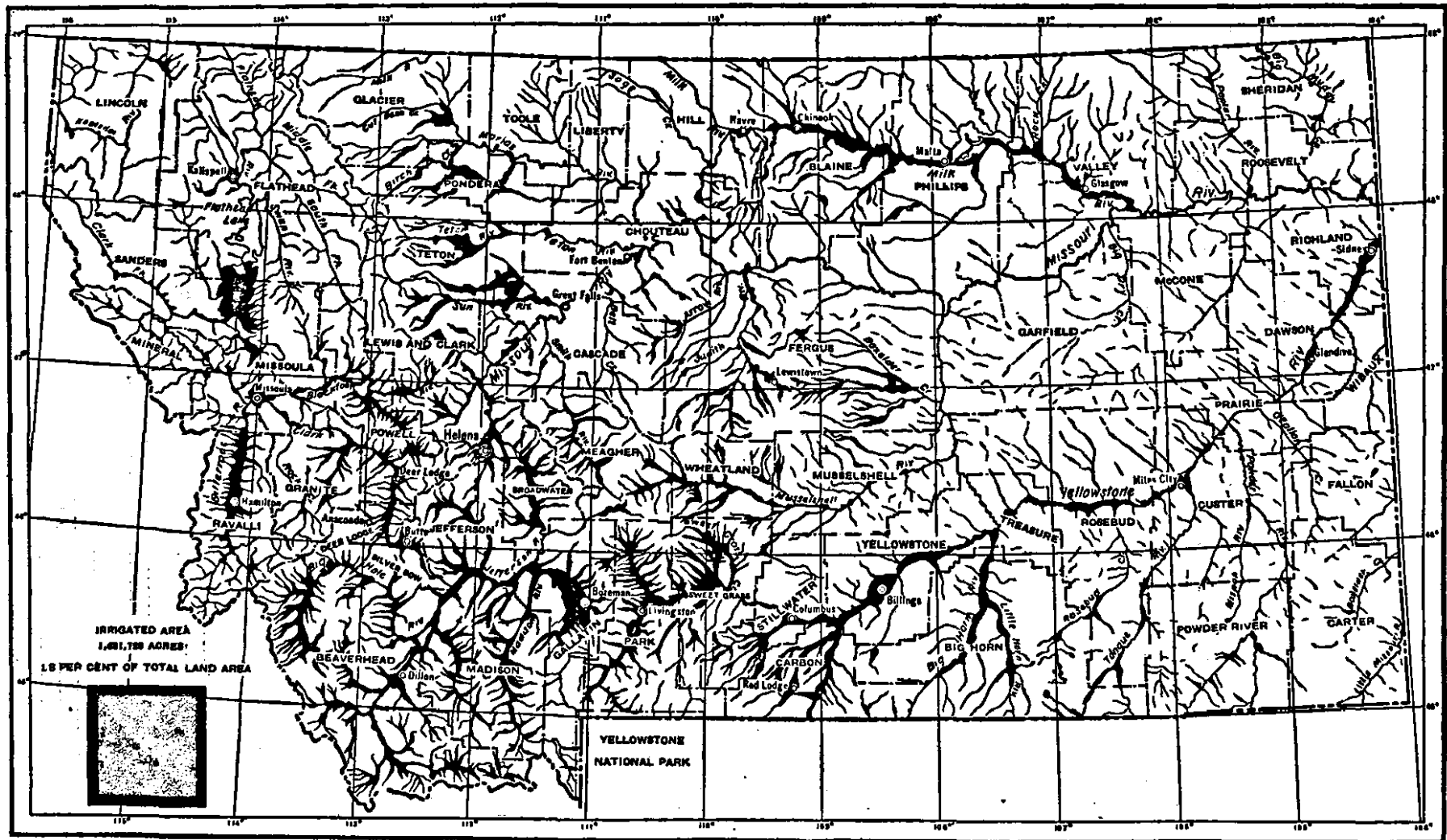
<sup>2</sup> Decrease due to the building of several reservoirs in connection with irrigation projects.

<sup>3</sup> Less than one-tenth of 1 per cent decrease.

<sup>4</sup> Not reported in 1910.

# MONTANA

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

The climatic conditions having the greatest influence in determining the necessity for irrigation are the amount and seasonal distribution of precipitation, especially rainfall. Temperature and wind movement also have an influence through their effect on evaporation from soil and plants.

The surface of Montana is divided approximately equally between the plains and the mountainous sections, the eastern part of the state consisting of high, rolling prairies and the western part of mountains and intervening valleys. The main range of the Rocky Mountains forms the boundary between Montana and Idaho for a considerable distance, then turns to the east and again to the north, leaving the northwestern part of the state on the Pacific slope, while all the rest of the state is in the drainage basin of the Missouri River and slopes to the east.

In the mountainous section the precipitation varies greatly with the altitude, the normal annual precipitation varying from about 10 inches in the lower portion of the Jefferson River drainage basin and along the Missouri, immediately below the point where this stream is formed by the confluence of the Madison, Jefferson, and Gallatin Rivers, to 20 inches in the vicinity of Yellowstone National Park and to 25 inches or more in the northwest corner of the state. In most of the valleys of this part of the state crops are grown without irrigation near the base of the mountains, while irrigation is practiced in the central portions. The mountain ranges prevent strong winds and tend to decrease the water requirements of plants. As a rule the precipitation is lightest in the autumn and winter, and the wettest season is from April to June, when water is most needed for grain crops.

On the plains the precipitation is lighter, the normal annual precipitation being from 12 to 15 inches, and the heat and wind velocity during the growing season are much greater than in the mountainous part of the state. In this section the demand for moisture is greater and the supply is smaller.

The year 1919 was the third in succession in which the precipitation was below normal, the summer season being drier than either of the two preceding. This condition not only brought about a general failure of "dry-farm" crops, but decreased greatly the supply of water available for irrigation, particularly from streams originating on the plains, which are not fed by melting snows in the mountains. As a result much land covered by irrigation ditches and ordinarily irrigated was not watered in 1919, and to that extent the figures for that year do not correctly represent the status of irrigation development in the state.

**WATER SUPPLY FOR IRRIGATION.**

In the mountains of western Montana the precipitation is heavy, while the area of irrigable land is limited to the comparatively narrow valleys. Consequently there is an abundant supply of water for irrigation. The northwestern part of the state is drained by the Kootenai River and the Clark Fork of the Columbia and their tributaries. Both of these streams carry large volumes of water from the state.

The southwestern part of the state is drained by the headwaters of the Missouri. The Beaverhead and the Big Hole, which unite to form the Jefferson, drain the northern and eastern slopes of the main range of the Rocky Mountains, and the Madison and the Gallatin rise in Yellowstone National Park and flow north to their junction with the Jefferson to form the Missouri. From its head the Missouri flows northward through mountain valleys for slightly more than 100 miles and then turns to the east and flows to the eastern border of the state, roughly paralleling the northern line at distances varying between 60 and 100 miles.

Between the Missouri and the Canadian border are the Sun, Teton, Marias, and Milk Rivers, which rise in the main range of the Rocky Mountains and flow eastward to their junctions with the Missouri.

South of the Missouri is the Yellowstone, which rises in Yellowstone Lake in Yellowstone National Park. It flows northward for about 50 miles and from that point flows northeastward across the state to its confluence with the Missouri, just east of the Montana-North Dakota line. Between the Missouri and the Yellowstone there are many smaller streams, tributary to one or the other of these rivers. From the south the Yellowstone receives several large tributaries, which rise in Wyoming and flow northward into Montana, and many small tributaries rising on the plains. The principal tributaries of the Yellowstone are Clark Fork, Big Horn, Tongue, and Powder Rivers.

The streams rising in the mountains receive their water from melting snows and maintain a summer flow, while most of those rising on the plains become dry, or nearly so, in the summer. In the larger streams which rise in the mountains the water supply is generally sufficient for the land in their valleys. The supply would not be sufficient to water the great areas of arable land on the plains between the large rivers, but crops are grown on these lands without irrigation and there is no great demand for their irrigation.

As previously stated, the succession of dry years, of which 1919 was the third, decreased the supply of water to such an extent that much land ordinarily irrigated was not watered in 1919.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	10,807	20.5	18.7	1,681,729	0.2	1.8	4.8	15.3
1910.....	8,970	11.5	34.2	1,679,084	78.5	1.8	12.4	46.1
1900.....	8,043	117.0	60.2	851,164	171.3	1.0	8.0	54.8
1890.....	3,708		66.1	350,582		0.4	17.8	38.3

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1910.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	6,035	4,329,148	1,681,729	38.8	2,753,498
Before 1860.....	10	5,755	4,586	79.7	5,585
1860-1869.....	503	252,161	110,225	43.7	179,832
1870-1879.....	516	283,981	114,804	40.4	185,018
1880-1889.....	1,343	966,530	470,529	48.7	697,811
1890-1899.....	1,195	765,658	361,503	47.2	580,515
1900-1904.....	667	821,648	148,076	18.0	228,249
1905-1909.....	487	937,065	272,239	29.1	506,833
1910-1914.....	418	392,991	59,280	15.1	123,847
1915-1919.....	367	294,323	38,556	13.1	165,278
Not reported.....	531	199,086	101,872	51.2	140,510

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	1,681,729	1,679,084	2,645	0.2	2,753,498	4,329,148
Streams, gravity.....	1,516,212	1,624,656	-109,444	-6.7	2,451,190	3,901,211
Streams, pumped.....	15,743	7,963	7,780	97.7	36,766	47,178
Streams, pumped and gravity.....	19,872	( <sup>2</sup> )	19,872		38,599	34,149
Wells, pumped.....	139	55	84		153	163
Wells, flowing.....	212	207	5	2.4	403	734
Lakes, gravity.....	16,663	5,617	11,036	196.5	22,512	24,840
Lakes, pumped.....	79	5	74		189	251
Springs.....	14,945	17,987	-3,022	-16.8	22,695	37,337
Stored storm water.....	3,290	22,614	-19,324	-85.5	12,152	32,261
City water.....	15	( <sup>2</sup> )	15		15	20
Sewage.....	245	( <sup>2</sup> )	245		290	933
Streams, gravity, and pumped wells.....	155	( <sup>2</sup> )	155		170	170
Streams, gravity, and flowing wells.....	6,068	( <sup>2</sup> )	6,068		12,063	12,443
Other mixed.....	89,070	( <sup>2</sup> )	89,070		160,603	237,120
Other and not reported.....	41	( <sup>2</sup> )	41		168	168

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

Montana enacted an irrigation district law in 1907, and has amended this law from time to time since that date. Generally, in Montana irrigation districts

have not built irrigation works, but have been organized to take over works built by other agencies.

The state of Montana accepted the terms of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1895, and at first undertook construction of irrigation works by direct state action. The law has been amended from time to time, and state construction has been abandoned for the contract system common to the Western states.

The small area reported under "State" in Table 5 belongs to a State institution and does not represent a scheme of state construction.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	1,681,729	1,679,084	2,645	0.2
Individual and partnership.....	976,615	1,191,060	-214,445	-18.0
Cooperative.....	393,257	333,926	59,331	17.8
Irrigation district.....	35,153	412	34,741	467.7
Carey Act.....	54,771	9,648	45,123	467.7
Commercial.....	34,115	62,544	-28,429	-45.5
U. S. Reclamation Service.....	88,291	14,077	74,214	527.2
U. S. Indian Service.....	98,887	67,417	31,470	46.7
State.....	20	( <sup>2</sup> )	20	
City.....	320	( <sup>2</sup> )	320	
Other.....	300	( <sup>2</sup> )	300	
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	2,753,498	2,205,155	548,343	24.9
Individual and partnership.....	1,617,617	1,495,513	122,104	8.2
Cooperative.....	553,952	373,022	180,930	48.5
Irrigation district.....	70,650	6,640	64,010	964.0
Carey Act.....	83,913	49,600	34,313	69.5
Commercial.....	38,215	80,895	-42,680	-52.8
U. S. Reclamation Service.....	172,206	85,245	86,961	102.0
U. S. Indian Service.....	215,940	114,340	101,600	88.9
State.....	50	( <sup>2</sup> )	50	
City.....	390	( <sup>2</sup> )	390	
Other.....	565	( <sup>2</sup> )	565	
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	4,329,148	3,515,602	813,546	23.1
Individual and partnership.....	2,372,086	1,982,220	389,866	19.7
Cooperative.....	699,310	518,209	181,101	34.9
Irrigation district.....	71,687	6,640	65,047	979.6
Carey Act.....	181,873	306,997	-125,124	-68.8
Commercial.....	39,160	146,852	-107,692	-73.3
U. S. Reclamation Service.....	436,982	113,744	323,238	284.2
U. S. Indian Service.....	526,690	440,940	85,750	19.4
State.....	100	( <sup>2</sup> )	100	
City.....	530	( <sup>2</sup> )	530	
Other.....	730	( <sup>2</sup> )	730	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Montana relating to water rights are summarized in the following paragraphs:

In 1865 the territory of Montana enacted a law recognizing the right of any person holding land bordering on or in the neighborhood of a stream to take water from the stream for irrigation, and providing for obtaining the right of way for ditches over the land of others.

This law was repealed in 1870 by one extending the right to take water for irrigation to the holder of land anywhere in the territory and recognizing priority among users.

In 1885 a more comprehensive law was enacted. This provided that rights might be acquired by "appropriation"; that the appropriation must be for a useful or beneficial purpose; that the place of use might be changed; and that "among appropriations the first in time is the first in right." This law provided also that persons desiring to appropriate water must post notices stating their claims, and must file copies of these claims with the county recorders; and, further, that persons who had acquired rights prior to the passage of the act should file with the proper county recorders declarations of their claims. The law provided also that controversies regarding water rights should be settled in the courts.

This law is still in effect, the state never having provided for applications for permits to appropriate water, as has been done in most of the Western states.

The constitution of the state, ratified in 1889, contains the following section relating to irrigation:

"The use of all water now appropriated, or that may hereafter be appropriated for sale, rental, distribution or other beneficial use and right of way over the lands of others for all ditches, drains, flumes, canals and aqueducts, necessarily used in connection therewith, as well as the sites for reservoirs necessary for collecting and storing the same shall be held to be a public use." (Art. 3, sec. 15.)

Under the rulings of the courts riparian rights are recognized in Montana to a limited extent.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	1,681,729	100.0	100.0
Appropriation and use.....	229,887	13.7	15.0
Notice filed and posted.....	666,305	39.6	44.4
Adjudicated by court.....	701,015	41.7	38.0
Permit from state.....	595	( <sup>2</sup> )	
Riparian rights.....	5,500	0.3	
Underground.....	482	( <sup>2</sup> )	( <sup>2</sup> )
Other and mixed.....	8,561	0.5	( <sup>2</sup> )
Not reported.....	69,384	4.1	( <sup>2</sup> )

<sup>1</sup> Small areas were incorrectly reported in some classes in 1910. These are not included here.

<sup>2</sup> Less than one-tenth of 1 per cent.

<sup>3</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 and 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	1,681,729	1,140,694	47.4	4,329,148	2,753,498
Missouri River and tributaries.....	1,389,763	908,243	53.0	3,713,068	2,269,910
Missouri River direct.....	15,635	11,390	37.3	34,194	23,174
Jefferson River and tributaries.....	425,685	231,788	53.7	831,898	574,672
Jefferson River direct.....	21,276	15,721	35.3	40,347	34,894
Beaverhead River.....	145,673	99,014	47.1	296,079	199,797
Big Hole River.....	184,655	67,422	173.9	306,885	227,920
Boulder River.....	7,265	9,333	-22.2	40,677	13,297
Ruby River.....	34,474	21,101	63.4	76,107	48,036
Other tributaries of Jefferson River.....	32,342	* 19,197	66.5	71,803	50,728
Madison River.....	34,425	20,338	69.3	88,524	62,065
Gallatin River.....	95,083	58,004	63.9	228,056	152,515
Smith River.....	16,861	18,677	-9.7	38,369	29,691
Sun River.....	31,785	32,927	-3.5	244,071	95,522
Teton River.....	44,945	34,961	28.6	146,468	82,241
Marias River.....	63,758	22,188	187.4	308,158	122,431
Judith River.....	15,173	44,672	-66.0	40,933	35,459
Musselshell River.....	45,559	87,233	-47.8	141,363	113,964
Milk River and tributaries.....	108,555	56,567	91.8	349,716	179,063
Milk River direct.....	19,766	24,305	-18.7	26,358	23,443
Sage Creek.....		4,947		2,850	1,750
Snake River.....	910	2,135	-57.4	3,130	2,275
Other tributaries of Milk River.....	87,679	* 26,210	248.6	317,378	151,566
Yellowstone River and tributaries.....	440,354	209,137	110.6	858,617	668,355
Yellowstone River direct.....	189,453	40,015	373.5	279,211	262,801
Shields River.....	25,940	19,836	30.8	94,238	53,062
Stillwater River.....	23,561	13,572	73.6	34,278	29,664
Clark Fork.....	68,839	64,628	6.5	125,367	116,506
Big Horn River.....	51,103	1,045		92,036	66,206
Rosebud River.....	365	13,618	-97.3	1,365	1,305
Tongue River.....	11,170	12,622	-11.6	31,399	21,403
Powder River.....	728	2,390	-69.5	5,871	4,841
Other tributaries of Yellowstone River.....	69,195	* 40,811	69.5	195,055	112,567
Little Missouri River.....	380	2,865	-86.7	3,205	1,490
Other tributaries of Missouri River.....	51,585	* 77,406	-33.4	399,236	154,278
Tributaries of Columbia River.....	291,966	232,451	25.6	616,080	453,588
Clark Fork and tributaries.....	285,984	229,851	24.4	601,657	443,864
Clark Fork direct.....	2,882	* 8,906	-67.3	14,403	4,722
Missoula River and tributaries.....	238,769	221,043	8.0	433,021	325,992
Missoula River direct.....	2,550	1,181	115.9	8,322	5,777
Hellgate River.....	77,381	78,139	-1.0	165,391	108,161
Big Blackfoot River.....	40,604	36,622	10.9	83,716	61,476
Bitter Root River.....	112,622	98,965	13.8	158,241	139,481
Other tributaries of Missoula River.....	5,612	* 6,136	-8.5	17,351	11,097
Flathead River.....	44,333	( <sup>1</sup> )		154,233	113,150
Kootenai River.....	5,982	2,600	130.1	14,423	9,724

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Includes springs and wells.

<sup>3</sup> Includes springs and wells and all sources in the Columbia River drainage basin, exclusive of the Missoula and Kootenai Rivers.

<sup>4</sup> Not reported separately in 1902.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$52,143,363	127.0	\$13.94	81.8
1910.....	22,970,658	390.5	10.42	111.8
1900.....	4,683,073	188.5	4.92	8.8
1890.....	1,623,195		4.63	



TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$52,143,363	100.0	\$18.94
Before 1880.....	55,527	0.1	9.94
1880-1889.....	1,323,315	2.5	7.36
1870-1879.....	2,063,841	3.9	11.15
1880-1889.....	5,085,794	9.8	7.29
1890-1899.....	7,045,284	13.5	12.14
1900-1904.....	3,005,519	5.8	13.17
1905-1909.....	25,592,158	49.1	50.49
1910-1914.....	2,756,019	5.3	22.25
1915-1919.....	3,631,564	7.0	34.49
Not reported.....	1,584,344	3.0	11.28

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$52,143,363	100.0	\$18.94	1,369,651	\$1.26
Streams, gravity.....	47,016,239	90.2	19.18	1,249,390	1.18
Streams, pumped.....	600,216	1.7	24.49	11,414	5.63
Streams, pumped and gravity.....	1,612,316	3.1	47.99	19,872	1.77
Wells, pumped.....	16,285	( <sup>2</sup> )	106.44	49	5.41
Wells, flowing.....	10,007	( <sup>2</sup> )	24.83	154	7.24
Lakes, pumped.....	8,250	( <sup>2</sup> )	43.65	41	11.07
Lakes, gravity.....	271,750	0.5	12.07	8,083	5.46
Springs.....	247,094	0.5	10.89	7,821	1.57
Stored storm water.....	268,392	0.6	24.55	1,967	5.74
Sewage.....	6,734	( <sup>2</sup> )	8.20	.....	.....
Streams, gravity, and pumped wells.....	3,000	( <sup>2</sup> )	17.65	150	6.67
Streams, gravity, and flowing wells.....	483,000	0.9	35.89	6,005	1.41
Other mixed.....	1,318,598	2.5	8.21	64,675	0.99
Other and not reported.....	1,382	( <sup>2</sup> )	8.22	.....	.....

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE, <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$52,143,363	\$5,576,975	\$46,566,388	835.0
Missouri River and tributaries.....	43,507,296	4,254,950	39,252,346	922.5
Missouri River direct.....	440,345	81,162	359,183	442.6
Jefferson River and tributaries.....	5,370,454	760,328	4,610,126	606.3
Jefferson River direct.....	587,358	115,995	471,363	406.4
Beaverhead River.....	1,723,746	255,779	1,467,967	573.9
Big Hole River.....	1,669,767	135,609	1,534,158	.....
Boulder River.....	149,665	43,510	106,155	244.0
Ruby River.....	659,000	122,658	436,342	355.7
Other tributaries of Jefferson River.....	680,898	* 86,777	594,121	684.7
Madison River.....	460,823	92,986	367,837	395.6
Gallatin River.....	977,796	454,845	522,941	115.0
Smith River.....	190,836	64,777	126,059	194.6
Sun River.....	4,709,303	173,399	4,535,904	.....
Teton River.....	1,261,130	111,990	1,149,140	.....
Marias River.....	5,502,770	142,443	5,360,327	.....
Judith River.....	281,842	124,513	157,329	126.4
Musselshell River.....	986,765	285,868	700,897	245.2
Milk River and tributaries.....	7,271,068	203,498	7,067,570	.....
Milk River direct.....	154,208	119,200	35,008	29.4
Sage Creek.....	2,400,248	18,127	2,382,121	.....
Snake River.....	8,600	9,835	-1,235	-13.4
Other tributaries of Milk River.....	4,708,042	* 118,438	4,589,604	.....
Yellowstone River and tributaries.....	13,762,837	1,308,838	12,454,000	933.1
Yellowstone River direct.....	7,608,390	303,888	7,304,502	.....
Shields River.....	424,103	109,074	315,029	283.8
Stillwater River.....	298,570	51,502	247,068	479.7
Clark Fork.....	1,108,191	295,302	812,889	275.3
Big Horn River.....	2,839,457	3,425	2,836,032	.....
Rosebud River.....	9,308	61,708	-52,400	-84.9
Tongue River.....	608,504	211,870	396,634	187.2

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000. <sup>2</sup> Includes springs and wells.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902—Continued.

DRAINAGE BASIN.	1920	1902	INCREASE, <sup>1</sup>	
			Amount.	Per cent.
Missouri River and tributaries—Continued.....				
Yellowstone River and tributaries—Continued.....				
Powder River.....	\$35,402	\$12,500	\$22,902	183.2
Other tributaries of Yellowstone River.....	1,430,417	* 257,569	1,172,848	455.4
Little Missouri River.....	15,064	33,747	-18,683	-55.4
Other tributaries of Missouri River.....	2,238,753	358,356	1,928,397	538.1
Tributaries of Columbia River.....	8,636,067	1,322,025	7,314,042	553.2
Clark Fork and tributaries.....	8,414,051	1,306,488	7,107,563	543.0
Clark Fork direct.....	202,256	* 64,591	137,665	213.1
Missoula River and tributaries.....	3,474,524	1,243,895	2,230,629	179.3
Missoula River direct.....	159,771	27,387	132,384	483.8
Holgate River.....	1,349,403	392,065	957,338	244.2
Big Blackfoot River.....	624,291	114,450	509,841	445.5
Bitter Root River.....	1,138,329	674,130	464,199	68.9
Other tributaries of Missoula River.....	202,730	* 35,883	166,847	465.0
Flathead River.....	4,737,311	( <sup>2</sup> )	.....	.....
Kootenai River.....	221,976	13,539	208,437	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000. <sup>2</sup> Includes springs and wells. <sup>3</sup> Includes springs and wells and all sources in the Columbia River drainage basin exclusive of the Missoula and Kootenai Rivers. <sup>4</sup> Not reported separately in 1902.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of most of the other classes shown in the table and a part of its expenditure is properly chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$52,143,363	100.0	1,369,651	\$1.26
Individual and partnership.....	15,543,287	29.8	747,131	1.07
Cooperative.....	6,692,877	12.8	349,499	0.86
Irrigation district.....	1,708,851	3.3	34,983	0.98
Carey Act.....	4,834,407	9.3	54,748	1.76
Commercial.....	676,535	1.3	34,115	2.14
U. S. Reclamation Service.....	14,351,818	27.6	45,786	2.09
U. S. Indian Service.....	8,193,390	15.7	103,309	3.01
State.....	100	( <sup>2</sup> )	20	0.75
City.....	106,538	0.2	.....	.....
Other.....	7,060	( <sup>2</sup> )	60	2.67

<sup>1</sup> Based on acreage irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	276
Acreage included in enterprises reporting land drained or needing drainage.....	751,274
Acreage for which drains have been installed.....	62,872
Additional acreage needing drainage.....	50,901
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	8.4
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	1.5
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	2.6

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing

estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Meas-ured.	Not meas-ured.
Average volume of water entering canals, second-feet.....	22,808	10,178	12,630
Area irrigated in 1919..... acres.....	794,762	425,618	369,144
Average number of acres per second-foot.....	35	42	29
Total quantity of water entering canals, acre-feet.....	4,103,486	1,802,871	2,300,615
Area irrigated in 1919..... acres.....	745,925	424,712	321,213
Average quantity per acre..... acre-feet.....	5.5	4.2	7.2
Total quantity of water delivered..... acre-feet.....	968,991	499,939	559,052
Area irrigated in 1919..... acres.....	290,894	181,430	109,464
Average quantity per acre..... acre-feet.....	3.3	2.8	5.1

IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	3,545	523	8,819	94,429	16,411	10,680	6,085	468	1,571,720
Before 1860.....	5	1	15	89	10	3	3		
1860-1869.....	238	22	798	4,614	1,259	240	146	21	6,209
1870-1879.....	373	10	876	6,284	1,516	876	370	7	40
1880-1889.....	1,064	58	2,222	19,259	3,985	2,538	865	43	55,430
1890-1899.....	763	91	1,861	16,702	3,429	3,070	1,554	79	52,572
1900-1904.....	339	95	870	12,275	1,566	892	421	88	43,666
1905-1909.....	272	97	615	22,983	1,963	1,581	1,887	81	555,349
1910-1914.....	197	87	484	4,672	896	579	245	84	758,984
1915-1919.....	163	38	407	3,241	808	395	402	43	95,791
Not reported.....	131	24	671	4,310	934	506	192	22	3,679

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps, Number. Capacity (gallons per minute).	
Total.....	48.0	41	4,608	22	11,085	258	10,941	299	453,231
Before 1860.....				1		1	2	1	
1860-1869.....	0.2	2				1		1	
1870-1879.....	2.9	4		2,257		3	30	2	1,000
1880-1889.....	2.0	1		4	905	6	38	7	1,905
1890-1899.....	6.9	1	50			15	479	24	28,311
1900-1904.....	3.3	5	51		5,010	36	332	37	62,760
1905-1909.....	14.6	7	1,032	2	10	37	2,368	48	76,105
1910-1914.....	11.5	5	1,109	1		54	4,539	73	121,635
1915-1919.....	4.7	13	1,109	6	2,090	54	1,714	59	145,394
Not reported.....	1.9	3		8	3,070	17	239	17	16,121

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	3,545	523	8,819	94,429	16,411	10,680	6,085	468	1,571,720
Individual and partnership.....	3,352	454	8,378	68,461	13,513	8,949	2,813	307	800,131
Cooperative.....	136	32	324	16,191	1,723	747	770	38	334,555
Irrigation district.....	10	5	24	1,680	212	50	62	4	30,313
Carey Act.....	3	6	8	1,977	82	250	588	4	18,000
Commercial.....	4	4	19	514	134	136	27	4	656,720
U. S. Reclamation Service.....	8	6	12	3,155	337	162	367	6	102,878
U. S. Indian Service.....	30	15	45	2,338	300	349	1,453	14	128,995
State.....	2		1	19	2	3	2		
City.....	1		1	68	5	1	1		
Other.....		1	7	26	7	3	2	1	128

IRRIGATION—MONTANA.

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920—Continued.

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	48.0	41	4,608	22	11,085	253	10,341	299	458,231
Individual and partnership.....	33.8	37	3,608	22	11,085	243	5,630	272	315,031
Cooperative.....	2.0	4	1,000			1	36	1	50
Irrigation district.....	1.9					4	260	10	61,660
Carey Act.....	1.3								
Commercial.....	4.8					2	3,680	11	73,500
U. S. Reclamation Service.....	1.5					2	710	4	
U. S. Indian Service.....	0.2					1	25	1	3,000
State.....									
City.....									
Other.....	2.5								

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	3,545	523	8,819	94,429	16,411	10,680	6,085	468	1,571,720
Missouri River and tributaries.....	2,805	414	6,672	78,815	13,194	8,803	4,956	396	1,477,741
Missouri River direct.....	19	11	73	778	456	178	55	13	870,709
Jefferson River and tributaries.....	1,174	45	2,106	25,319	3,422	3,468	890	59	165,008
Jefferson River direct.....	23	2	52	1,331	189	18	39		
Beaverhead River.....	516	15	805	5,340	1,120	954	253	16	130,375
Big Hole River.....	442	8	726	7,171	1,132	2,231	480	10	6,171
Boulder River.....	48	3	105	649	185	83	2	3	11
Ruby River.....	54	7	184	1,456	298	101	61	18	19,676
Other tributaries of Jefferson River.....	91	10	234	9,372	498	81	55	12	8,870
Madison River.....	100	10	251	2,709	560	129	112	12	4,602
Gallatin River.....	88	5	410	4,243	885	146	228	2	1,200
Smith River.....	66	4	285	983	325	600	124	7	181
Sun River.....	91	14	199	2,467	313	166	199	16	854
Teton River.....	31	7	76	2,566	266	74	112	7	145,742
Marias River.....	38	15	76	2,634	227	260	719	15	22,926
Judith River.....	147	5	214	1,479	311	252	84	7	85
Musselshell River.....	192	35	443	4,277	866	806	286	16	34,479
Milk River and tributaries.....	201	104	301	7,416	692	895	554	94	146,041
Milk River direct.....	5		7	200	31	9	2	1	16
Sage Creek.....	5	6	8	11	12	16	15	5	2,089
Snake River.....	13	6	17	72	23	86	38	4	158
Other tributaries of Milk River.....	178	92	269	7,183	626	784	499	84	143,778
Yellowstone River and tributaries.....	449	86	1,463	19,605	3,435	1,332	1,248	70	21,388
Yellowstone River direct.....	14	11	102	5,508	720	279	447	11	2,519
Shields River.....	88	1	208	1,620	457	210	75	5	9,016
Stillwater River.....	5		128	1,284	279	40	46	2	2
Clark Fork.....	101	5	300	3,139	707	397	217	1	91
Big Horn River.....	45	1	51	1,675	198	24	218		
Rosebud River.....	11	2	17	73	21	6		2	18
Tongue River.....	23	12	59	974	130	78	28	9	150
Powder River.....	17	13	34	111	23	17	3	10	50
Other tributaries of Yellowstone River.....	145	41	584	5,221	900	281	214	30	19,542
Little Missouri River.....	12	7	19	70	16	35	13	14	1,513
Other tributaries of Missouri River.....	207	66	846	4,269	1,420	562	332	64	53,018
Tributaries of Columbia River.....	740	109	2,147	15,614	3,217	1,787	1,129	72	93,979
Clark Fork (of Columbia) and tributaries.....	710	102	2,083	14,519	3,124	1,746	1,103	59	93,655
Clark Fork direct.....	1		64	1,300	73	9	1		
Missoula River and tributaries.....	609	79	1,863	11,998	2,855	1,217	367	46	8,640
Missoula River direct.....	5	1	15	200	116	11		1	
Helgate River.....	248	27	777	4,623	1,195	455	142	24	527
Big Blackfoot River.....	137	10	310	2,378	364	193	48	3	200
Bitter Root River.....	173	37	644	4,073	870	424	158	10	7,634
Other tributaries of Missoula River.....	48	4	117	724	110	134	19	8	279
Flathead River.....	180	23	186	1,221	396	520	735	13	85,015
Kootenai River.....	30	7	64	1,065	93	41	26	18	324

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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse- power).	Pumps.		Aver- age lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	48.0	41	4,608	22	11,085	253	10,341	299	453,231	20
Missouri River and tributaries.....	17.6	28	1,245	19	11,005	225	10,058	271	440,779	19
Missouri River direct.....	4.0					26	4,404	34	115,975	24
Jefferson River and tributaries.....	0.1	2	2			3	135	4	4,968	25
Jefferson River direct.....	0.1					2	25	2	1,968	24
Beaverhead River.....		1								
Boulder River.....						1	110	2	3,000	24
Other tributaries of Jefferson River.....		1	2							
Gallatin River.....	0.5					4	70	4	5,329	16
Smith River.....						1	18	1	6,000	9
Sun River.....	1.2					15	326	20	20,210	15
Teton River.....	0.5	3	1,000	1	10	8	130	8	13,410	17
Marias River.....	1.6			3	8,000	22	623	22	37,165	15
Judith River.....	2.4			1	1,500	8	72	16	10,600	11
Musselshell River.....						10	178	12	16,250	19
Milk River and tributaries.....	1.2	1	50			22	377	23	24,345	16
Milk River direct.....						4	70	4	2,570	18
Other tributaries of Milk River.....	1.2	1	50			18	307	19	21,775	16
Yellowstone River and tributaries.....	2.7	18	188	2	50	75	3,173	90	166,553	19
Yellowstone River direct.....	2.0	3	69			35	2,501	45	127,662	24
Shields River.....				1	40					
Clark Fork.....						2	10	2	470	8
Big Horn River.....	0.1					2	38	3	1,850	17
Tongue River.....	0.1					16	286	16	14,575	15
Powder River.....		16	119	1	10	9	221	13	13,365	15
Other tributaries of Yellowstone River.....	0.5					11	117	11	8,631	12
Other tributaries of Missouri River.....	3.4	4	5	12	1,445	31	462	37	18,974	16
Tributaries of Columbia River.....	30.4	13	3,363	3	80	28	288	28	12,452	31
Clark Fork (of Columbia) and tributaries.....	26.8	11	3,333	3	80	27	288	27	12,447	8
Clark Fork direct.....	1.5									8
Missoula River and tributaries.....	17.2	1	2,250	3	80	11	106	11	3,282	24
Missoula River direct.....	3.8			2		6	52	6	1,096	20
Hellgate River.....	3.2	1	2,250	1	80	2	10	2	130	29
Big Blackfoot River.....	0.4					1	16	1	650	12
Bitter Root River.....	3.4					1	12	1	1,406	7
Other tributaries of Missoula River.....	5.4					1	16	1		
Flathead River.....	8.1	10	1,083			16	177	16	9,165	37
Kootenai River.....	3.6	2	30			1		1	5	10

IRRIGATION—MONTANA.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	2,436	13.0	1,040	17.2	48.5	Bu.....	34,132	21.4	51,488	18.8	-33.7
2 Oats.....	45,153	23.6	159,658	47.9	-71.7	Bu.....	1,183,068	45.8	6,966,254	50.5	-83.0
3 Winter wheat.....	39,398	7.3				Bu.....	331,668	11.9			
4 Spring wheat.....	121,804	10.6	45,568	17.6	253.8	Bu.....	1,551,685	31.0	1,236,137	19.8	52.4
5 Barley.....	10,286	35.1	9,271	34.0	10.9	Bu.....	185,866	53.6	273,827	36.4	-32.1
6 Rye.....	1,370	1.8	867	14.4	58.0	Bu.....	6,826	3.0	15,468	13.9	-55.8
<b>Hay and forage:</b>											
7 Timothy alone.....	35,781	44.3	48,868	41.5	-26.8	Tons...	35,613	56.8	76,230	44.6	-53.3
8 Timothy and clover mixed.....	91,912	65.3	60,437	66.8	52.1	Tons...	105,845	70.4	102,660	65.8	3.1
9 Clover alone.....	5,576	42.4	8,433	72.9	-33.9	Tons...	8,967	51.0	17,350	72.0	-59.8
10 Alfalfa.....	220,281	58.9	183,264	81.7	20.2	Tons...	408,993	69.7	514,803	85.8	-20.6
11 Other tame grasses.....	39,254	52.0	22,195	37.5	78.9	Tons...	39,523	61.6	37,424	47.6	5.6
12 Annual legumes cut for hay.....	770	12.1				Tons...	1,184	25.4			
13 Small grains cut for hay.....	25,349	5.4	5,988	13.0	236.2	Tons...	18,194	10.6	10,418	14.8	86.0
14 Wild, salt, or prairie grasses.....	177,385	39.3	329,579	56.4	-46.2	Tons...	131,652	46.8	339,821	57.6	-61.3
15 Silage crops.....	620	32.3	( <sup>2</sup> )			Tons...	3,357	43.2	( <sup>2</sup> )		
<b>Vegetables:</b>											
16 Potatoes.....	4,908	22.1	11,137	53.8	-56.0	Bu.....	568,008	34.2	1,938,677	59.8	-70.7
<b>Fruits:</b>											
17 Apples.....	* 761,904	71.9	( <sup>3</sup> )			Bu.....	477,796	70.9	( <sup>3</sup> )		
18 Cherries.....	* 47,600	72.5	( <sup>3</sup> )			Bu.....	9,595	65.0	( <sup>3</sup> )		
<b>Miscellaneous:</b>											
19 Sugar beets grown for sugar.....	7,686	89.4	7,551	86.7	1.8	Tons...	67,297	91.2	91,509	84.1	-26.5
20 Clover and alfalfa seed <sup>4</sup> .....	3,330	34.6	1,527	41.3	118.1	Bu.....	8,824	37.8	4,817	45.4	53.2
21 Dry beans.....	1,022	44.5				Bu.....	14,576	55.8	( <sup>5</sup> )		
22 Dry peas.....	12,070	81.2	951	80.3		Bu.....	143,042	85.9	19,966	92.1	615.4
23 Flaxseed.....	3,740	2.9	( <sup>2</sup> )			Bu.....	22,534	6.9	( <sup>2</sup> )		
24 Sugar-beet seed.....	965	56.3	( <sup>2</sup> )			Lbs....	508,385	52.0	( <sup>2</sup> )		

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	8.5	7.7	14.0	164.7	181.8	\$58,024	21.4	\$38,613	20.8	50.3
2 Oats.....	Bu.....	13.5	9.6	26.2	194.1	272.9	1,183,068	45.8	3,273,203	53.2	-63.9
3 Winter wheat.....	Bu.....	5.2	4.9	8.4	181.5	171.4	792,687	11.9			
4 Spring wheat.....	Bu.....	4.3	3.3	12.7	295.3	384.8	3,708,527	31.0	1,064,794	20.0	322.7
5 Barley.....	Bu.....	11.8	8.5	18.1	153.4	212.9	278,799	53.8	189,952	39.7	46.8
6 Rye.....	Bu.....	3.0	3.0	5.0	166.7	166.7	11,263	3.0	10,985	13.3	2.5
<b>Hay and forage:</b>											
7 Timothy alone.....	Tons...	0.78	0.60	1.00	128.2	166.7	1,050,584	56.8	736,041	45.2	42.7
8 Timothy and clover mixed.....	Tons...	1.07	0.91	1.15	107.5	126.4	3,175,350	70.4	952,118	65.3	233.5
9 Clover alone.....	Tons...	1.04	0.88	1.25	120.2	142.0	205,526	61.0	126,659	71.8	62.3
10 Alfalfa.....	Tons...	1.57	1.15	1.86	118.5	161.7	11,247,308	69.7	3,188,918	84.1	252.7
11 Other tame grasses.....	Tons...	0.85	0.68	1.01	118.8	148.5	1,047,360	61.6	318,494	55.0	228.8
12 Annual legumes cut for hay.....	Tons...	0.78	0.62	1.54	211.0	248.4	28,416	25.4			
13 Small grains cut for hay.....	Tons...	0.37	0.35	0.72	194.6	205.7	436,656	10.6	81,597	13.8	470.0
14 Wild, salt, or prairie grasses.....	Tons...	0.62	0.55	0.74	119.4	134.5	3,093,822	46.8	2,392,486	57.9	29.3
15 Silage crops.....	Tons...	4.05	3.40	5.41	133.6	159.1	40,284	43.2	( <sup>2</sup> )		
<b>Vegetables:</b>											
16 Potatoes.....	Bu.....	74.8	63.2	115.8	154.8	183.2	1,334,819	34.2	755,968	58.2	76.9
<b>Fruits:</b>											
17 Apples.....	Bu.....	* 0.6	* 0.7	* 0.6	100.0	85.7	788,363	70.9	( <sup>3</sup> )		
18 Cherries.....	Bu.....	* 0.2	* 0.3	* 0.2	100.0	66.7	39,819	65.0	( <sup>3</sup> )		
<b>Miscellaneous:</b>											
19 Sugar beets grown for sugar.....	Tons...	8.58	7.14	8.76	102.1	122.7	740,287	91.2	461,208	84.9	60.5
20 Clover and alfalfa seed <sup>4</sup> .....	Bu.....	2.4	2.3	2.5	108.3	113.0	211,776	37.8	36,007	40.7	483.2
21 Dry beans.....	Bu.....	11.4	9.1	14.3	125.4	157.1	61,219	55.8	( <sup>5</sup> )		
22 Dry peas.....	Bu.....	11.2	8.4	11.9	106.2	141.7	443,430	85.9	31,824	94.3	
23 Flaxseed.....	Bu.....	2.5	2.4	6.0	240.0	250.0	100,276	6.9	( <sup>2</sup> )		
24 Sugar-beet seed.....	Lbs....	571.1	628.2	528.8	92.2	83.9	305,031	52.0	( <sup>2</sup> )		

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1910.  
<sup>3</sup> Number of trees of bearing age.

<sup>4</sup> Not including red clover seed.  
<sup>5</sup> Yield per tree.

# IRRIGATION—MONTANA.

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## COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease.]

	THE STATE.	Beaver-head. <sup>1</sup>	Big Horn. <sup>2</sup>	Blaine. <sup>3</sup>	Broad-water.	Carbon. <sup>4</sup>	Carter. <sup>5</sup>	Cascade.	Chouteau. <sup>6</sup>	Custer. <sup>7</sup>	
1	Number of all farms in 1920.....	87,077	642	791	1,761	466	1,353	855	1,708	2,578	941
2	Number of farms irrigated in 1919.....	10,807	479	341	162	196	768	13	218	32	112
3	Per cent of all farms.....	18.7	74.6	43.1	9.2	42.1	56.8	1.5	12.8	1.2	11.9
4	Number of farms irrigated in 1909.....	8,970	480			231	912		194	354	129
5	Per cent of increase, 1909-1919.....	20.5				-15.2			12.4		
<b>LAND AND FARM AREA.</b>											
6	Approximate land area..... acres..	93,523,840	3,620,480	3,178,240	2,706,560	771,840	1,318,400	2,160,000	2,183,040	2,606,320	2,394,240
7	All land in farms..... acres..	35,070,656	637,009	748,749	1,159,056	304,483	446,388	567,495	1,252,282	1,508,888	997,169
8	Improved land in farms..... acres..	11,007,278	270,603	158,383	291,431	110,566	178,503	83,783	378,035	599,542	121,688
9	Area irrigated in 1919..... acres..	1,681,729	302,375	48,306	59,119	25,733	99,336	330	14,864	6,029	8,469
10	Per cent of improved land in farms.....	15.3	111.7	30.5	20.3	23.3	55.6	0.5	8.9	1.0	7.0
11	Area irrigated in 1909..... acres..	1,679,084	221,716			89,612	121,174		25,063	110,291	19,399
12	Per cent of increase, 1909-1919.....	0.2				-35.0			-40.7		
13	Area enterprises were capable of irrigating in 1920..... acres..	2,753,498	385,619	60,591	99,764	61,175	147,195	1,320	83,163	18,790	21,960
14	Area enterprises were capable of irrigating in 1910..... acres..	2,205,155	238,267			50,870	129,922		80,334	138,063	32,872
15	Per cent of increase, 1910-1920.....	24.9				20.3			5.6		
16	Area included in enterprises in 1920..... acres..	4,379,148	525,181	87,765	190,347	109,435	158,675	2,045	144,376	40,244	25,872
17	Area included in enterprises in 1910..... acres..	3,516,502	347,877			72,436	165,509		81,279	193,849	57,191
18	Per cent of increase, 1910-1920.....	23.1				51.1			77.6		
19	Area of irrigated land reported as available for settlement..... acres..	207,530	1,800		47,597	450			168	150	
<b>IRRIGATION WORKS.</b>											
<b>Independent enterprises:</b>											
20	Number, 1920.....	6,035	521	38	87	211	253	10	100	98	44
21	Number, 1910.....	5,534	446			180	288		93	247	89
<b>Main ditches:</b>											
22	Number, 1920.....	8,819	1,318	67	165	299	343	18	127	134	41
23	Number, 1910.....	6,673	901			221	284		100	306	78
24	Length, 1920..... miles..	16,411	2,004	206	358	591	831	15	213	491	88
25	Length, 1910..... miles..	12,990	1,415			417	805		217	747	169
26	Capacity, 1920..... second-feet..	94,429	10,119	1,540	2,110	1,883	3,772	70	1,264	972	852
27	Capacity, 1910..... second-feet..	83,849	8,596			1,938	4,112		1,019	5,392	1,148
<b>Laterals:</b>											
28	Number, 1920.....	10,680	2,931	18	271	96	406	83	122	318	13
29	Number, 1910.....	8,307	1,163			93	401		192	630	110
30	Length, 1920..... miles..	6,085	669	304	299	49	230	11	47	201	4
31	Length, 1910..... miles..	5,944	555			61	335		156	344	7
<b>Reservoirs:</b>											
32	Number, 1920.....	468	25	8	45	4	1	18	15	27	18
33	Number, 1910.....	827	27			14	8		62	137	76
34	Capacity, 1920..... acre-feet..	1,571,720	136,449	123	15,671	211	91	1,513	218,088	3,124	844
35	Capacity, 1910..... acre-feet..	580,261	158,772			490	467		30,772	44,146	7,728
<b>Flowing wells:</b>											
36	Number, 1920.....	41	1								1
37	Number, 1910.....	15					1				4
38	Capacity, 1920..... gallons per minute..	4,608									1
39	Capacity, 1910..... gallons per minute..	22,185					2,138				42
<b>Pumped wells:</b>											
40	Number, 1920.....	22				5				1	
41	Number, 1910.....	10				3					
42	Capacity, 1920..... gallons per minute..	11,085								10	
43	Capacity, 1910..... gallons per minute..	5,263				185					
<b>Pumping plants:</b>											
44	Number, 1920.....	253		9	7	8	4		22	26	12
45	Number, 1910.....	125				4	4		11	21	8
46	Engine capacity, 1920..... horsepower..	10,341		172	136	94	26		565	577	375
47	Engine capacity, 1910..... horsepower..	8,511				16	59		377	709	538
48	Pump capacity, 1920..... gallons per minute..	453,231		10,225	8,785	2,688	1,741		32,310	42,260	28,250
49	Pump capacity, 1910..... gallons per minute..	281,199				1,438	1,182		20,225	51,244	42,925
50	Average lift, 1920..... feet..	20		14	20	16	10		18	18	14
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920..... dollars..	52,143,363	2,385,045	2,311,418	2,549,735	478,675	1,458,985	14,095	2,555,563	640,658	299,355
52	Capital invested to July 1, 1910..... dollars..	22,970,958	4,003,286			379,681	546,864		832,204	849,450	375,414
53	Per cent of increase, 1910-1920.....	127.0				25.6			207.1		
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	18.94	6.18	38.15	25.56	7.79	9.90	10.68	48.07	34.10	13.68
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	10.42	16.80			7.46	4.21		18.53	6.15	11.42
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920..... dollars..	70,079,028	2,433,395	2,686,470	2,737,185	482,625	1,463,610	18,095	5,120,595	1,051,398	376,180
57	Estimated final cost of existing enterprises in 1910..... dollars..	32,382,077	4,003,286			379,681	546,864		912,194	890,801	379,409
58	Per cent of increase, 1910-1920.....	116.4				27.1			481.3		
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	16.19	4.63	30.91	14.88	4.41	9.34	5.94	35.47	26.13	14.54
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	9.21	11.51			5.24	2.30		11.22	4.60	6.63

<sup>1</sup> Part of Madison annexed in 1911.

<sup>2</sup> Organized from parts of Rosebud and Yellowstone in 1913.

<sup>3</sup> Organized from part of Chouteau in 1912; part taken to form part of Phillips in 1915.

<sup>4</sup> Part taken to form part of Stillwater in 1913; part annexed to Yellowstone and part of Yellowstone annexed in 1919.

<sup>5</sup> Organized from part of Fallon in 1917.

<sup>6</sup> Parts taken to form Blaine and Hill in 1912, and parts of Pondera and Liberty in 1919.

<sup>7</sup> Part, including Northern Cheyenne Indian Reservation and part of Crow Indian Reservation, taken to form Rosebud in 1901; parts taken to form Fallon in 1913, part of Prairie in 1915, and Powder River in 1919.

<sup>8</sup> Includes Liberty and McCone Counties and that part of Yellowstone National Park which is in Montana, for which no irrigation is reported in 1919.

## IRRIGATION—MONTANA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease.]

	Dawson. <sup>1</sup>	Deer Lodge. <sup>2</sup>	Fallon. <sup>3</sup>	Fergus. <sup>4</sup>	Flathead. <sup>5</sup>	Gallatin.	Garfield. <sup>6</sup>	Glacier. <sup>7</sup>	Granite.	Hill. <sup>8</sup>	
1	Number of all farms in 1920.....	1,195	202	758	4,226	1,923	1,349	1,530	372	854	2,257
2	Number of farms irrigated in 1919.....	14	120	2	154	247	782	3	19	199	34
3	Per cent of all farms.....	1.2	59.4	0.3	3.6	12.8	58.0	0.2	5.1	53.4	1.5
4	Number of farms irrigated in 1909.....	100	170		191	63	802			175	
5	Per cent of increase, 1909-1919.....						-2.5			8.0	
<b>LAND AND FARM AREA.</b>											
6	Approximate land area..... acres.....	1,509,760	476,800	1,029,120	4,573,440	3,909,760	1,604,480	3,095,680	1,907,840	1,098,980	1,850,880
7	All land in farms..... acres.....	747,993	58,494	578,754	2,578,981	470,283	783,189	874,129	545,258	254,148	1,107,399
8	Improved land in farms..... acres.....	298,620	24,210	171,815	1,037,819	179,201	350,776	136,554	168,338	72,336	491,358
9	Area irrigated in 1919..... acres.....	1,674	13,474		33,499	11,244	103,975	370	9,767	31,177	2,528
10	Per cent of improved land in farms.....	0.6	55.7		3.2	6.3	29.6	0.3	5.8	43.1	0.5
11	Area irrigated in 1909..... acres.....	11,158	29,881		48,232	14,527	127,449			24,107	
12	Per cent of increase, 1909-1919.....						-18.4			20.3	
13	Area enterprises were capable of irrigating in 1920..... acres.....	6,860	24,271	260	82,521	24,642	174,906	390	25,600	38,500	12,033
14	Area enterprises were capable of irrigating in 1910..... acres.....	46,741	39,949		84,558	19,908	139,050			28,350	
15	Per cent of increase, 1910-1920.....						25.8			35.8	
16	Area included in enterprises in 1920..... acres.....	7,663	40,125	260	96,690	33,787	287,590	4,090	118,500	58,394	14,824
17	Area included in enterprises in 1910..... acres.....	73,061	45,858		100,364	88,287	169,928			33,916	
18	Per cent of increase, 1910-1920.....						69.2			72.2	
19	Area of irrigated land reported as available for settlement..... acres.....	793	560		2,480		3,270				
<b>IRRIGATION WORKS.</b>											
Independent enterprises:											
20	Number, 1920.....	14	90	2	232	129	463	2	2	170	42
21	Number, 1910.....	30	161		206	42	389			151	
Main ditches:											
22	Number, 1920.....	11	142	2	360	109	531	5	6	277	67
23	Number, 1910.....	27	200		253	40	384			172	
24	Length, 1920..... miles.....	10	285	2	580	283	1,127	15	114	272	95
25	Length, 1910..... miles.....	108	341		536	82	770			231	
26	Capacity, 1920..... second-feet.....	83	1,304	2	3,283	1,292	5,315	3	341	1,622	235
27	Capacity, 1910..... second-feet.....	1,275	1,677		2,847	454	5,552			1,177	
Laterals:											
28	Number, 1920.....	37	399	6	472	162	204			143	282
29	Number, 1910.....	56	155		309	48	479			94	
30	Length, 1920..... miles.....	10	65	2	195	139	269			44	91
31	Length, 1910..... miles.....	143	79		191	46	362			41	
Reservoirs:											
32	Number, 1920.....	2	9	2	16	11	4		3	2	31
33	Number, 1910.....	16	20		31	7	12			16	
34	Capacity, 1920..... acre-feet.....	2	109	80	31,638	89,101	2,199		95,000	330	7,205
35	Capacity, 1910..... acre-feet.....	1,119	143		655	12,281	1,420			68	
Flowing wells:											
36	Number, 1920.....		1			9					1
37	Number, 1910.....										
38	Capacity, 1920..... gallons per minute.....		2,250			1,083					50
39	Capacity, 1910..... gallons per minute.....										
Pumped wells:											
40	Number, 1920.....				1						1
41	Number, 1910.....	2					1				
42	Capacity, 1920..... gallons per minute.....				1,500						3,000
43	Capacity, 1910..... gallons per minute.....	4,550					135				
Pumping plants:											
44	Number, 1920.....	4			14	15	6				12
45	Number, 1910.....	12			2		3				
46	Engine capacity, 1920..... horsepower.....	497			204	170	115				352
47	Engine capacity, 1910..... horsepower.....	205			35		24				
48	Pump capacity, 1920..... gallons per minute.....	7,750			16,180	9,165	6,729				21,335
49	Pump capacity, 1910..... gallons per minute.....	23,942			3,350		785				
50	Average lift, 1920..... feet.....	41			14	38	14				16
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920..... dollars.....	154,334	354,148	2,900	729,436	836,723	1,176,492	50,385	3,545,089	344,544	188,822
52	Capital invested to July 1, 1910..... dollars.....	2,819,774	139,766		375,025	239,589	1,017,474			78,500	
53	Per cent of increase, 1910-1920.....						15.6			355.4	
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars.....	22.50	14.59	11.15	8.84	33.96	6.73	129.19	138.48	8.95	15.69
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars.....	60.33	3.50		4.44	12.03	7.32			2.70	
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920..... dollars.....	189,070	356,338	2,900	743,186	1,234,620	1,211,747	50,885	7,219,059	355,744	208,222
57	Estimated final cost of existing enterprises in 1910..... dollars.....	8,168,960	139,766		375,025	2,371,947	1,017,474			78,500	
58	Per cent of increase, 1910-1920.....						19.1			365.0	
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....	24.67	8.88	11.15	7.69	36.54	4.21	12.44	60.92	6.09	14.05
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....	43.24	3.05		3.74	27.49	5.99			2.26	

<sup>1</sup> Parts taken to form Richland and part of Wibaux in 1914, part of Prairie in 1915, and Garfield and part of McCone in 1919; part annexed to Wibaux in 1917.<sup>2</sup> Parts taken to form Powell in 1901; part of Silver Bow annexed in 1903; and part annexed to Silver Bow in 1917.<sup>3</sup> Organized from part of Custer in 1913; parts taken to form part of Wibaux in 1914, part of Prairie in 1915, and Carter in 1917.<sup>4</sup> Part annexed to Meagher and part taken to form part of Musselshell in 1911.<sup>5</sup> Part taken to form Lincoln in 1909; part annexed to Missoula in 1917.<sup>6</sup> Organized from part of Dawson in 1919.<sup>7</sup> Organized from part of Teton in 1919.<sup>8</sup> Organized from part of Chouteau in 1912; parts taken to form part of Toole in 1914 and part of Liberty in 1919.



IRRIGATION—MONTANA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease.]

	Jefferson.	Lewis and Clark.	Lincoln. <sup>1</sup>	Madison. <sup>2</sup>	Meagher. <sup>3</sup>	Mineral. <sup>4</sup>	Missoula. <sup>5</sup>	Musselshell. <sup>6</sup>	Park.	Phillips. <sup>7</sup>
1	555	855	341	901	447	95	1,323	1,604	756	1,914
2	227	109	81	614	122	28	854	49	402	137
3	40.9	12.7	23.8	68.1	27.3	29.5	64.6	3.1	53.2	7.2
4	188	295	54	592	176		833		463	
5	20.7	-63.1							-13.2	
<b>LAND AND FARM AREA.</b>										
6	1,044,480	2,206,060	2,319,360	2,318,080	1,516,160	787,200	2,030,720	1,857,920	1,703,040	3,313,920
7	281,494	754,135	65,050	564,516	801,801	20,209	388,408	996,389	613,597	1,084,725
8	80,933	132,578	16,894	168,635	136,839	5,160	173,031	382,159	168,679	227,811
9	24,946	33,226	5,923	115,598	25,075	967	50,237	4,138	52,854	28,047
10	30.8	25.1	35.1	68.5	18.3	18.7	28.0	1.1	31.3	12.3
11	23,314	38,391	2,105	102,179	102,090		42,689		78,722	
12	7.0	-18.5	181.4						-32.9	
13	45,553	69,907	9,353	172,083	48,175	2,105	120,456	11,659	88,940	43,748
14	26,373	55,317	3,081	118,115	128,209		47,917		99,802	
15	72.7	26.4	203.6						-10.9	
16	86,086	94,133	13,737	265,103	60,348	6,690	156,883	19,255	126,787	85,132
17	37,494	107,789	4,281	191,230	146,373		127,779		149,593	
18	129.6	-12.7	220.9						-15.9	
19	800			3,489		110		610		34,556
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	175	311	64	517	137	57	253	47	314	36
21	149	251	32	446	290		252		363	
Main ditches:										
22	226	423	56	627	376	55	257	73	382	47
23	159	313	30	493	481		268		361	
24	440	635	83	1,304	490	36	507	126	756	124
25	259	518	30	938	792		351		729	
26	9,547	2,356	577	6,290	1,546	239	2,404	671	3,180	852
27	1,267	2,334	187	7,855	4,464		2,316		3,665	
Laterals:										
28	123	268	35	349	577	69	437	227	315	176
29	137	273	38	752	378		78		635	
30	52	107	22	267	127	7	632	78	122	120
31	67	180	20	487	170		45		435	
Reservoirs:										
32	11	31	10	37	7	5	3	2	7	8
33	15	38	3	39	14		12		41	
34	8,268	651,071	318	24,879	181	129	43,297	129	8,029	48,221
35	687	1,482	1	5,927	3,807		1,732		5,747	
Flowing wells:										
36		4	2							
37							1			
38		5	30							
39							5			
Pumped wells:										
40		7							1	
41			1				2			
42		1,445							40	
43			30							
Pumping plants:										
44	1	14	1			3	5	5	1	6
45	1		2				3		1	
46	10	3,884				48	32	86	15	154
47	5		4				45		1	
48	280	77,949	5			361	2,141	11,970		10,420
49	550		90				2,932		64	
50	33	45	10			28	22	20	18	18
<b>CAPITAL INVESTED.</b>										
51	685,014	784,413	195,752	2,566,017	346,267	41,481	3,975,483	155,259	672,677	1,417,569
52	148,694	711,000	21,526	1,101,329	490,092		332,442		470,173	
53	360.7	10.3	809.4						43.1	
54	15.04	11.22	20.98	14.91	7.19	19.71	33.00	13.32	7.56	32.40
55	5.64	12.65	6.99	9.32	3.82		6.94		4.71	
<b>ESTIMATED FINAL COST.</b>										
56	699,764	819,113	197,902	2,587,647	363,507	47,646	5,909,973	160,209	691,027	1,430,709
57	148,694	895,000	21,526	1,101,329	490,092		2,498,292		470,173	
58	370.6	-8.6	819.4						47.0	
59	3.13	8.70	14.41	9.76	6.02	7.12	37.67	8.32	5.49	16.81
60	3.97	8.31	5.08	5.76	3.35		19.55		3.14	

<sup>1</sup> Organized from part of Flathead in 1906.  
<sup>2</sup> Part annexed to Beaverhead in 1911.  
<sup>3</sup> Part of Fergus annexed in 1911; parts taken to form part of Musselshell in 1911 and part of Wheatland in 1917.  
<sup>4</sup> Organized from part of Missoula in 1914.  
<sup>5</sup> Parts taken to form Sanders in 1906, and Mineral in 1914; part of Powell annexed in 1915. Parts of Flathead and Powell annexed in 1917.  
<sup>6</sup> Organized from parts of Fergus, Meagher, and Yellowstone in 1911.  
<sup>7</sup> Organized from parts of Blaine and Valley in 1915.

IRRIGATION—MONTANA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100, or when per cent is more than 1,000.]

	Pondera. <sup>1</sup>	Powder River. <sup>2</sup>	Powell. <sup>3</sup>	Prairie. <sup>4</sup>	Ravalli.	Richland. <sup>5</sup>	Roosevelt. <sup>6</sup>	Rosebud. <sup>7</sup>	Sanders. <sup>8</sup>	Sheridan. <sup>9</sup>
1 Number of all farms in 1920.....	1,060	833	476	673	1,231	1,577	1,215	1,136	667	2,408
2 Number of farms irrigated in 1919.....	427	11	219	8	1,096	200	7	61	123	16
3 Per cent of all farms.....	40.3	1.3	46.0	1.2	89.0	12.7	0.6	5.4	18.4	0.7
4 Number of farms irrigated in 1909.....			278		975			179	62	
5 Per cent of increase, 1909-1919.....					12.4					
<b>LAND AND FARM AREA.</b>										
6 Approximate land area.....acres..	1,061,120	2,135,680	1,490,560	1,114,880	1,530,240	1,345,920	1,505,920	3,195,520	1,831,040	1,719,040
7 All land in farms.....acres.....	629,965	597,056	520,065	548,989	245,965	812,194	673,936	1,608,235	175,088	1,155,859
8 Improved land in farms.....acres..	266,150	75,240	125,924	126,134	114,473	311,008	302,519	226,113	42,425	570,955
9 Area irrigated in 1919.....acres..	55,754	800	64,045	486	107,028	15,450	1,190	20,814	6,373	3,879
10 Per cent of improved land in farms.....	20.9	1.1	50.9	0.4	33.5	5.0	0.4	9.2	15.0	0.7
11 Area irrigated in 1909.....acres..			51,373		93,441			33,271	3,101	
12 Per cent of increase, 1909-1919.....					14.5				105.5	
13 Area enterprises were capable of irrigating in 1920.....acres.....	103,411	3,785	93,120	834	126,401	35,535	7,537	29,670	13,291	10,355
14 Area enterprises were capable of irrigating in 1910.....acres.....			60,643		118,964			64,453	4,101	
15 Per cent of increase, 1910-1920.....					6.2				224.1	
16 Area included in enterprises in 1920.....acres..	212,743	3,785	134,742	834	143,892	41,385	115,955	36,733	26,537	16,499
17 Area included in enterprises in 1910.....acres..			81,360		202,296			92,217	9,812	
18 Per cent of increase, 1910-1920.....					-28.9					
19 Area of irrigated land reported as available for settlement.....acres..	27,198		600			23,535		200		
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20 Number, 1920.....	30	23	272	10	449	9	8	36	83	28
21 Number, 1910.....			302		350			90	61	
Main ditches:										
22 Number, 1920.....	44	31	526	7	578	13	6	44	73	28
23 Number, 1910.....			368		364			102	62	
24 Length, 1920.....miles.....	143	17	809	9	762	60	48	110	87	43
25 Length, 1910.....miles.....			563		682			284	66	
26 Capacity, 1920.....second-feet.....	3,134	89	3,233	55	3,430	672	287	1,540	1,343	419
27 Capacity, 1910.....second-feet.....			2,563		4,235			1,921	184	
Laterals:										
28 Number, 1920.....	232	17	200	3	428	57	63	95	91	21
29 Number, 1910.....			290		295			89	79	
30 Length, 1920.....miles.....	499	3	62		130	73	63	28	71	12
31 Length, 1910.....miles.....			137		264			71	24	
Reservoirs:										
32 Number, 1920.....	6	8	8	3	10	4	6	1	1	5
33 Number, 1910.....			40		46			17		
34 Capacity, 1920.....acre-feet.....	62,800	50	276	8	7,634	395	50,095	40	3,778	468
35 Capacity, 1910.....acre-feet.....			5,502		57,450			778		
Flowing wells:										
36 Number, 1920.....	3	12		5					1	
37 Number, 1910.....										
38 Capacity, 1920.....gallons per minute.....	1,000	83		104						
39 Capacity, 1910.....gallons per minute.....										
Pumped wells:										
40 Number, 1920.....		1						1	2	
41 Number, 1910.....										
42 Capacity, 1920.....gallons per minute.....		10								
43 Capacity, 1910.....gallons per minute.....								176	177	
Pumping plants:										
44 Number, 1920.....		4	1	3		3	1	10	1	14
45 Number, 1910.....								18	3	
46 Engine capacity, 1920.....horsepower.....		56	16	462		125	50	269	7	183
47 Engine capacity, 1910.....horsepower.....								566	5	
48 Pump capacity, 1920.....gallons per minute.....		4,750	650	19,015		9,750	4,500	13,100		11,700
49 Pump capacity, 1910.....gallons per minute.....								38,507	197	
50 Average lift, 1920.....feet.....		12	12	24		20	22	16	10	12
<b>CAPITAL INVESTED.</b>										
51 Capital invested to Jan. 1, 1920.....dollars.....	4,919,860	20,435	877,108	66,866	904,246	2,442,376	713,197	1,024,981	595,212	91,808
52 Capital invested to July 1, 1910.....dollars.....			306,173		960,144			1,007,778	27,859	
53 Per cent of increase, 1910-1920.....					3.6					
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars.....	47.58	5.40	9.42	80.18	7.87	68.16	94.63	34.55	44.78	8.87
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars.....			5.06		8.07			15.64	6.80	
<b>ESTIMATED FINAL COST.</b>										
56 Estimated final cost of existing enterprises in 1920.....dollars.....	5,264,860	37,835	929,633	66,866	908,697	2,664,392	4,327,335	1,040,341	854,850	227,102
57 Estimated final cost of existing enterprises in 1910.....dollars.....			306,173		1,185,094			1,286,565	27,869	
58 Per cent of increase, 1910-1920.....					-15.7					
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars.....	24.75	10.00	6.90	80.18	6.04	64.35	37.32	28.32	32.21	13.76
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars.....			3.76		5.86			13.95	2.84	

<sup>1</sup> Organized from parts of Chouteau and Teton in 1919.  
<sup>2</sup> Organized from part of Custer in 1919.  
<sup>3</sup> Organized from part of Deer Lodge in 1901; part annexed to Missoula in 1917.  
<sup>4</sup> Organized from parts of Custer, Dawson, and Fallon in 1915.  
<sup>5</sup> Organized from part of Dawson in 1914; parts taken to form part of Wibaux in 1914 and part of McCone in 1919.  
<sup>6</sup> Organized from part of Sheridan in 1919.  
<sup>7</sup> Organized from part of Custer County, including Northern Cheyenne Indian Reservation and part of Crow Indian Reservation in 1901; parts taken to form part of Big Horn in 1913 and Treasure in 1919.  
<sup>8</sup> Organized from part of Missoula in 1906.  
<sup>9</sup> Organized from part of Valley in 1913; part taken to form Roosevelt in 1919.

# IRRIGATION—MONTANA.

**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1920; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

	Silver Bow. <sup>1</sup>	Stillwater. <sup>2</sup>	Sweet Grass. <sup>3</sup>	Teton. <sup>4</sup>	Toole. <sup>5</sup>	Treasure. <sup>6</sup>	Valley. <sup>7</sup>	Wheatland. <sup>8</sup>	Wibaux. <sup>9</sup>	Yellowstone. <sup>10</sup>
1	<b>Number of all farms in 1920.....</b>									
2	<b>Number of farms irrigated in 1919.....</b>									
3	<b>Per cent of all farms.....</b>									
4	<b>Number of farms irrigated in 1909.....</b>									
5	<b>Per cent of increase, 1909-1919.....</b>									
<b>LAND AND FARM AREA.</b>										
6	<b>Approximate land area..... acres.....</b>									
7	<b>All land in farms..... acres.....</b>									
8	<b>Improved land in farms..... acres.....</b>									
9	<b>Area irrigated in 1919..... acres.....</b>									
10	<b>Per cent of improved land in farms.....</b>									
11	<b>Area irrigated in 1909..... acres.....</b>									
12	<b>Per cent of increase, 1909-1919.....</b>									
13	<b>Area enterprises were capable of irrigating in 1920..... acres.....</b>									
14	<b>Area enterprises were capable of irrigating in 1910..... acres.....</b>									
15	<b>Per cent of increase, 1910-1920.....</b>									
16	<b>Area included in enterprises in 1920..... acres.....</b>									
17	<b>Area included in enterprises in 1910..... acres.....</b>									
18	<b>Per cent of increase, 1910-1920.....</b>									
19	<b>Area of irrigated land reported as available for settlement..... acres.....</b>									
<b>IRRIGATION WORKS.</b>										
<b>Independent enterprises:</b>										
20	<b>Number, 1920.....</b>									
21	<b>Number, 1910.....</b>									
<b>Main ditches:</b>										
22	<b>Number, 1920.....</b>									
23	<b>Number, 1910.....</b>									
24	<b>Length, 1920..... miles.....</b>									
25	<b>Length, 1910..... miles.....</b>									
26	<b>Capacity, 1920..... second-feet.....</b>									
27	<b>Capacity, 1910..... second-feet.....</b>									
<b>Laterals:</b>										
28	<b>Number, 1920.....</b>									
29	<b>Number, 1910.....</b>									
30	<b>Length, 1920..... miles.....</b>									
31	<b>Length, 1910..... miles.....</b>									
<b>Reservoirs:</b>										
32	<b>Number, 1920.....</b>									
33	<b>Number, 1910.....</b>									
34	<b>Capacity, 1920..... acre-feet.....</b>									
35	<b>Capacity, 1910..... acre-feet.....</b>									
<b>Flowing wells:</b>										
36	<b>Number, 1920.....</b>									
37	<b>Number, 1910.....</b>									
38	<b>Capacity, 1920..... gallons per minute.....</b>									
39	<b>Capacity, 1910..... gallons per minute.....</b>									
<b>Pumped wells:</b>										
40	<b>Number, 1920.....</b>									
41	<b>Number, 1910.....</b>									
42	<b>Capacity, 1920..... gallons per minute.....</b>									
43	<b>Capacity, 1910..... gallons per minute.....</b>									
<b>Pumping plants:</b>										
44	<b>Number, 1920.....</b>									
45	<b>Number, 1910.....</b>									
46	<b>Engine capacity, 1920..... horsepower.....</b>									
47	<b>Engine capacity, 1910..... horsepower.....</b>									
48	<b>Pump capacity, 1920..... gallons per minute.....</b>									
49	<b>Pump capacity, 1910..... gallons per minute.....</b>									
50	<b>Average lift, 1920..... feet.....</b>									
<b>CAPITAL INVESTED.</b>										
51	<b>Capital invested to Jan. 1, 1920..... dollars.....</b>									
52	<b>Capital invested to July 1, 1910..... dollars.....</b>									
53	<b>Per cent of increase, 1910-1920.....</b>									
54	<b>Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars.....</b>									
55	<b>Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars.....</b>									
<b>ESTIMATED FINAL COST.</b>										
56	<b>Estimated final cost of existing enterprises in 1920..... dollars.....</b>									
57	<b>Estimated final cost of existing enterprises in 1910..... dollars.....</b>									
58	<b>Per cent of increase, 1910-1920.....</b>									
59	<b>Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....</b>									
60	<b>Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....</b>									

<sup>1</sup> Part annexed to Deer Lodge in 1903; part of Deer Lodge annexed in 1917.  
<sup>2</sup> Organized from parts of Carbon, Sweet Grass, and Yellowstone in 1913. Part annexed to Sweet Grass in 1915.  
<sup>3</sup> Parts taken to form part of Stillwater in 1913 and part of Wheatland in 1917. Part of Stillwater annexed in 1915.  
<sup>4</sup> Part taken to form part of Toole in 1914; parts taken to form Glacier and part of Fondera in 1919.  
<sup>5</sup> Organized from parts of Hill and Teton in 1914.  
<sup>6</sup> Organized from part of Rosebud in 1919.  
<sup>7</sup> Parts taken to form Sheridan in 1913 and part of Phillips in 1915.  
<sup>8</sup> Organized from parts of Meagher and Sweet Grass in 1917.  
<sup>9</sup> Organized from parts of Dawson, Fallon, and Richland in 1914; part of Dawson annexed in 1917.  
<sup>10</sup> Parts taken to form part of Musselshell in 1911 and parts of Big Horn and Stillwater in 1913; part annexed to Carbon and part of Carbon annexed in 1919.

# NEBRASKA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Nebraska collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

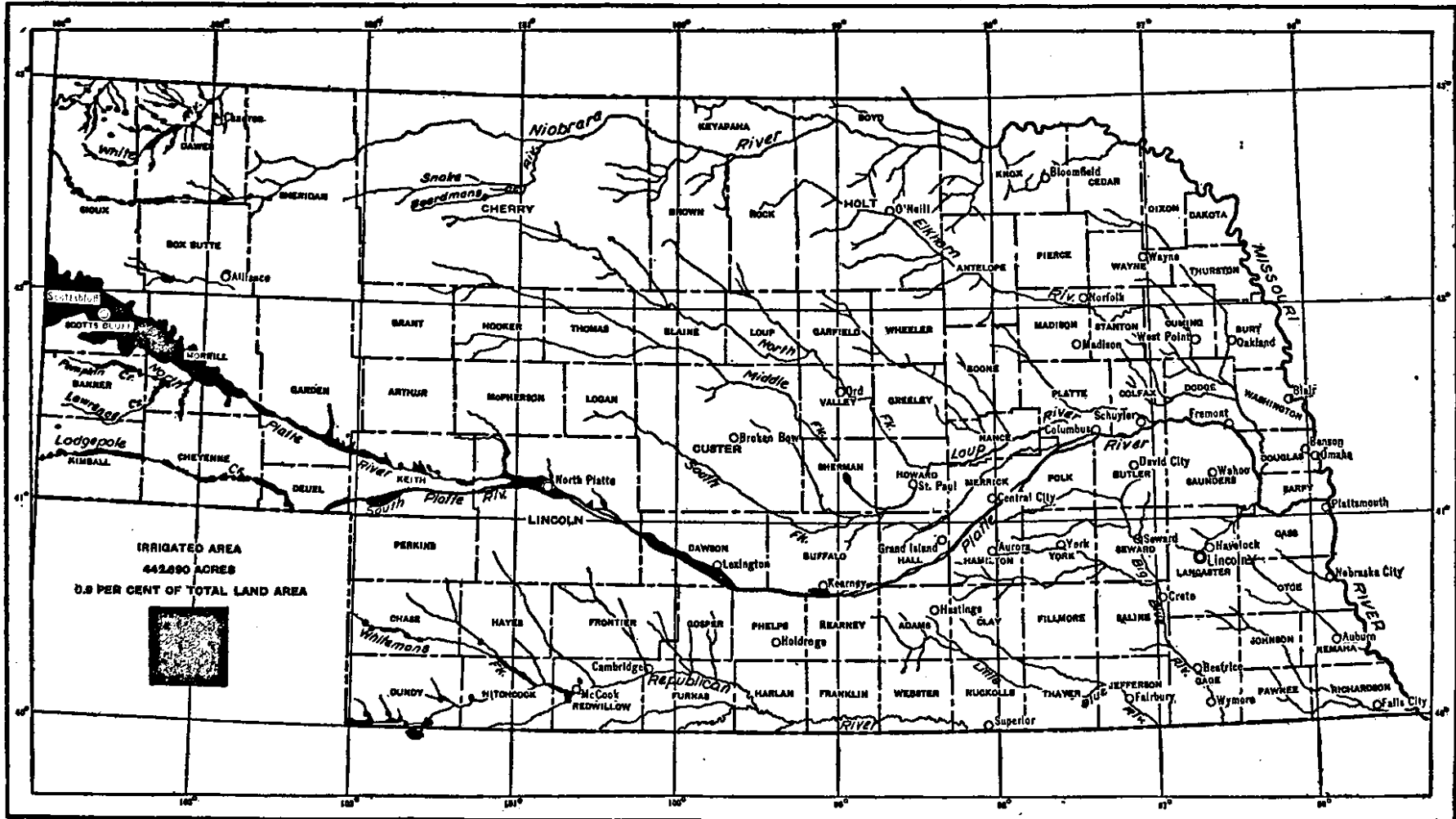
TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	124, 417	129, 678	-5, 261	-4. 1
Approximate land area of the state..... acres..	49, 157, 120	49, 157, 120		
All land in farms..... acres..	42, 225, 475	38, 622, 021	3, 603, 454	9. 3
Improved land in farms..... acres..	23, 109, 624	24, 382, 577	-1, 272, 953	-5. 2
Number of farms irrigated.....	3, 021	1, 852	1, 169	63. 1
Area irrigated..... acres..	442, 690	255, 950	186, 740	73. 0
Area enterprises were capable of irrigating..... acres..	562, 468	429, 225	133, 243	31. 0
Area included in enterprises..... acres..	766, 768	680, 133	86, 635	12. 7
Per cent irrigated:				
Number of all farms.....	2. 4	1. 4	1. 0	
Approximate land area of the state.....	0. 9	0. 5	0. 4	
Land in farms.....	1. 0	0. 7	0. 3	
Improved land in farms.....	1. 9	1. 0	0. 9	
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	119, 778	173, 275	-53, 497	-30. 9
Excess of area included in enterprises over area irrigated..... acres..	324, 078	424, 183	-100, 105	-23. 6
Capital invested.....	\$13, 909, 185	\$7, 798, 310	\$6, 110, 875	78. 4
Average per acre enterprises were capable of irrigating.....	\$24. 73	\$18. 17	\$6. 56	36. 1
Estimated final cost of existing enterprises.....	\$18, 030, 154	\$9, 485, 231	\$8, 544, 923	90. 1
Average per acre included in enterprises.....	\$23. 51	\$13. 95	\$9. 56	68. 5
Average cost of operation and maintenance per acre.....	\$1. 48	\$1. 09	\$0. 39	35. 8
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	470	474	-4	-0. 8
Number of main ditches.....	513	420	93	22. 1
Length of main ditches..... miles..	1, 780	1, 459	321	22. 0
Capacity of main ditches..... second-feet..	11, 665	9, 378	2, 287	24. 4
Number of lateral ditches.....	913	1, 038	-125	-12. 0
Length of lateral ditches..... miles..	1, 545	1, 269	276	21. 7
Number of reservoirs.....	59	44	15	
Capacity of reservoirs..... acre-feet..	197, 890	2, 098	195, 792	
Number of flowing wells.....	( <sup>2</sup> )	( <sup>2</sup> )		
Capacity of flowing wells..... gallons per minute..	( <sup>2</sup> )	( <sup>2</sup> )		
Number of pumped wells.....	34	66	-32	
Capacity of pumped wells..... gallons per minute..	24, 701	3, 363	21, 338	634. 5
Number of pumping plants.....	51	75	-24	
Engine capacity..... horsepower..	959	140	819	585. 0
Pump capacity..... gallons per minute..	73, 686	5, 366	68, 320	
Average lift..... feet..	24	( <sup>2</sup> )	24	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000. <sup>2</sup> Not reported in 1920. <sup>3</sup> Not reported in 1910.

# NEBRASKA

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

Nebraska lies in the semiarid region. The eastern part of the state receives sufficient rainfall for the growth of crops in most seasons; while the extreme western part receives so little rainfall that irrigation is generally practiced where water is available, although crops are grown without irrigation.

The normal annual precipitation is about 30 inches at the eastern line of the state, and decreases very regularly to the westward to about 15 inches at the Nebraska-Wyoming line. About three-fourths of the annual precipitation occurs within the growing season, the spring and early summer rains being general while the late summer precipitation occurs in local and irregular showers.

In the western part of the state in summer the relative humidity is low, and temperatures and wind velocities are high, and these conditions result in heavy demands for moisture to maintain plant growth.

The line of 20-inch normal annual precipitation follows approximately the one-hundredth meridian of longitude, and this marks approximately the eastern extension of the general practice of irrigation.

For the state as a whole the precipitation in 1919 was slightly above the normal but the excess occurred in the winter, and in the western part of the state there was a marked deficiency in May and August, with no excess in June and July.

**WATER SUPPLY FOR IRRIGATION.**

Western Nebraska consists of high, rolling prairies cut by the valleys of the North Platte, the South Platte, the Niobrara, and the Republican Rivers. The streams named, and their tributaries, and the main Platte River, below the junction of the north and south branches, supply water to almost all of the land irrigated.

The North Platte and its tributaries supplied water to nearly 85 per cent of the land irrigated in 1919. This river rises in the mountains of northern Colorado, flows through Wyoming and then into Nebraska, and is used for irrigation in all three states. The flow of the river in eastern Wyoming and in Nebraska is regulated by the Pathfinder Reservoir of the United States Reclamation Service, and stored water is furnished to lands along the main Platte as well as to those along the North Platte. The supply is usually ample for the lands under existing canals, and a large extension of the North Platte project of the United States Reclamation Service, covering land in both Wyoming and Nebraska, is under construction. Stored water from Pathfinder Reservoir also serves a large area under numerous private canals, mainly

in Nebraska. Before the construction of the Pathfinder Reservoir the North Platte in Nebraska carried very heavy flood discharges in the spring and very little water in the late summer.

The South Platte also rises in the mountains in Colorado, and is used extensively for irrigation in that state, the area irrigated from the stream and its tributaries in Colorado in 1919 being more than 1,000,000 acres. The South Platte is a typical plains stream, having its source in the mountains, being subject to heavy floods in the early summer with the melting of the snows, and having a greatly reduced flow in the late summer, and the summer flow is largely lost in its sandy bed and by evaporation. This natural condition has been much changed by the storage of flood waters and the use of water in Colorado. The storage of flood waters has greatly reduced the flood flow in Nebraska, while return seepage from the irrigated lands in Colorado has tended to increase the regular flow of the stream in both summer and winter. No storage has been provided on this stream in Nebraska, although there is a large quantity of water available for storage.

The Platte River is formed by the uniting of the north and south forks, and is of the same character as its branches—it has a large flood flow in spring and early summer, and is very low in late summer, sometimes having no visible flow. The regulation of the North Platte and return seepage to that stream are increasing the summer flow, and stored water from the Pathfinder Reservoir is available for canals taking water from the main stream.

The Niobrara, which rises in Wyoming and flows along the northern border of Nebraska, is a plains stream but a considerable part of its drainage area is composed of sand hills which absorb the rains and snows. As a consequence the water drains into the stream gradually, and it has a remarkably uniform flow, giving rise to its original name, "The river which flows."

The Republican River rises on the plains in Colorado, enters Nebraska near the southwest corner of the state, flows eastward near the southern line of the state for about 275 miles, and crosses the line into Kansas. During the spring the river is subject to heavy floods and it is very low in summer. It is used to some extent for irrigation in both Colorado and Nebraska, although in both states crops are grown in its drainage basin without irrigation. Very little provision for storing flood water has been made.

In the stream valleys water for irrigation can be obtained from wells with low lifts but on the high plains the ground water is at such great depths that the cost of pumping is prohibitive.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	3,021	63.1	2.4	442,690	73.0	0.9	1.0	1.9
1910.....	1,852	-4.1	1.4	255,950	72.3	0.5	0.7	1.0
1900.....	1,932	802.8	1.6	148,538	.....	0.3	0.5	0.8
1890.....	214	.....	0.2	11,744	.....	.....	0.1	0.1

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	470	766,768	442,690	57.7	562,468
Before 1860.....	1	30	30	100.0	30
1870-1879.....	4	1,515	1,090	71.9	1,115
1880-1889.....	61	117,177	104,100	88.8	105,817
1890-1899.....	191	375,191	191,229	51.0	258,341
1900-1904.....	58	33,808	21,580	63.8	40,979
1905-1909.....	26	192,888	98,704	51.2	124,540
1910-1914.....	62	27,184	19,788	72.8	23,241
1915-1919.....	35	5,103	2,748	45.0	3,784
Not reported.....	31	12,872	3,423	26.6	4,621

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase.			
			Amount.	Per cent. <sup>1</sup>		
Total.....	442,690	255,950	186,740	73.0	562,468	766,768
Streams, gravity.....	435,667	254,105	181,462	71.4	550,491	750,931
Streams, pumped.....	1,115	18	1,097	.....	2,468	2,755
Streams, pumped and gravity.....	850	( <sup>2</sup> )	850	.....	1,140	1,140
Wells, pumped.....	546	139	407	292.8	1,148	1,228
Lake, gravity.....	.....	.....	.....	.....	30	30
Springs.....	2,050	686	1,364	198.8	3,141	4,546
Stored storm water.....	1,200	1,002	198	19.8	1,870	1,900
City water.....	7	( <sup>2</sup> )	7	.....	7	7
Sewage.....	120	( <sup>2</sup> )	120	.....	120	120
Streams, gravity, and pumped wells.....	115	( <sup>2</sup> )	115	.....	280	320
Streams, gravity, and flowing wells.....	.....	( <sup>2</sup> )	.....	.....	160	160
Other mixed.....	1,120	( <sup>2</sup> )	1,120	.....	1,663	3,631

<sup>1</sup> Per cent not shown when base is less than 100.  
<sup>2</sup> Not included in 1909 classification.

ACREAGE, BY CHARACTER OF ENTERPRISE.

The provisions of law relating to internal improvements were extended to irrigation canals by a law of 1877. This empowered canal companies to issue bonds and to condemn rights of way for canals.

Nebraska enacted an irrigation district law in 1895. This law has been amended from time to time, and is

still in force. Very few districts have been organized to develop new enterprises, but many have been organized to take over works already built, many cooperative enterprises having been organized into districts. The land watered by such enterprises is reported under districts in Table 5.

Nebraska has not accepted the conditions of the Federal Carey Act (act of Aug. 18, 1894).

In addition to the area credited to the United States Reclamation Service in Table 5, that service supplies water to a large but varying area under the Warren Act and special contracts providing for supplying water to lands that receive their principal supply from other sources.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	442,690	255,950	186,740	73.0
Individual and partnership.....	68,140	45,227	22,913	50.7
Cooperative.....	55,408	78,605	-23,197	-29.5
Irrigation district.....	206,206	76,448	129,758	169.7
Commercial.....	25,335	24,834	501	2.0
U. S. Reclamation Service.....	* 87,558	30,536	57,022	186.7
U. S. Indian Service.....	.....	300	-300	.....
Other.....	43	( <sup>2</sup> )	43	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	562,468	429,225	133,243	31.0
Individual and partnership.....	96,465	64,472	31,993	49.6
Cooperative.....	102,242	168,260	-66,018	-39.2
Irrigation district.....	220,359	77,228	143,131	186.0
Commercial.....	27,332	52,724	-25,392	-48.2
U. S. Reclamation Service.....	* 115,487	66,241	49,246	74.3
U. S. Indian Service.....	.....	300	-300	.....
Other.....	83	( <sup>2</sup> )	83	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	766,768	680,183	86,635	12.7
Individual and partnership.....	124,098	86,305	37,793	43.8
Cooperative.....	145,444	240,009	-94,565	-39.4
Irrigation district.....	244,383	91,076	153,307	168.3
Commercial.....	76,925	154,623	-77,698	-50.2
U. S. Reclamation Service.....	* 175,820	107,520	68,300	63.5
U. S. Indian Service.....	.....	600	-600	.....
Other.....	98	( <sup>2</sup> )	98	.....

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Does not include land supplied with stored water under the Warren Act.  
<sup>3</sup> Not included in 1910 classification.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Nebraska relating to water rights are summarized in the following paragraphs:

Upon its organization the territory of Nebraska adopted the common law of England, so far as it was applicable and not inconsistent with the Constitution of the United States, with the organic law of the territory, or with any law passed by the legislature. The supreme court of the state held that this included the common law rule as to riparian rights, and that this rule held until abrogated by statute.

In 1889 a law was enacted providing that rights to the use of water for beneficial or useful purpose might be acquired by appropriation, and the court has held that this law abrogated the common law of riparian rights (Crawford Company v. Hathaway, 93 N. W., 791). This law provided for the posting and filing of notices of intended diversions, but did not require the filing of claims for rights previously acquired.



In 1895 the state board of irrigation was created, and from that time parties wishing to acquire rights have been required to apply to the board for permits to appropriate water, and to submit proof of the completion of works in accordance with the permits. Certificates defining rights acquired are issued by the board.

The board was given the power to adjudicate rights to water, the procedure being left to the board.

In 1919 the functions of the board of irrigation were assigned to a new department of public works, but the general features of the system of water rights were not changed.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	442,690	100.0	100.0
Appropriation and use.....	42,141	9.5	8.8
Notice filed and posted.....	16,517	3.7	9.9
Adjudicated by court.....	9,280	2.1	18.8
Permit from state.....	234,806	53.0	59.6
Certificate or license from state.....	117,960	26.6	2.7
Riparian rights.....	618	0.1	( <sup>1</sup> )
Underground.....	545	0.1	( <sup>1</sup> )
Other and mixed.....	13	( <sup>2</sup> )	( <sup>1</sup> )
Not reported.....	20,809	4.7	( <sup>1</sup> )

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."  
<sup>2</sup> Less than one-tenth of 1 per cent.

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	442,690	245,910	80.0	766,768	562,468
Hat Creek.....	2,938	*2,649	10.9	3,755	3,705
White River.....	8,008	*9,706	-17.5	21,922	16,939
Niobrara River.....	5,693	*7,210	-21.0	28,511	9,820
Platte River and tributaries.....	400,623	211,890	89.1	678,053	501,435
Platte River direct.....	37,532	30,887	21.5	151,377	68,732
North Platte River and tributaries.....	326,045	148,197	123.0	479,258	389,140
North Platte River direct.....	291,738	130,900	122.9	436,013	349,766
Blue River.....	7,376	4,929	49.6	7,391	7,391
Pumpkin Creek.....	7,273	2,314	214.3	10,554	9,168
Other tributaries of North Platte River.....	19,660	*8,054	144.1	25,300	22,815
South Platte River and tributaries.....	35,290	19,473	81.2	42,262	40,542
South Platte River direct.....	17,061	10,861	57.1	18,623	18,530
Lodgepole Creek.....	18,229	8,612	111.7	23,639	21,952
Loup River.....	1,177	12,872	-90.9	4,512	2,377
Other tributaries of Platte River.....	579	*2,461	-70.5	644	644
Kansas River and tributaries.....	26,428	14,455	75.9	34,537	30,569
Big Blue River.....	19	( <sup>1</sup> )	.....	44	44
Republican River.....	26,409	( <sup>1</sup> )	.....	34,483	30,525

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Main stream and tributaries shown as one item in 1902.

The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase. <sup>1</sup>	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$13,909,185	78.4	\$24.73	36.1
1910.....	7,788,310	495.0	18.17	106.0
1900.....	1,310,698	.....	8.82	116.7
1890.....	*47,798	.....	*4.07	.....

<sup>1</sup> Per cent not shown when more than 1,000.  
<sup>2</sup> Based on average for "subhumid" region. Average for Nebraska not shown separately in 1890.  
<sup>3</sup> Average for "subhumid" region.

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$13,909,185	100.0	\$24.73
Before 1860.....	500	( <sup>1</sup> )	16.67
1870-1879.....	21,583	0.2	19.36
1880-1889.....	1,659,094	11.9	15.68
1890-1899.....	2,075,677	14.9	8.03
1900-1904.....	321,927	2.3	7.86
1905-1909.....	8,685,843	62.4	69.74
1910-1914.....	444,144	3.2	19.11
1915-1919.....	180,314	1.3	47.65
Not reported.....	520,103	3.7	112.55

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$13,909,185	100.0	\$24.73	394,392	\$1.48
Streams, gravity.....	13,819,775	97.9	24.74	359,669	1.48
Streams, pumped.....	39,581	0.3	16.04	572	2.86
Streams, pumped and gravity.....	18,700	0.1	16.40	850	1.04
Wells, pumped.....	23,250	0.2	20.25	436	5.16
Lake, gravity.....	*100,300	0.7	*10.00	.....	.....
Springs.....	24,497	0.2	7.80	1,700	1.14
Stored storm water.....	40,429	0.3	21.62	895	0.36
City water.....	1,000	( <sup>2</sup> )	142.86	.....	.....
Sewage.....	313	( <sup>2</sup> )	2.61	.....	.....
Streams, gravity, and pumped wells.....	5,035	( <sup>2</sup> )	21.89	10	3.00
Streams, gravity, and flowing wells.....	6,902	( <sup>2</sup> )	43.14	.....	.....
Other mixed.....	29,408	0.2	17.68	230	2.63

<sup>1</sup> Based on area irrigated in 1919.  
<sup>2</sup> Capital invested includes \$100,000 for which no acreage is reported and not included in computing average capital per acre.  
<sup>3</sup> Less than one-tenth of 1 per cent.

## IRRIGATION—NEBRASKA.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$13,909,185	\$2,483,748	\$11,445,437	464.6
Hat Creek.....	85,243	* 19,090	66,153	346.5
White River.....	183,349	* 155,924	27,425	17.6
Niobrara River.....	349,874	* 72,900	276,974	379.9
Platte River and tributaries.....	12,894,088	1,982,149	10,911,939	550.5
Platte River direct.....	488,642	565,470	-76,828	-13.6
North Platte River and tributaries.....	11,834,733	967,110	10,867,623	.....
North Platte River direct.....	11,661,937	891,875	10,770,062	.....
Blue River.....	31,050	22,820	8,430	87.3
Pumpkin Creek.....	92,060	19,925	72,135	362.0
Other tributaries of North Platte River.....	149,686	* 32,690	116,996	357.9
South Platte River and tributaries.....	444,413	101,240	343,173	339.0
South Platte River direct.....	87,712	53,600	34,112	63.6
Lodgepole Creek.....	356,701	47,640	309,061	648.7
Loup River.....	21,300	320,615	-299,315	-93.4
Other tributaries of Platte River.....	5,000	* 27,714	-22,714	-82.0
Kansas River and tributaries.....	396,631	233,686	162,945	69.7
Big Blue River.....	1,625	( <sup>2</sup> )	.....	.....
Republican River.....	395,006	( <sup>2</sup> )	.....	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Includes springs and wells.

<sup>3</sup> Main stream and tributaries shown as one item in 1902.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is difficult to arrive at a correct figure.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendances.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$13,909,185	100.0	394,392	\$1.48
Individual and partnership.....	1,146,227	8.2	47,530	1.42
Cooperative.....	547,104	3.9	54,298	0.95
Irrigation district.....	2,811,474	20.2	187,186	1.24
Commercial.....	726,560	5.2	25,335	1.10
U. S. Reclamation Service.....	8,674,260	62.4	80,000	2.54
Other.....	3,570	( <sup>2</sup> )	43	11.86

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

The United States Reclamation Service supplies stored water to enterprises controlled by agencies of

most of the other classes shown in the table and a part of its expenditure is properly chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes since the area served varies from season to season.

## DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	24
Acreage included in enterprises reporting land drained or needing drainage.....	376,518
Acreage for which drains have been installed.....	10,793
Additional acreage needing drainage.....	26,606
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	2.9
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	1.4
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	4.9

## QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-foot.....	2,655	2,154	501
Area irrigated in 1919..... acres.....	171,080	136,500	35,580
Average number of acres per second-foot.....	64	63	71
Total quantity of water entering canals... acre-feet.....	975,071	894,316	80,755
Area irrigated in 1919..... acres.....	232,620	199,650	32,970
Average quantity of water per acre... acre-feet.....	4.2	4.5	2.4
Total quantity of water delivered..... acre-feet.....	445,585	188,089	257,496
Area irrigated in 1919..... acres.....	185,795	76,987	108,808
Average quantity delivered per acre... acre-feet.....	2.4	2.4	2.4

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## IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPED WELLS.		PUMPING PLANTS.			
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).		Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
Total.....	260	73	513	11,665	1,780	913	1,545	59	197,890	3.8	34	24,701	51	959	54	73,686
Before 1800.....	5	2	2	39	4	3	3	1	3							
1870-1879.....	5		6	12	10	9	7									
1880-1889.....	42	2	71	2,748	284	105	370	2	70	0.4						
1890-1899.....	91	22	215	4,814	904	459	435	19	14,244	0.8	2	3,480	4	69	4	7,480
1900-1904.....	45	11	63	479	115	82	64	10	75,928	0.3	1	300	3	75	3	5,800
1905-1909.....	14	7	28	2,825	227	138	569	7	212		1	2,100	4	38	4	3,097
1910-1914.....	26	15	56	488	126	37	41	9	6,764	2.0	18	11,959	19	480	21	35,199
1915-1919.....	15	8	38	152	48	22	13	3	100,300	0.3	12	6,871	20	260	21	21,210
Not reported.....	17	6	34	108	62	26	10	8	369				1	7	1	900

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPED WELLS.		PUMPING PLANTS.			
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).		Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
Total.....	260	73	513	11,665	1,780	913	1,545	59	197,890	3.8	34	24,701	51	959	54	73,686
Individual and partnership.....	223	61	434	1,892	697	470	268	46	3,467	3.3	33	23,601	47	926	50	72,271
Cooperative.....	11	4	32	1,276	222	52	79	1	13,000							
Irrigation district.....	11	3	28	4,878	551	251	599	1	6,000	0.4						
Commercial.....	12	2	14	928	124	29	59	5	100,256	0.1						
U. S. Reclamation Service.....	3	3	3	2,690	185	111	570	6	75,167							
Other.....			2	1	1						1	1,100	4	33	4	1,415

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPED WELLS.		PUMPING PLANTS.				
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).		Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).	Average lift (feet).
Total.....	260	73	513	11,665	1,780	913	1,545	59	197,890	3.8	34	24,701	51	959	54	73,686	24
Hat Creek.....	11	2	40	25	44	1	1	6	109								
White River.....	63	23	81	237	131	104	66	17	1,302	0.4	2	2,200	3	63	3	4,000	35
Nebraska River.....	27	10	44	204	88	92	36	1	13,005	0.1			1	8	1	480	8
Platte River and tributaries.....	131	29	309	10,593	1,379	661	1,412	31	183,317	0.9	19	14,501	33	437	36	36,008	27
Platte River direct.....	4	1	26	1,776	207	36	137	1	1		14	10,551	13	180	14	14,580	31
North Platte River and tributaries.....	66	17	178	7,769	978	418	1,169	13	175,235	0.5			5	81	6	7,000	15
North Platte River direct.....	25	5	71	7,052	782	315	1,087	9	175,169	0.5			4	71	5	6,400	8
Blue River.....	3		5	139	27												
Pumpkin Creek.....	13	7	43	209	71	44	23										
Other tributaries of North Platte River.....	25	5	59	369	93	59	59	4	66				1	10	1	600	35
South Platte River and tributaries.....	57	5	98	949	175	202	100	12	7,156	0.1	5	3,950	5	108	5	9,682	17
South Platte River direct.....	3		6	598	39	95	18				4	1,850	3	36	2	1,850	25
Lodgepole Creek.....	54	5	90	351	136	107	82	12	7,156	0.1	1	2,100	2	70	3	7,832	11
Loup River.....	3	5	7	91	16	5	6	3	60				3	49	7	4,280	17
Other tributaries of Platte River.....	1	1	2	8	3			2	860	0.3			3	21	4	461	30
Kansas River and tributaries.....	28	9	39	606	138	55	30	4	162	2.4	13	8,000	14	461	14	33,203	26
Big Blue River.....			2	5	1					0.4			2	30	2	1,000	18
Republican River.....	28	9	37	601	137	55	30	4	162	2.0	13	8,000	12	431	12	32,203	27

IRRIGATION—NEBRASKA.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	26,798	0.4	21,552	0.3	24.3	Bu.....	628,064	0.4	563,857	0.3	11.0
2 Oats.....	12,375	0.6	18,794	0.8	-31.5	Bu.....	364,083	0.6	555,048	1.0	-34.4
3 Winter wheat.....	15,321	0.4				Bu.....	321,419	0.6			
4 Spring wheat.....	9,748	1.8	9,015	0.3	178.1	Bu.....	158,405	3.9	170,952	0.4	180.7
5 Barley.....	3,610	1.7	3,495	3.1	3.3	Bu.....	105,958	2.4	90,368	4.5	17.3
6 Rye.....	1,403	0.4	427	0.7	228.6	Bu.....	17,630	0.5	7,475	1.1	135.9
<b>Hay and forage:</b>											
7 Alfalfa.....	60,476	5.0	31,842	4.6	89.9	Tons...	135,942	6.1	81,225	5.3	67.4
8 Other tame or cultivated grasses.....	1,205	0.8	( <sup>2</sup> )			Tons...	1,506	0.7	( <sup>2</sup> )		
9 Wild, salt, or prairie grasses.....	14,956	0.5	37,019	1.2	-59.6	Tons...	12,797	0.5	38,796	1.3	-67.0
10 Small grains cut for hay.....	942	1.2	( <sup>2</sup> )			Tons...	867	1.1	( <sup>2</sup> )		
11 Corn cut for forage.....	1,459	0.5	( <sup>2</sup> )			Tons...	2,923	0.7	( <sup>2</sup> )		
12 Kafir, sorghum, etc., for forage.....	1,392	0.5	( <sup>2</sup> )			Tons...	3,385	0.6	( <sup>2</sup> )		
<b>Vegetables:</b>											
13 Potatoes.....	6,671	7.1	6,077	5.5	9.8	Bu.....	720,833	16.2	888,766	10.9	-18.9
<b>Miscellaneous:</b>											
14 Sugar beets grown for sugar.....	42,959	78.8	3,114	74.5		Tons...	445,521	80.3	85,849	92.7	

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On nonirrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	23.9	23.9	23.4	97.9	97.9	\$845,186	0.4	\$290,241	0.3	191.2
2 Oats.....	Bu.....	29.5	29.5	28.3	95.9	95.9	273,062	0.6	219,389	1.1	24.5
3 Winter wheat.....	Bu.....	14.3	14.3	21.0	148.9	148.9	691,050	0.6			
4 Spring wheat.....	Bu.....	7.7	7.6	18.3	214.5	217.3	340,571	3.9	135,554	0.3	661.0
5 Barley.....	Bu.....	20.9	20.7	28.4	140.7	142.0	116,554	2.4	40,801	4.7	185.7
6 Rye.....	Bu.....	9.1	9.0	12.6	138.5	140.0	24,682	0.5	4,624	1.2	433.8
<b>Hay and forage:</b>											
7 Alfalfa.....	Tons...	1.83	1.81	2.25	123.0	124.3	2,582,898	6.1	497,656	4.6	419.0
8 Other tame or cultivated grasses.....	Tons...	1.38	1.39	1.25	90.6	89.9	18,825	0.7	( <sup>2</sup> )		
9 Wild, salt, or prairie grasses.....	Tons...	0.80	0.80	0.86	107.5	107.5	172,760	0.5	254,216	1.8	-32.0
10 Small grains cut for hay.....	Tons...	1.02	1.02	0.92	90.2	90.2	11,271	1.1	( <sup>2</sup> )		
11 Corn cut for forage.....	Tons...	1.63	1.63	2.00	122.7	122.7	30,692	0.7	( <sup>2</sup> )		
12 Kafir, sorghum, etc., for forage.....	Tons...	2.10	2.10	2.43	115.7	115.7	32,158	0.6	( <sup>2</sup> )		
<b>Vegetables:</b>											
13 Potatoes.....	Bu.....	47.2	43.6	108.1	229.0	253.8	1,729,999	16.2	274,910	7.3	529.3
<b>Miscellaneous:</b>											
14 Sugar beets grown for sugar.....	Tons...	10.18	9.47	10.37	101.9	109.5	4,677,971	80.3	152,310	84.8	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

<sup>2</sup> Not reported separately in 1909.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.**

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100, or when per cent is more than 1,000.]

		THE STATE.	Banner.	Box Butte.	Buffalo.	Chase.	Cherry.	Cheyenne.
1	Number of all farms in 1920.....	124,417	301	641	2,376	705	1,664	854
2	Number of farms irrigated in 1919.....	3,021	6	5	29	15	5	8
3	Per cent of all farms.....	2.4	2.0	0.8	1.2	2.1	0.3	0.9
4	Number of farms irrigated in 1909.....	1,852	10	7	1	14	18	33
5	Per cent of increase, 1909-1919.....	63.1						
<b>LAND AND FARM AREA.</b>								
6	Approximate land area..... acres..	49,157,120	474,880	688,640	604,800	575,360	3,826,560	764,160
7	All land in farms..... acres..	42,225,475	447,629	646,509	570,881	571,027	2,981,685	513,414
8	Improved land in farms..... acres..	23,100,624	136,669	129,438	433,371	173,346	591,881	262,395
9	Area irrigated in 1919..... acres..	442,690	2,703	2,162	3,019	2,292	501	5,247
10	Per cent of improved land in farms.....	1.9	2.0	1.7	0.7	1.3	0.1	2.0
11	Area irrigated in 1909..... acres..	255,950	1,915	1,171	2	3,226	546	3,635
12	Per cent of increase, 1909-1919.....	73.0	41.1	84.6		-26.0	-8.2	44.3
13	Area enterprises were capable of irrigating in 1920..... acres..	562,468	3,283	3,062	3,059	4,311	1,301	5,778
14	Area enterprises were capable of irrigating in 1910..... acres..	420,225	1,965	1,113	2	4,767	1,046	3,095
15	Per cent of increase, 1910-1920.....	31.0	67.1	161.0		-9.8	24.4	44.8
16	Area included in enterprises in 1920..... acres..	766,768	4,269	3,802	6,419	4,491	1,373	5,058
17	Area included in enterprises in 1910..... acres..	680,139	2,110	1,373	4	6,187	1,046	4,345
18	Per cent of increase, 1910-1920.....	12.7	103.7	176.9		-27.4	31.3	37.1
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
19	Number, 1920.....	470	15	5	4	13	5	36
20	Number, 1910.....	474	16	6	1	6	13	25
<b>Main ditches:</b>								
21	Number, 1920.....	513	18	6	1	13	4	47
22	Number, 1910.....	420	16	6	1	6	3	37
23	Length, 1920..... miles..	1,780	31	19	16	36	7	46
24	Length, 1910..... miles..	1,459	18	13	1	24	9	33
25	Capacity, 1920..... second-feet..	11,665	78	86	160	107	15	78
26	Capacity, 1910..... second-feet..	9,378	39	24	1	86	30	95
<b>Laterals:</b>								
27	Number, 1920.....	913	29	9		15		57
28	Number, 1910.....	1,038	2	3		9		41
29	Length, 1920..... miles..	1,545	13	6		4		48
30	Length, 1910..... miles..	1,269	1	2		3		15
<b>Reservoirs:</b>								
31	Number, 1920.....	59	1		2	2		4
32	Number, 1910.....	44	1			1	1	8
33	Capacity, 1920..... acre-feet..	197,890	40		360	152		95
34	Capacity, 1910..... acre-feet..	2,098	240			1	13	40
<b>Flowing wells:</b>								
35	Number, 1920.....							
36	Number, 1910.....							
37	Capacity, 1920..... gallons per minute..							
38	Capacity, 1910..... gallons per minute..							
<b>Pumped wells:</b>								
39	Number, 1920.....	34			1	1		
40	Number, 1910.....	66	8	2			13	
41	Capacity, 1920..... gallons per minute..	24,701			450	300		
42	Capacity, 1910..... gallons per minute..	3,363	30	30			80	
<b>Pumping plants:</b>								
43	Number, 1920.....	51			3	2	1	
44	Number, 1910.....	75	8	2	1		13	
45	Engine capacity, 1920..... horsepower..	959			18	40	8	
46	Engine capacity, 1910..... horsepower..	140	8	3	4		8	
47	Pump capacity, 1920..... gallons per minute..	73,686			836	6,300	480	
48	Pump capacity, 1910..... gallons per minute..	5,366	30	30	20		80	
49	Average lift, 1920..... feet..	24			23	19	8	
<b>CAPITAL INVESTED.</b>								
50	Capital invested to Jan. 1, 1920..... dollars..	13,006,185	47,760	32,410	301,750	39,095	6,310	49,137
51	Capital invested to July 1, 1910..... dollars..	7,798,310	13,754	6,115	205	28,273	2,493	19,353
52	Per cent of increase, 1910-1920.....	78.4	247.3	430.0		38.3	153.1	153.4
53	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	24.73	14.55	10.53	98.64	9.07	4.85	8.50
54	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	18.17	7.00	5.21	102.50	5.93	2.33	4.85
<b>ESTIMATED FINAL COST.</b>								
55	Estimated final cost of existing enterprises in 1920..... dollars..	18,030,154	49,260	32,410	301,750	41,095	6,310	49,437
56	Estimated final cost of existing enterprises in 1910..... dollars..	9,485,231	13,754	6,115	205	28,273	2,493	19,353
57	Per cent of increase, 1910-1920.....	90.1	258.3	430.0		46.4	153.1	155.0
58	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	23.51	11.46	8.52	47.01	9.15	4.60	8.30
59	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	18.95	6.52	4.45	51.25	4.57	2.33	4.46

## IRRIGATION—NEBRASKA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	Dawes.	Dawson.	Deuel.	Dundy.	Garden. <sup>1</sup>	Hitchcock.	Keith.
1 Number of all farms in 1920.....	728	1,934	384	661	714	776	673
2 Number of farms irrigated in 1919.....	58	330	40	27	97	96	111
3 Per cent of all farms.....	8.0	17.1	10.4	4.1	13.6	12.4	16.5
4 Number of farms irrigated in 1909.....	67	109	31	28	70	102	96
5 Per cent of increase, 1909-1919.....		202.8				-5.9	
<b>LAND AND FARM AREA.</b>							
6 Approximate land area..... acres..	897,280	630,400	280,960	593,280	1,079,680	463,360	633,520
7 All land in farms..... acres..	822,158	570,874	202,689	474,055	884,328	418,283	614,842
8 Improved land in farms..... acres..	136,939	377,185	98,194	179,082	226,316	202,767	218,703
9 Area irrigated in 1919..... acres..	9,005	33,700	10,317	9,045	20,488	9,788	25,832
10 Per cent of improved land in farms.....	6.6	8.9	10.5	5.1	9.1	4.8	11.8
11 Area irrigated in 1909..... acres..	7,029	12,742	4,745	8,069	16,164	12,210	13,140
12 Per cent of increase, 1909-1919.....	28.1	164.5	117.4	194.7		-19.9	96.6
13 Area enterprises were capable of irrigating in 1920..... acres..	19,052	64,725	11,755	10,918	25,554	10,226	31,466
14 Area enterprises were capable of irrigating in 1910..... acres..	12,389	30,833	4,660	6,006	21,604	12,850	19,581
15 Per cent of increase, 1910-1920.....	53.8	109.2	152.3	81.8		-20.4	60.7
16 Area included in enterprises in 1920..... acres..	24,326	141,610	13,155	14,118	26,714	10,576	33,974
17 Area included in enterprises in 1910..... acres..	12,896	126,309	9,568	6,121	47,429	21,260	36,160
18 Per cent of increase, 1910-1920.....	88.6	11.7	37.5	130.6		-50.2	-6.0
<b>IRRIGATION WORKS.</b>							
Independent enterprises:							
19 Number, 1920.....	88	13	21	12	31	3	25
20 Number, 1910.....	73	8	7	16	33	5	26
Main ditches:							
21 Number, 1920.....	90	19	25	11	34	3	38
22 Number, 1910.....	75	3	5	12	34	5	24
23 Length, 1920..... miles..	149	152	89	46	128	33	111
24 Length, 1910..... miles..	113	67	16	45	119	56	93
25 Capacity, 1920..... second-feet..	282	1,145	296	203	480	190	722
26 Capacity, 1910..... second-feet..	232	600	72	161	816	217	410
Laterals:							
27 Number, 1920.....	132	17	49	18	37	1	114
28 Number, 1910.....	99	8	6	8	38	1	13
29 Length, 1920..... miles..	82	39	35	16	37		40
30 Length, 1910..... miles..	32	71	8	5	17	2	20
Reservoirs:							
31 Number, 1920.....	17		2		2		1
32 Number, 1910.....	7	1		2	1		2
33 Capacity, 1920..... acre-feet..	1,302		3		100,000		5
34 Capacity, 1910..... acre-feet..	220	1		12	2		2
Flowing wells:							
35 Number, 1920.....							
36 Number, 1910.....							
37 Capacity, 1920..... gallons per minute..							
38 Capacity, 1910..... gallons per minute..							
Pumped wells:							
39 Number, 1920.....	2	3	2				3
40 Number, 1910.....	1	5			4		2
41 Capacity, 1920..... gallons per minute..	2,200	3,901	2,450				1,500
42 Capacity, 1910..... gallons per minute..	10	80			100		5
Pumping plants:							
43 Number, 1920.....	3	9	4		3	1	2
44 Number, 1910.....	1	5		5	4		2
45 Engine capacity, 1920..... horsepower..	53	97	78		64	25	35
46 Engine capacity, 1910..... horsepower..	1	8		5	10		2
47 Pump capacity, 1920..... gallons per minute..	4,000	5,430	8,182		5,500	2,500	2,400
48 Pump capacity, 1910..... gallons per minute..	10	80		54	100		5
49 Average lift, 1920..... feet..	26	36	16		9	10	13
<b>CAPITAL INVESTED.</b>							
50 Capital invested to Jan. 1, 1920..... dollars..	211,145	170,435	59,613	111,800	229,001	162,500	205,734
51 Capital invested to July 1, 1910..... dollars..	70,479	230,250	44,967	41,479	89,323	216,350	84,200
52 Per cent of increase, 1910-1920.....	199.6	-26.0	32.6	169.5		-24.9	144.3
53 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	11.08	2.63	5.07	10.24	8.96	15.89	6.54
54 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	5.69	7.44	9.65	6.91	4.13	16.84	4.30
<b>ESTIMATED FINAL COST.</b>							
55 Estimated final cost of existing enterprises in 1920..... dollars..	243,245	270,435	59,613	112,300	270,201	162,500	221,334
56 Estimated final cost of existing enterprises in 1910..... dollars..	70,479	230,250	44,967	41,479	89,323	216,350	84,200
57 Per cent of increase, 1910-1920.....	245.1	17.5	32.6	170.7		-24.9	162.9
58 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	10.00	1.91	4.53	7.95	10.11	15.86	6.51
59 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	5.47	1.82	4.70	6.78	1.88	10.18	2.32

<sup>1</sup> Part annexed to Grant County in 1918.

IRRIGATION—NEBRASKA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Kimball.	Lincoln.	Morrill.	Red-willow.	Scotts Bluff.	Sherman.	Sioux.	All other counties.
1 Number of all farms in 1920.....	456	2,024	957	1,091	1,391	1,337	942	103,908
2 Number of farms irrigated in 1919.....	50	203	397	33	1,166	6	812	27
3 Per cent of all farms.....	11.0	10.0	41.5	3.0	83.8	0.4	87.1	(1)
4 Number of farms irrigated in 1909.....	18	98	109	17	702	1	234	85
5 Per cent of increase, 1909-1919.....			264.2		66.1		33.3	
<b>LAND AND FARM AREA.</b>								
6 Approximate land area..... acres..	613,120	1,623,040	906,880	460,800	462,720	366,720	1,315,200	31,845,760
7 All land in farms..... acres.....	347,591	1,383,879	647,543	420,737	281,492	339,005	1,079,327	28,012,527
8 Improved land in farms..... acres..	115,174	512,778	152,556	257,025	157,176	244,643	108,353	18,395,634
9 Area irrigated in 1919..... acres..	9,101	35,246	55,216	4,013	173,245	850	20,796	1,126
10 Per cent of improved land in farms.....	7.9	6.9	36.2	1.6	110.2	0.3	27.5	(1)
11 Area irrigated in 1909..... acres..	3,432	34,760	29,445	2,003	100,301	3	5,576	836
12 Per cent of increase, 1909-1919.....	165.2	1.4	87.5	100.3	72.7		434.4	34.7
13 Area enterprises were capable of irrigating in 1920..... acres..	11,117	41,811	70,845	4,700	196,229	1,200	39,793	2,483
14 Area enterprises were capable of irrigating in 1910..... acres..	3,507	38,240	56,990	10,003	181,206	3	7,170	1,135
15 Per cent of increase, 1910-1920.....	217.0	9.3	24.0	-53.0	2.6		455.0	118.8
16 Area included in enterprises in 1920..... acres..	11,224	45,421	100,588	4,928	251,647	1,500	47,307	13,338
17 Area included in enterprises in 1910..... acres..	3,901	55,820	70,290	10,003	224,185	3	39,159	1,468
18 Per cent of increase, 1910-1920.....	187.7	-18.6	43.1	-50.7	12.2		20.3	808.6
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
19 Number, 1920.....	16	10	48	9	28	1	54	23
20 Number, 1910.....	26	8	36	1	20	1	78	71
<b>Main ditches:</b>								
21 Number, 1920.....	23	10	48	8	30	1	65	19
22 Number, 1910.....	26	9	39	1	22		74	22
23 Length, 1920..... miles.....	64	103	225	21	404	3	125	17
24 Length, 1910..... miles.....	42	134	191	30	326		100	39
25 Capacity, 1920..... second-feet..	174	710	1,380	66	4,754	31	558	176
26 Capacity, 1910..... second-feet..	104	1,175	1,058	150	3,922		151	34
<b>Laterals:</b>								
27 Number, 1920.....	20	27	187	14	100	3	48	35
28 Number, 1910.....	35	12	215		465		69	13
29 Length, 1920..... miles.....	11	107	343	8	636	6	107	8
30 Length, 1910..... miles.....	13	45	253		755		23	4
<b>Reservoirs:</b>								
31 Number, 1920.....	7	1	2	1	4		8	5
32 Number, 1910.....					1		16	3
33 Capacity, 1920..... acre-feet..	7,058	4	4	10	75,165		132	13,060
34 Capacity, 1910..... acre-feet..					1,000		560	7
<b>Flowing wells:</b>								
35 Number, 1920.....								
36 Number, 1910.....								
37 Capacity, 1920..... gallons per minute..								
38 Capacity, 1910..... gallons per minute..								
<b>Pumped wells:</b>								
39 Number, 1920.....				11				6
40 Number, 1910.....			1	5	1	1		23
41 Capacity, 1920..... gallons per minute..				4,700				9,200
42 Capacity, 1910..... gallons per minute..			2,500	30	165	25		308
<b>Pumping plants:</b>								
43 Number, 1920.....		1		7				15
44 Number, 1910.....			1	5	1	1	1	25
45 Engine capacity, 1920..... horsepower..		10		312				219
46 Engine capacity, 1910..... horsepower..			20	3	6	3	3	51
47 Pump capacity, 1920..... gallons per minute..		600		18,403				19,055
48 Pump capacity, 1910..... gallons per minute..			2,500	30	165	25	412	1,825
49 Average lift, 1920..... feet.....		35		28				
<b>CAPITAL INVESTED.</b>								
50 Capital invested to Jan. 1, 1920..... dollars..	270,500	830,481	2,502,018	74,450	7,037,085	12,000	1,978,842	77,119
51 Capital invested to July 1, 1910..... dollars..	15,778	255,950	337,191	50,477	6,204,582	54	69,122	17,880
52 Per cent of increase, 1910-1920.....		29.1	642.0	47.5	13.4			331.3
53 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	24.33	7.90	35.42	15.84	35.86	10.00	49.73	31.06
54 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	4.50	6.69	5.92	5.05	32.45	18.00	9.64	15.75
<b>ESTIMATED FINAL COST.</b>								
55 Estimated final cost of existing enterprises in 1920..... dollars..	270,500	330,481	3,029,213	75,450	9,585,622	12,000	2,727,029	179,969
56 Estimated final cost of existing enterprises in 1910..... dollars..	15,778	255,950	337,191	50,477	7,891,503	54	69,122	17,880
57 Per cent of increase, 1910-1920.....		29.1	798.4	49.5	21.5			906.5
58 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	24.10	7.28	30.12	15.31	38.09	8.00	57.65	13.49
59 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	4.04	4.59	4.80	5.05	35.20	18.00	1.77	12.18

<sup>1</sup> Less than one-tenth of 1 per cent.



# NEVADA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Nevada collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of show-

ing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	3,163	2,689	474	17.6
Approximate land area of the state..... acres..	70,285,440	70,285,440	—	—
All land in farms..... acres..	2,357,168	2,714,757	-357,594	-13.2
Improved land in farms..... acres..	594,741	752,117	-157,376	-20.9
Number of farms irrigated.....	2,718	2,406	312	13.0
Area irrigated..... acres..	561,447	701,833	-140,386	-20.0
Area enterprises were capable of irrigating..... acres..	704,708	840,962	-136,254	-16.2
Area included in enterprises..... acres..	1,382,036	1,232,142	149,894	12.2
Per cent irrigated:				
Number of all farms.....	85.9	89.5	-3.6	—
Approximate land area of the state.....	0.8	1.0	-0.2	—
Land in farms.....	23.8	25.9	-2.1	—
Improved land in farms.....	94.4	93.3	1.1	—
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	122,161	139,129	-16,968	-12.2
Excess of area included in enterprises over area irrigated..... acres..	801,589	530,309	271,280	51.2
Area of irrigated land reported as available for settlement.... acres..	139,352	( <sup>2</sup> )	—	—
Capital invested.....	\$14,754,280	\$6,721,924	\$8,032,356	119.5
Average per acre enterprises were capable of irrigating.....	\$20.94	\$7.99	\$12.95	162.1
Estimated final cost of existing enterprises.....	\$22,648,747	\$12,188,756	\$10,459,991	85.8
Average per acre included in enterprises.....	\$16.39	\$9.89	\$6.50	65.7
Average cost of operation and maintenance per acre.....	\$0.79	\$0.97	-\$0.18	-18.6
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	1,015	1,347	-332	-24.6
Number of main ditches.....	2,032	994	1,038	104.4
Length of main ditches..... miles..	3,123	1,938	1,185	61.1
Capacity of main ditches..... second-feet..	10,554	17,579	-7,025	-40.0
Number of lateral ditches.....	2,064	1,531	533	34.8
Length of lateral ditches..... miles..	1,245	1,213	32	2.6
Number of reservoirs.....	134	109	25	22.9
Capacity of reservoirs..... acre-feet..	504,428	325,953	178,475	54.8
Number of flowing wells.....	123	19	104	( <sup>3</sup> )
Capacity of flowing wells..... gallons per minute..	21,942	1,302	20,640	( <sup>3</sup> )
Number of pumped wells.....	129	6	123	( <sup>3</sup> )
Capacity of pumped wells..... gallons per minute..	6,798	1,349	5,449	403.9
Number of pumping plants.....	64	18	46	( <sup>3</sup> )
Engine capacity..... horsepower..	409	693	-284	-41.0
Pump capacity..... gallons per minute..	35,266	24,295	10,971	45.2
Average lift..... feet..	22	( <sup>3</sup> )	22	—

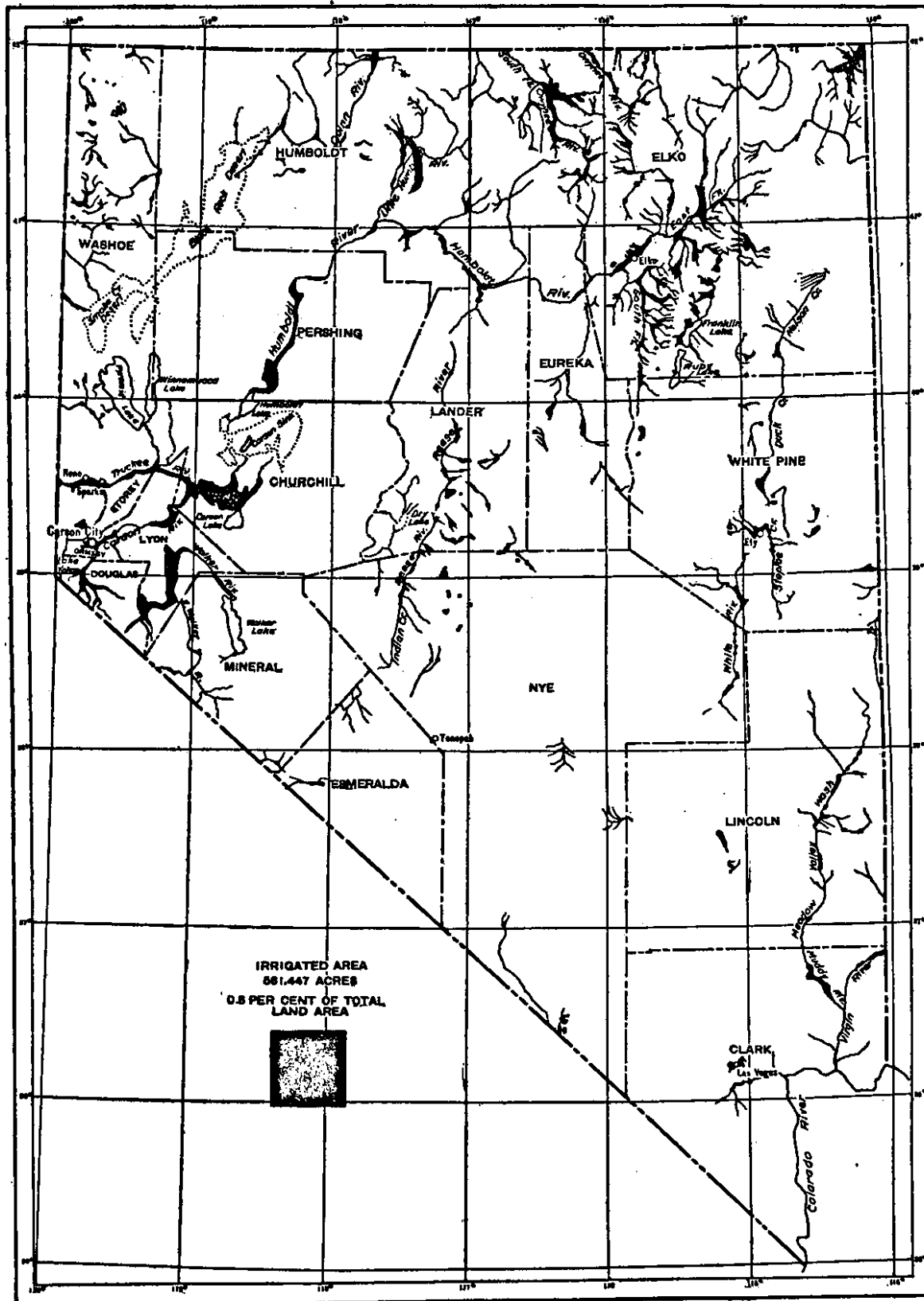
<sup>1</sup>A minus sign (-) denotes decrease.

<sup>2</sup>Not reported in 1910.

<sup>3</sup>Per cent not shown when base is less than 100 or when per cent is more than 1,000.

# NEVADA

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

Except for small areas on the extreme western border, the surface of the state of Nevada consists of broken ranges of mountains, with broad, sage-covered valleys between. Along the western border the state extends into the Sierra Nevada Mountains.

Precipitation is heavy in the Sierra Nevadas, particularly snowfall in the winter, and, as is usually the case, immediately to the east of the mountains precipitation drops suddenly, then increases gradually to the east, the driest part of the state being in the lowest part, which lies near the western border. A very small area on the western border of the state receives more than 15 inches of precipitation annually, a narrow strip east of that receives from 12 to 15 inches, another narrow strip receives from 9 to 12 inches, followed by another that receives from 6 to 9 inches. East of this, and extending along the southwestern border of the state and taking in the whole southern end, is a wide zone that receives less than 6 inches of precipitation annually. East and north of this the amount increases, rising to 12 to 15 inches in a section lying just east of the center of the state. Taking the state as a whole the average annual precipitation is less than 10 inches. More than half of this occurs in the winter, the summers being extremely dry and hot. In the Sierra Nevada Mountains the snowfall in winter is very heavy and the snow lies well into the summer.

The year 1919 was one of the driest years on record, the average precipitation for the state being about 7 inches, while the normal is about 9.5 inches. April and May were warm months, and the snow melted earlier than usual, thus decreasing the supply of water later in the season. The drouth was detrimental to crops where stored water was not available, and to pastures and ranges generally.

The state has a wide range of temperature. The extreme southern point of the state is semitropical, the growing season extending seven or eight months, while in some of the higher valleys in the Sierras it is but two or three months. In most of the valleys of the state the growing season is about six months.

In only very small areas in the state can crops be grown without irrigation in normal years.

**WATER SUPPLY FOR IRRIGATION.**

Except for a small area in the extreme southern point of the state, which is in the Colorado River drainage, and a somewhat larger area along the northern border of the state, which is in the Snake River drainage, the state of Nevada lies within the Great Basin and has no outlet to the sea. The rivers rise in the mountains and lose their waters by evaporation and seepage along their channels or flow into lakes or sinks, where the water evaporates, leaving large deposits of salt and other alkalis.

The principal streams are Humboldt River, which rises in the northeastern part of the state and flows in a southwesterly direction to the sinks in the western part of the state, and Truckee, Carson, and Walker Rivers, which rise in the Sierra Nevada Mountains in California and flow in an easterly direction to the sinks in the same part of the state.

Humboldt River, rising in the extreme northeastern part of the state, flows in a westerly and southwesterly direction, breaking through successive ranges of mountains which have a general north and south direction, forming a succession of valleys along the river. Tributaries reach the river from both north and south, draining the valleys between the mountain ranges. The discharge of the Humboldt and its tributaries is typical of such streams, being high in spring, when the snow melts, and very low in the summer. Without storage, crops are limited to such as mature early; in fact, the larger part of the irrigation along the Humboldt consists of flooding wild-grass meadows when the stream is in flood. Schemes for storage have been discussed but never carried out.

Truckee River rises in Lake Tahoe, which lies on the boundary between Nevada and California, and after a northerly course in the mountains in California, turns eastward into Nevada, where it waters considerable land in Truckee Meadows, near Reno, and below is diverted into the drainage basin of Carson River, to supply a part of the land in the Newlands Project of the United States Reclamation Service. Plans for using Lake Tahoe for storing water for summer use are delayed by controversies between water users in Nevada and the owners of land around the lake in California. Storage for a part of Truckee River water is provided for in Lahontan Reservoir of the United States Reclamation Service.

Carson and Walker Rivers also rise in the Sierra Nevadas in California and flow in a northeasterly direction into Carson Lake and Walker Lake, respectively, after being used for irrigation in the valleys through which they pass. Complete use of these streams requires storage, which has not yet been provided, except that some of the water of Carson River is stored in Lahontan Reservoir.

In the extreme southern part of the state Virgin River and its tributary, Muddy River, supply small areas, and in the northern part of the state tributaries of Snake River water small areas.

In by far the larger part of the state there is little or no surface water available for irrigation, but some of the streams water small areas before losing their water in the deserts.

In several of the valleys of the state wells have been put down and water obtained for small areas. No doubt much more land can be watered from this source if the value of the crops justifies the expense.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase. <sup>1</sup>	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	2,718	13.0	85.9	561,447	-20.0	0.8	23.8	94.4
1910.....	2,406	26.2	89.5	701,833	39.2	1.0	25.9	93.3
1900.....	1,906	63.3	87.3	504,168	124.7	0.7	19.7	88.0
1890.....	1,167	.....	91.4	224,403	.....	0.3	13.5	31.0

<sup>1</sup> A minus sign (-) denotes decrease.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	1,015	1,382,036	561,447	40.6	704,708
Before 1890.....	23	5,938	4,782	79.8	5,072
1890-1899.....	131	456,730	171,317	37.5	183,064
1870-1879.....	147	228,749	124,723	54.5	142,042
1890-1899.....	114	178,291	83,562	46.9	124,227
1880-1889.....	52	21,452	9,081	42.3	11,708
1900-1904.....	58	238,961	60,897	25.5	89,330
1905-1909.....	29	23,253	18,770	80.7	19,465
1910-1914.....	133	56,456	24,833	44.0	35,034
1915-1919.....	132	53,214	13,937	26.2	36,046
Not reported.....	196	118,937	49,545	41.7	58,521

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	561,447	701,833	-140,386	-20.0	704,708	1,382,036
Streams, gravity.....	466,812	661,299	-194,487	-29.4	585,105	1,130,770
Streams, pumped.....	2,647	463	2,184	471.7	2,676	4,330
Streams, pumped and gravity.....	720	( <sup>2</sup> )	720	.....	720	740
Wells, pumped.....	295	87	208	.....	524	1,548
Wells, flowing.....	811	150	661	440.7	1,210	5,577
Wells, flowing and pumped.....	65	( <sup>2</sup> )	65	.....	70	332
Lakes, gravity.....	445	500	-55	-11.0	1,410	4,516
Lakes, pumped.....	.....	406	-406	.....	.....	.....
Springs.....	21,987	38,840	-16,853	-43.4	25,659	72,179
Stored storm water.....	17,348	138	17,210	.....	17,508	23,648
City water.....	14	( <sup>2</sup> )	14	.....	20	20
Sewage.....	88	( <sup>2</sup> )	88	.....	88	708
Streams, gravity, and pumped wells.....	4,967	( <sup>2</sup> )	4,967	.....	8,034	22,764
Streams, gravity, and flowing wells.....	82	( <sup>2</sup> )	82	.....	82	592
Other mixed.....	45,176	( <sup>2</sup> )	45,176	.....	61,613	114,314

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.  
<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

In 1889 Nevada enacted a law dividing the state into internal improvement districts, and provided for the issuing of bonds by such districts. The next

legislature, in 1891, enacted a district law similar to those enacted by other Western states, and this has been amended from time to time. But one district is reported in the state, and this was organized to take over works already built. This accounts, in part, for the decrease in the acreage reported for individual and cooperative enterprises in Table 5. The land in the Newlands Project of the United States Reclamation Service has been organized into an irrigation district, but this land is credited to the Reclamation Service in Table 5, because the Government built the works and still controls them to a large extent.

Nevada accepted the terms of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1895, but no land is reported as being supplied with water under this law.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	561,447	701,833	-140,386	-20.0
Individual and partnership.....	355,901	581,406	-225,505	-38.8
Cooperative.....	69,877	78,966	-9,089	-11.5
Irrigation district.....	80,000	.....	80,000	.....
Commercial.....	5,990	8,864	-2,874	-32.4
U. S. Reclamation Service.....	44,324	30,000	14,324	47.7
U. S. Indian Service.....	5,321	2,597	2,724	104.9
State.....	12	( <sup>2</sup> )	12	.....
City.....	22	( <sup>2</sup> )	22	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	704,708	840,962	-136,254	-16.2
Individual and partnership.....	453,900	649,841	-195,941	-30.2
Cooperative.....	85,483	88,255	-2,772	-3.1
Irrigation district.....	80,000	.....	80,000	.....
Commercial.....	7,240	9,300	-2,060	-22.2
U. S. Reclamation Service.....	69,850	90,185	-20,335	-22.5
U. S. Indian Service.....	8,195	3,381	4,814	143.4
State.....	12	( <sup>2</sup> )	12	.....
City.....	28	( <sup>2</sup> )	28	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	1,382,036	1,232,142	149,894	12.2
Individual and partnership.....	807,045	844,128	-37,083	-4.4
Cooperative.....	93,253	129,269	-36,016	-27.9
Irrigation district.....	260,000	.....	260,000	.....
Commercial.....	14,240	24,500	-10,260	-41.9
U. S. Reclamation Service.....	192,000	216,185	-24,185	-11.2
U. S. Indian Service.....	15,390	18,060	-2,670	-14.8
State.....	80	( <sup>2</sup> )	80	.....
City.....	28	( <sup>2</sup> )	28	.....

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Nevada relating to water rights are summarized in the following paragraphs:

In 1866 the legislature enacted a law requiring any person desiring to construct or maintain any ditch or flume to make a certificate describing the ditch, before some officer competent to take acknowledgments of deeds. No provision for recording these certificates was made.

The state of Nevada enacted in 1889 a law which was intended to provide for a complete record of water rights and for their administration. All parties claiming any interest in irrigation works were required to file statements of their claims on or before September 1, 1890, and parties wishing to build ditches or to enlarge

or extend existing ditches were required to file statements with the proper county recorders. The state was divided into districts, exclusive jurisdiction of controversies over water rights was given to the district courts, and the courts were to issue certificates to holders of rights. The law provided also for the appointment of commissioners to distribute water from streams in accordance with the decrees of the courts. This law was repealed in 1893, but many filings were made after that date.

In 1899 a new law on the subject of water rights was enacted. This law declared that "All natural water courses and natural lakes, and the waters thereof, which are not held in private ownership, belong to the state, and are subject to regulation and control by the state." It provided that rights to water might be acquired in the manner provided by the act, and not otherwise. The county commissioners and the county surveyor of each county were made a board of water commissioners for their county. Applications to appropriate water were to be made to these boards "but in no case shall permission to appropriate water be granted, except there be a surplus of water remaining in the source of supply over and above their existing vested and accrued rights." It was left to the discretion of each county board to determine whether the county should avail itself of the provision of the act. The act was not generally put into effect.

Another new water law was enacted in 1903. This law declared that the waters of all watercourses and lakes belong to the "public," rather than to the "state," and were subject to appropriation for beneficial use, and the use of water is made a public use. This law created the office of state engineer, and made it the duty of the engineer to prepare for each stream in the state a list of the appropriations of water according to their priority. County recorders were required to supply to the engineer transcripts of all claims on record in their respective offices, and the engineer was to get copies of all decrees rendered by the courts. The state engineer was to examine the lands irrigated and irrigable on each stream, make his list of rights on the basis of the claims filed, court decrees, and his own surveys, and issue certificates to claimants defining their rights. Appeal to the courts was provided for. This law has been amended in such a way that the findings of the engineer are submitted to the court and the court issues a decree defining rights.

This law was amended in 1905, and sections were added requiring parties wishing to acquire rights to make application to the state engineer for permits. The law provided for the submitting of proof of completion of works in accordance with the permits and for the issuing and recording of certificates showing the rights acquired. This law was repealed and reenacted in substance by the act of February 26, 1907, and that law was superseded by the act of March 22, 1913, which was the same in its general effect. The law of 1913 has been amended in some particulars, but the general system provided in that and previous laws is still in force. Riparian rights are not recognized in Nevada.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	561,447	100.0	100.0
Appropriation and use.....	200,550	35.7	85.9
Notice filed and posted.....	52,027	9.3	5.5
Adjudicated by court.....	161,176	28.7	1.4
Permit from state.....	106,837	19.0	1.4
Certificate or license from state.....	6,686	1.2	4.8
Underground.....	1,244	0.2	(1)
Other and mixed.....	1,705	0.3	(1)
Not reported.....	31,217	5.6	(1)

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase.		
Total.....	561,447	570,001	-1.5	1,382,036	704,708
Quinn River.....	9,935	38,150	-74.0	19,635	13,452
Owyhee River.....	57,632	8,625	568.2	143,690	62,335
Bruneau River.....	1,297	1,065	21.8	2,708	2,125
Salmon River.....	12,160	12,160	.....	.....	.....
Goose Creek.....	25,000	2,000	.....	50,000	50,000
Humboldt River and tributaries.....	197,778	219,767	-10.0	348,573	231,251
Humboldt River direct.....	69,186	97,742	-29.2	84,049	77,736
East Fork of Humboldt River.....	33,473	11,680	186.6	74,264	43,649
Lamoille Creek.....	22,278	7,765	185.9	40,610	26,055
North Fork of Humboldt River.....	7,940	3,960	100.5	28,667	10,470
South Fork of Humboldt River.....	32,052	26,733	23.6	43,338	41,201
Pine Creek.....	3,250	1,010	221.8	3,530	3,250
Reese River.....	11,178	14,906	-25.0	40,769	10,898
Little Humboldt River.....	6,350	31,562	-79.9	6,790	6,350
Other tributaries of Humboldt River.....	11,071	* 24,409	-54.6	21,626	11,582
Truckee River and tributaries.....	20,002	40,541	-50.7	34,659	20,920
Truckee River direct.....	14,696	32,748	-55.4	28,040	15,456
Steamboat Creek.....	3,152	7,000	-55.0	3,298	3,218
Other tributaries of Truckee River.....	2,244	* 793	183.0	3,321	2,266
Carson River and tributaries.....	70,980	70,267	1.0	226,641	99,645
Carson River direct.....	4,860	48,155	-89.9	9,567	7,200
West Fork of Carson River.....	7,463	8,476	-12.0	7,691	7,523
East Fork of Carson River.....	11,028	9,524	15.8	11,128	11,128
Other tributaries of Carson River.....	47,629	* 4,112	.....	198,255	78,794
Walker River and tributaries.....	113,364	54,055	109.7	357,987	139,207
Walker River direct.....	94,240	28,232	233.2	294,990	98,500
East Walker River.....	5,574	13,355	-58.3	8,637	6,767
West Walker River.....	12,980	12,348	5.1	51,850	32,590
Other tributaries of Walker River.....	570	* 70	.....	2,460	1,350
Colorado River and tributaries.....	8,546	11,481	-25.6	21,342	10,338
Colorado River direct.....	.....	890	.....	.....	.....
Virgin River.....	7,855	4,090	92.3	17,259	9,460
Other tributaries of Colorado River.....	681	* 6,501	-89.5	4,083	878
Independent streams.....	56,913	111,890	-49.1	176,851	75,385
Duck Creek.....	6,252	4,109	52.2	13,855	7,872
Steptoe Creek.....	3,708	6,705	-44.7	12,069	3,628
Other independent streams.....	46,953	* 101,076	-53.5	150,927	63,885

<sup>1</sup> A minus sign (-) denotes decrease. Percent not shown when base is less than 100 or when per cent is more than 1,000.  
<sup>2</sup> Includes springs and wells.

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.**

CENSUS YEAR.	Amount.	Per cent of increase. <sup>1</sup>	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$14,754,280	119.5	\$20.94	162.1
1910.....	6,721,924	837.2	7.99	162.0
1900.....	1,537,559	-9.6	3.05	-59.8
1890.....	1,700,976		7.58	

<sup>1</sup> A minus sign (-) denotes decrease.

**TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.**

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$14,754,280	\$1,706,212	\$13,048,068	764.7
Quinn River.....	50,548	61,100	-10,552	-17.3
Owyhee River.....	192,772	15,145	177,627	92.4
Bruneau River.....	42,210	3,890	38,320	905.1
Salmon River.....		14,840	-14,840	
Goose Creek.....	393,755	3,000	390,755	96.9
Humboldt River and tributaries.....	1,751,586	763,110	988,476	129.5
Humboldt River direct.....	739,995	486,730	253,265	52.0
East Fork of Humboldt River.....	202,071	7,610	194,461	96.2
Lamolle Creek.....	91,280	14,840	76,440	515.1
North Fork of Humboldt River.....	57,408	10,045	47,363	471.5
South Fork of Humboldt River.....	288,162	53,570	234,592	434.9
Pine Creek.....	2,809	2,450	359	14.7
Roose River.....	79,120	26,815	42,305	114.9
Little Humboldt River.....	2,544	53,580	-51,036	-95.3
Other tributaries of Humboldt River.....	288,182	97,170	191,012	196.6
Truckee River and tributaries.....	594,187	296,435	297,752	100.4
Truckee River direct.....	435,900	253,470	232,430	91.7
Steamboat Creek.....	42,070	39,670	2,400	6.0
Other tributaries of Truckee River.....	66,217	3,295	62,922	93.7
Carson River and tributaries.....	8,024,300	142,703	7,881,597	97.1
Carson River direct.....	61,055	95,913	-34,858	-36.3
West Fork of Carson River.....	14,169	14,610	-441	-3.0
East Fork of Carson River.....	48,736	13,695	35,041	266.2
Other tributaries of Carson River.....	7,900,290	18,485	7,881,805	99.8
Walker River and tributaries.....	1,661,484	179,995	1,481,489	823.1
Walker River direct.....	1,466,889	71,425	1,395,464	95.2
East Walker River.....	68,565	58,800	9,765	16.5
West Walker River.....	107,622	49,000	58,622	119.4
Other tributaries of Walker River.....	18,408	650	17,758	96.5
Colorado River and tributaries.....	415,953	35,200	380,663	91.6
Colorado River direct.....		3,000	-3,000	
Virgin River.....	357,542	12,415	345,127	96.5
Other tributaries of Colorado River.....	58,411	19,775	38,636	193.9
Independent streams.....	1,627,595	190,704	1,436,891	758.4
Duck Creek.....	252,851	10,700	242,151	95.8
Steptoe Creek.....	139,998	19,940	120,058	85.8
Other independent streams.....	1,184,666	160,064	1,024,602	86.6

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

**TABLE 10.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$14,754,280	100.0	\$20.94
Before 1880.....	55,645	0.4	10.97
1880-1882.....	2,400,832	16.3	13.11
1870-1879.....	1,592,890	10.8	11.26
1880-1889.....	1,026,933	7.0	8.27
1890-1899.....	134,494	0.9	11.49
1900-1904.....	8,149,026	55.2	91.02
1905-1909.....	244,493	1.7	12.56
1910-1914.....	576,638	3.9	16.45
1915-1919.....	234,932	1.6	6.52
Not reported.....	331,547	2.2	5.67

**TABLE 11.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.**

(When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.)

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$14,754,280	100.0	\$21.58	460,317	\$0.79
Streams, gravity.....	12,493,231	84.7	22.28	284,358	0.66
Streams, pumped.....	119,900	0.8	44.82	897	1.76
Streams, pumped and gravity.....	8,000	0.1	11.11	720	0.78
Wells, pumped.....	19,900	0.1	37.98	236	12.10
Wells, flowing.....	50,575	0.4	41.80	157	6.56
Wells, flowing and pumped.....	5,500	( <sup>2</sup> )	78.57	65	61.77
Lakes, gravity.....	234,851	1.6	48.93	130	19.63
Springs.....	568,000	3.9	22.14	17,840	1.74
Stored storm water.....	184,350	1.1	9.39	15,548	0.37
City water.....	300	( <sup>2</sup> )	15.00		
Sewage.....	620	( <sup>2</sup> )	7.06	80	0.44
Streams, gravity, and pumped wells.....	181,887	1.2	22.67	1,246	1.57
Streams, gravity, and flowing wells.....	3,400	( <sup>2</sup> )	41.46	82	1.46
Other mixed.....	903,766	6.1	14.67	38,958	1.54

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.**

(When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.)

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$14,754,280	100.0	460,317	\$0.79
Individual and partnership.....	4,014,570	27.2	265,826	0.80
Cooperative.....	1,019,047	6.9	62,664	0.75
Irrigation district.....	1,248,611	8.5	80,000	0.66
Commercial.....	340,559	2.3	4,240	2.36
U. S. Reclamation Service.....	7,953,537	53.9	44,324	1.04
U. S. Indian Service.....	178,536	1.2	3,451	0.30
State.....	1,000	( <sup>2</sup> )	12	12.50
City.....	420	( <sup>2</sup> )		

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**DRAINAGE OF IRRIGATED LAND.**

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

**TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.**

Number of enterprises reporting land drained or needing drainage.....	58
Acreage included in enterprises reporting land drained or needing drainage.....	537,417
Acreage for which drains have been installed.....	34,175
Additional acreage needing drainage.....	98,249
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	6.4
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	2.5
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	9.6

**QUANTITY OF WATER USED.**

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

**TABLE 14.—QUANTITY OF WATER USED IN 1919.**

ITEM.	Total.	Meas-ured.	Not meas-ured.
Average volume of water entering canals.....second-feet..	2,328	1,623	705
Area irrigated in 1919.....acres..	204,526	111,017	93,509
Average number of acres per second-foot.....	88	68	133
Total quantity of water entering canals.....acre-feet..	926,308	727,037	199,271
Area irrigated in 1919.....acres..	212,323	122,827	89,496
Average quantity of water per acre.....acre-feet..	4.4	5.9	2.2
Total quantity of water delivered.....acre-feet..	170,911	157,638	13,273
Area irrigated in 1919.....acres..	60,044	49,494	10,550
Average quantity delivered per acre.....acre-feet..	2.8	3.2	1.3

**IRRIGATION WORKS.**

**TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	1,523	82	2,032	10,554	3,123	2,064	1,245	134	504,428
Before 1860.....	55	3	18	141	21	8	4	2	1
1860-1869.....	340	6	489	1,474	838	521	309	9	9,357
1870-1879.....	437	9	485	3,232	681	321	143	14	36,606
1880-1889.....	233	7	335	890	627	397	174	9	646
1890-1899.....	50	7	87	220	98	55	12	8	350,825
1900-1904.....	58	2	79	3,480	195	195	330	13	33,438
1905-1909.....	37	26	40	42	29	56	13	41	9,935
1910-1914.....	77	16	167	402	178	228	107	32	12,288
1915-1919.....	93	6	156	420	215	167	106	6	51,302
Not reported.....	143		176	253	241	116	47		

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).
Total.....	33.0	123	21,942	129	6,798	64	409	72	35,266
Before 1860.....									
1860-1869.....	2.0	2	110	50		2		2	
1870-1879.....	2.1	3	6	12	3	6	4	11	20,003
1880-1889.....	0.1	17	152	22	105	5	7	5	100
1890-1899.....	0.6								
1900-1904.....	1.8			3	100	3	11	4	850
1905-1909.....	0.6	2	663	1	442	2	75	2	2,600
1910-1914.....	16.5	49	14,770	18	1,630	16	122	16	3,625
1915-1919.....	5.5	44	6,127	20	4,418	25	168	26	6,308
Not reported.....	3.8	6	114	3	100	5	22	6	1,780

IRRIGATION—NEVADA.

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	1,523	82	2,032	10,554	3,123	2,064	1,245	134	504,428
Individual and partnership.....	1,451	71	1,928	4,094	2,489	1,688	641	120	120,295
Cooperative.....	22	9	47	2,758	165	186	174	12	84,133
Irrigation district.....	40	.....	40	.....	320	50	100	.....	.....
Commercial.....	4	.....	4	318	63	.....	.....	.....	.....
U. S. Indian Service.....	4	.....	4	184	35	15	18	.....	.....
U. S. Reclamation Service.....	2	2	3	3,200	51	125	312	2	350,000
State.....	.....	.....	2	.....	.....	.....	.....	.....	.....
City.....	.....	.....	2	.....	.....	2	.....	.....	.....

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	33.0	123	21,942	129	6,798	64	409	72	35,266
Individual and partnership.....	27.0	108	21,812	48	6,572	59	403	61	35,046
Cooperative.....	4.1	15	130	29	5	4	6	9	.....
Commercial.....	0.1	.....	.....	.....	.....	.....	.....	.....	.....
U. S. Indian Service.....	1.8	.....	.....	50	.....	.....	.....	.....	.....
State.....	.....	.....	.....	2	220	1	.....	2	220

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	1,523	82	2,032	10,554	3,123	2,064	1,245	134	504,428
Quinn River.....	5	1	14	98	22	20	16	2	.....
Owyhee River.....	181	2	202	525	245	170	90	1	1,000
Bruneau River.....	31	1	39	55	32	7	2	1	50
Goose Creek.....	35	.....	3	100	100	35	70	3	30,000
Humboldt River and tributaries.....	715	12	1,040	1,204	1,292	965	281	27	42,791
Humboldt River direct.....	55	3	51	394	147	303	119	5	32,025
East Fork of Humboldt River.....	195	2	226	75	188	241	44	4	688
Lamoille Creek.....	173	.....	196	90	193	128	41	.....	.....
North Fork of Humboldt River.....	47	.....	62	48	109	86	22	.....	.....
South Fork of Humboldt River.....	161	.....	281	297	354	96	29	4	7,974
Pine Creek.....	.....	.....	1	.....	.....	2	1	.....	.....
Reese River.....	47	.....	170	155	237	13	4	.....	.....
Little Humboldt River.....	6	.....	4	.....	4	.....	.....	.....	.....
Other tributaries of Humboldt River.....	31	7	49	155	60	96	21	14	2,104
Truckee River and tributaries.....	54	5	40	2,465	158	21	14	8	201
Truckee River direct.....	23	2	26	426	134	17	11	1	2
Steamboat Creek.....	6	1	8	2,001	14	4	3	1	.....
Other tributaries of Truckee River.....	25	2	6	38	10	.....	.....	6	199
Carson River and tributaries.....	128	12	95	3,853	170	179	340	14	400,060
Carson River direct.....	12	8	13	297	27	36	15	7	.....
West Fork of Carson River.....	19	.....	27	85	17	.....	.....	.....	.....
East Fork of Carson River.....	34	.....	39	824	50	.....	.....	.....	.....
Other tributaries of Carson River.....	63	4	16	3,217	76	143	325	7	400,060
Walker River and tributaries.....	70	14	120	1,267	498	96	157	4	1,508
Walker River direct.....	44	.....	47	515	368	60	127	.....	.....
East Walker River.....	5	.....	43	186	65	1	3	1	3
West Walker River.....	11	1	10	551	51	11	25	1	1,500
Other tributaries of Walker River.....	10	13	20	15	14	24	2	2	.....
Colorado River and tributaries.....	35	5	83	141	94	182	102	16	558
Virgin River.....	35	5	59	119	86	126	101	5	354
Other tributaries of Colorado River.....	.....	.....	24	22	8	56	1	11	204
Independent streams.....	269	30	396	846	512	389	173	58	28,265
Duck Creek.....	14	.....	21	45	36	17	12	1	50
Stepos Creek.....	14	1	17	47	43	20	13	3	4,000
Other independent streams.....	241	29	358	754	428	352	148	54	24,215



IRRIGATION—NEVADA.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse- power).	Pumps.		Aver- age lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	33.0	123	21,942	129	6,798	64	409	72	35,266	22
Orinn River.....				10	50	3	4	5		25
Owyhee River.....	0.1			1	25	1	6	1	350	30
Bruneau River.....	0.6									
Humboldt River and tributaries.....	15.7	12	805	18	2,540	18	71	19	22,495	30
Humboldt River direct.....	2.0	2		8	1,495	8	34	8	2,345	32
East Fork of Humboldt River.....				1	25	1		1	25	12
North Fork of Humboldt River.....	0.4			1		1	8	1		30
South Fork of Humboldt River.....				1	100	1	5	1	100	12
Pine Creek.....				1	10	1	10	1	10	
Reese River.....		4	190	4		3		3		
Other tributaries of Humboldt River.....	13.3	6	615	2	910	8	24	4	20,015	39
Truckee River and tributaries.....	0.9			1	250	1	6	1	250	8
Truckee River direct.....	0.7									
Other tributaries of Truckee River.....	0.2			1	250	1	6	1	250	8
Carson River and tributaries.....	4.1	3	22	1	50	12	134	13	1,650	12
Carson River direct.....	0.6			1	50	3	53	3	50	17
East Fork of Carson River.....						1		1		
Other tributaries of Carson River.....	3.5	3	22			8	81	9	1,600	11
Walker River and tributaries.....		26	242	71	5	2	2	2		10
Walker River direct.....				50						
West Walker River.....		17	240	20	5	2	2	2		10
Other tributaries of Walker River.....		9	2	1						
Colorado River and tributaries.....	7.2	53	18,872	7	705	8	72	9	4,878	21
Virgin River.....	4.4			5	230	6	43	7	2,245	15
Other tributaries of Colorado River.....	2.8	53	18,872	2	475	2	29	2	2,633	38
Independent streams.....	4.4	29	2,001	20	3,173	19	114	22	5,643	20
Duck Creek.....	0.1	3	794	6	2,285	5	56	8	2,465	20
Steptoe Creek.....				4	503	4	17	4	1,203	23
Other independent streams.....	4.3	27	1,207	10	385	10	41	10	1,975	17

IRRIGATION—NEVADA.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 and 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of in-crease. <sup>1</sup>	Unit.	1919		1909		Per cent of in-crease. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Winter wheat.....	2,921	83.9	14,010	98.2	42.6	Bu.....	60,220	87.7	392,472	99.1	11.5
2 Spring wheat.....	17,062	92.2				Bu.....	377,248	95.4			
3 Oats.....	2,501	84.1	7,285	92.8	-65.7	Bu.....	64,873	86.5	307,618	91.8	-78.9
4 Barley.....	5,156	92.1	11,852	97.1	-56.5	Bu.....	138,798	93.6	401,450	97.4	-65.4
<b>Hay and forage:</b>											
5 Alfalfa.....	112,166	95.7	89,904	99.7	24.8	Tons...	318,906	96.2	237,536	99.6	34.3
6 Timothy alone.....	4,229	94.8	10,437	99.8	-59.5	Tons...	4,855	95.6	16,217	75.8	-70.1
7 Timothy and clover mixed.....	14,059	96.8	9,442	55.1	48.9	Tons...	19,351	96.5	15,607	59.7	24.0
8 Clover alone.....	487	62.7				Tons...	768	64.4			
9 Other tame grasses.....	29,114	95.3	7,259	27.7	301.1	Tons...	31,306	96.6	11,107	27.5	181.9
10 Annual legumes cut for hay.....	706	91.2				Tons...	545	92.2			
11 Small grains cut for hay.....	5,564	79.0	1,775	42.4	253.2	Tons...	6,272	84.1	2,362	43.5	188.6
12 Wild, salt, or prairie grasses.....	134,389	75.8	195,381	98.8	-31.2	Tons...	122,146	82.6	188,582	99.6	-35.2
<b>Vegetables:</b>											
13 Potatoes.....	2,823	77.6	4,711	96.9	-40.1	Bu.....	410,001	83.5	728,227	95.0	-43.7

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of in-crease. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on nonirrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Winter wheat.....	Bu.....	19.7	15.1	20.6	104.5	136.4	\$138,506	87.7	\$393,144	99.2	155.9
2 Spring wheat.....	Bu.....	21.4	12.7	22.1	103.3	174.0	867,670	95.4			
3 Oats.....	Bu.....	25.2	21.5	25.9	102.8	120.5	74,604	86.5	175,987	91.7	-57.6
4 Barley.....	Bu.....	26.5	21.3	28.9	101.5	126.3	242,838	93.6	302,229	97.4	-19.6
<b>Hay and forage:</b>											
5 Alfalfa.....	Tons...	2.83	2.42	2.84	100.4	117.4	6,537,573	96.3	1,951,293	99.8	235.0
6 Timothy alone.....	Tons...	1.14	0.97	1.15	100.9	118.6	111,665	95.6	127,553	77.8	-12.5
7 Timothy and clover mixed.....	Tons...	1.37	1.12	1.38	100.7	123.2	445,073	96.5	133,871	59.2	232.5
8 Clover alone.....	Tons...	1.54	1.47	1.58	102.6	107.5	16,896	64.4			
9 Other tame grasses.....	Tons...	1.06	0.76	1.08	101.9	142.1	641,773	96.6	91,240	27.6	603.4
10 Annual legumes cut for hay.....	Tons...	0.76	0.68	0.77	101.3	113.2	9,810	92.2			
11 Small grains cut for hay.....	Tons...	1.06	0.80	1.13	103.6	141.2	116,032	84.1	28,059	33.5	348.5
12 Wild, salt, or prairie grasses.....	Tons...	0.83	0.60	0.91	109.6	151.7	2,259,701	82.6	1,407,500	99.1	60.5
<b>Vegetables:</b>											
13 Potatoes.....	Bu.....	134.9	98.9	145.2	107.6	146.8	918,402	83.5	894,651	99.5	132.7

<sup>1</sup> A minus sign (-) denotes decrease.

IRRIGATION—NEVADA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	THE STATE.	Churchill.	Clark.	Douglas.	Elko.	Esmeralda. <sup>1</sup>	Eureka.	Humboldt. <sup>1</sup>	Lander.	
1	Number of all farms in 1920.....	3,163	498	162	129	543	19	60	132	64
2	Number of farms irrigated in 1919.....	2,718	448	149	124	459	10	52	98	54
3	Per cent of all farms.....	85.9	90.0	92.0	96.1	84.5	52.6	86.7	70.5	84.4
4	Number of farms irrigated in 1909.....	2,406	326	145	132	359	99	58	270	54
5	Per cent of increase, 1909-1919.....	13.0	37.4	2.8	-6.1	27.9				
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres..	70,285,440	3,232,000	5,148,800	469,120	10,917,760	2,184,320	2,660,480	6,274,560	3,661,440
7	All land in farms.....acres..	2,357,163	108,307	13,544	119,211	718,102	13,977	86,197	393,865	133,566
8	Improved land in farms.....acres..	694,741	35,870	5,646	27,277	183,721	3,457	25,121	76,788	16,342
9	Area irrigated in 1919.....acres..	561,447	41,739	5,206	23,412	202,724	1,695	5,086	27,884	10,400
10	Per cent of improved land in farms.....	94.4	116.4	92.2	85.8	110.3	48.7	20.2	36.3	63.6
11	Area irrigated in 1909.....acres..	701,833	35,114	8,116	32,181	183,552	14,011	18,715	207,763	23,342
12	Per cent of increase, 1909-1919.....	-20.0	18.9	-35.9	-27.2	10.4		-72.8		-55.4
13	Area enterprises were capable of irrigating in 1920.....acres..	704,708	65,661	6,282	24,472	263,403	2,200	5,134	31,695	10,245
14	Area enterprises were capable of irrigating in 1910.....acres..	840,962	42,622	16,844	35,548	189,253	14,108	21,973	228,845	24,085
15	Per cent of increase, 1910-1920.....	-16.2	54.1	-62.7	-31.2	39.2		-76.6		-57.5
16	Area included in enterprises in 1920.....acres..	1,382,036	171,661	10,512	43,191	434,582	9,316	5,404	45,331	26,637
17	Area included in enterprises in 1910.....acres..	1,232,142	62,030	22,016	37,649	262,315	26,538	23,608	304,152	54,285
18	Per cent of increase, 1910-1920.....	12.2	230.0	-52.3	14.7	65.7		-77.1		-47.2
19	Area of irrigated land reported as available for settlement.....acres..	139,352	87,451	1,230	19,220		550		1,764	
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	1,015	14	37	78	367	7	24	63	41
21	Number, 1910.....	1,347	22	28	128	341	34	57	205	60
Main ditches:										
22	Number, 1920.....	2,032	8	42	77	1,194	5	1	50	140
23	Number, 1910.....	994	17	32	142	172	39	36	199	70
24	Length, 1920.....miles..	3,123	79	47	88	1,428	5	3	69	194
25	Length, 1910.....miles..	1,938	78	65	213	211	85	65	879	118
26	Capacity, 1920.....second-feet..	10,554	3,141	110	460	1,297	31	18	307	39
27	Capacity, 1910.....second-feet..	17,579	1,656	203	1,688	1,529	236	280	3,368	2,654
Laterals:										
28	Number, 1920.....	2,064	127	116	2	1,053			75	10
29	Number, 1910.....	1,531	78	30	24	803	8	23	66	29
30	Length, 1920.....miles..	1,245	302	79	5	370			29	4
31	Length, 1910.....miles..	1,213	191	12	17	200	25	15	102	13
Reservoirs:										
32	Number, 1920.....	134	8	13	7	21			16	
33	Number, 1910.....	109	2	5	4	9		21	15	8
34	Capacity, 1920.....acre-feet..	504,428	350,009	214		40,068			7,452	
35	Capacity, 1910.....acre-feet..	325,953	300,010	7	5,043	3,007		1,014	5,283	1
Flowing wells:										
36	Number, 1920.....	123	6	53	2	2			20	1
37	Number, 1910.....	19	2	6						11
38	Capacity, 1920.....gallons per minute..	21,942	615	18,872	22				400	25
39	Capacity, 1910.....gallons per minute..	1,302	64	1,210						38
Pumped wells:										
40	Number, 1920.....	129		2		9			13	5
41	Number, 1910.....	6					1		3	
42	Capacity, 1920.....gallons per minute..	6,798		475		645			1,050	10
43	Capacity, 1910.....gallons per minute..	1,349					5		1,076	
Pumping plants:										
44	Number, 1920.....	64	1	3	7	9			7	4
45	Number, 1910.....	18	1	4	2		1		3	
46	Engine capacity, 1920.....horsepower	409	6	41	108	32			22	10
47	Engine capacity, 1910.....horsepower	693	8	72	100		2		303	
48	Pump capacity, 1920.....gallons per minute..	35,266		4,633		1,720			20,200	10
49	Pump capacity, 1910.....gallons per minute..	24,265	490	6,750	4,000		5		1,076	
50	Average lift, 1920.....feet	22	6	28	16	23			26	
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars..	14,754,280	7,774,129	352,332	94,311	1,447,201	26,849	25,211	271,719	79,332
52	Capital invested to July 1, 1910.....dollars..	6,721,924	1,621,996	61,009	64,696	384,096	137,092	25,396	556,998	188,431
53	Per cent of increase, 1910-1920.....	119.5	379.3	477.5	46.8	276.8		-0.7		-57.9
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	30.94	118.40	56.09	3.85	5.49	11.72	4.91	8.57	7.74
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	7.99	38.06	3.62	1.82	2.03	9.72	1.16	2.43	7.82
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars..	22,648,747	13,809,636	515,332	109,311	1,475,376	26,849	25,211	314,719	79,332
57	Estimated final cost of existing enterprises in 1910.....dollars..	12,188,766	7,016,828	67,009	64,696	385,096	150,092	25,396	608,998	188,431
58	Per cent of increase, 1910-1920.....	86.8	96.8	669.0	69.0	283.1		-0.7		-57.9
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	16.39	80.44	49.02	2.53	3.39	2.88	4.07	6.94	2.77
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	9.89	134.86	3.04	1.72	1.47	5.66	1.08	2.00	3.47

<sup>1</sup> Part taken to form Mineral County in 1911.

<sup>2</sup> Part taken to form Pershing County in 1919.

IRRIGATION—NEVADA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	Lincoln.	Lyon.	Mineral. <sup>1</sup>	Nye.	Ormsby.	Pershing. <sup>2</sup>	Storey.	Washoe.	White Pine.
1 Number of all farms in 1920.....	145	297	92	152	49	115	14	481	211
2 Number of farms irrigated in 1919.....	131	275	89	110	37	109	12	381	185
3 Per cent of all farms.....	90.3	92.6	96.7	72.4	75.5	94.8	85.7	79.2	87.7
4 Number of farms irrigated in 1909.....	118	199		106	39		19	326	164
5 Per cent of increase, 1909-1919.....	15.9	40.3		8.8				16.9	12.8
<b>LAND AND FARM AREA.</b>									
6 Approximate land area.....acres..	6,727,040	965,760	2,572,160	11,708,160	99,840	3,873,920	160,640	4,000,640	5,628,800
7 All land in farms.....acres..	31,105	145,371	27,621	95,002	9,972	130,968	1,833	230,052	98,470
8 Improved land in farms.....acres..	9,264	52,280	9,056	19,759	2,027	50,141	969	45,036	31,257
9 Area irrigated in 1919.....acres..	5,826	110,902	5,212	11,354	3,146	53,628	172	28,801	24,270
10 Per cent of improved land in farms.....	62.9	212.1	57.6	57.5	103.9	107.0	24.6	64.0	77.6
11 Area irrigated in 1909.....acres..	9,907	62,145		19,978	2,426		891	50,904	32,795
12 Per cent of increase, 1909-1919.....	-41.2	78.4		-43.2	29.7		-80.7	-43.4	-26.0
13 Area enterprises were capable of irrigating in 1920.....acres..	10,752	138,475	7,662	14,169	4,718	61,940	268	31,610	27,932
14 Area enterprises were capable of irrigating in 1910.....acres..	15,391	116,222		28,902	2,466		925	54,551	49,229
15 Per cent of increase, 1910-1920.....	-30.1	17.4		-51.0	91.3		-71.0	-42.1	-43.3
16 Area included in enterprises in 1920.....acres..	20,866	332,810	12,937	70,601	7,410	62,795	348	78,274	47,841
17 Area included in enterprises in 1910.....acres..	16,124	260,354		34,082	2,466		1,025	82,600	52,918
18 Per cent of increase, 1910-1920.....	26.3	27.8		107.3	200.5		-66.0	-5.2	-9.6
19 Area of irrigated land reported as available for settlement.....acres..	2,300	16,537		1,620	1,280			7,000	800
<b>IRRIGATION WORKS.</b>									
<b>Independent enterprises:</b>									
20 Number, 1920.....	49	40	23	95	20	16	4	87	50
21 Number, 1910.....	51	59		101	39		17	99	106
<b>Main ditches:</b>									
22 Number, 1920.....	54	79	49	159	8	12	4	84	71
23 Number, 1910.....	26	56		65	11		6	43	80
24 Length, 1920.....miles..	82	421	77	156	5	60	1	255	153
25 Length, 1910.....miles..	37	289		83	7		10	209	100
26 Capacity, 1920.....second-feet..	47	1,097	289	423	133	266	2	2,612	282
27 Capacity, 1910.....second-feet..	78	4,014		147	28		51	1,104	543
<b>Laterals:</b>									
28 Number, 1920.....	78	74	24	77	51	190	3	136	48
29 Number, 1910.....	16	269		91	12		1	17	64
30 Length, 1920.....miles..	38	151	14	13	25	96	1	61	57
31 Length, 1910.....miles..	10	520		34	4		1	29	40
<b>Reservoirs:</b>									
32 Number, 1920.....	6	3	2	13	5	3	1	29	7
33 Number, 1910.....	2	4		13	6			8	12
34 Capacity, 1920.....acre-feet..	354	1,500	5	1,354	50,060	32,003		16,626	4,753
35 Capacity, 1910.....acre-feet..	3	2		1,083	203			10,277	20
<b>Flowing wells:</b>									
36 Number, 1920.....		26		9	1				3
37 Number, 1910.....									
38 Capacity, 1920.....gallons per minute..		242		410					1,356
39 Capacity, 1910.....gallons per minute..									
<b>Pumped wells:</b>									
40 Number, 1920.....	5	21	53	7	1	2		1	10
41 Number, 1910.....	1								1
42 Capacity, 1920.....gallons per minute..	230	5	25	360	50	910		250	2,788
43 Capacity, 1910.....gallons per minute..	196								72
<b>Pumping plants:</b>									
44 Number, 1920.....	5	3	1	8	3	2		2	9
45 Number, 1910.....	2	1		1				3	1
46 Engine capacity, 1920.....horsepower..	31	2		25	20	17		12	73
47 Engine capacity, 1910.....horsepower..	10			1				193	4
48 Pump capacity, 1920.....gallons per minute..	245		25	350	1,650	915		1,850	3,668
49 Pump capacity, 1910.....gallons per minute..	588			10				11,304	72
50 Average lift, 1920.....feet..	16	10	17	19	10	78		11	21
<b>CAPITAL INVESTED.</b>									
51 Capital invested to Jan. 1, 1920.....dollars..	124,536	1,740,387	208,132	260,220	54,777	550,952	6,229	658,775	1,079,188
52 Capital invested to July 1, 1910.....dollars..	39,262	2,761,261		56,871	11,620		16,270	678,284	118,642
53 Per cent of increase, 1910-1920.....	217.2	-37.0		357.6	371.4		-61.7	-2.9	809.6
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	11.58	12.78	27.16	18.37	11.61	8.89	23.24	20.84	38.64
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	2.55	23.76		1.97	4.71		17.59	12.43	2.41
<b>ESTIMATED FINAL COST.</b>									
56 Estimated final cost of existing enterprises in 1920.....dollars..	141,936	2,934,907	218,132	303,445	55,777	554,952	9,819	832,725	1,245,988
57 Estimated final cost of existing enterprises in 1910.....dollars..	39,262	2,761,261		56,871	11,620		16,270	678,284	118,642
58 Per cent of increase, 1910-1920.....	261.5	6.3		433.6	380.0		-39.6	22.8	950.2
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	6.97	8.82	16.47	4.30	7.53	8.84	28.22	10.64	26.04
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	2.44	10.61		1.67	4.71		15.87	8.21	2.24

<sup>1</sup> Formed from part of Esmeralda County in 1911.

<sup>2</sup> Formed from part of Humboldt County in 1919.

# NEW MEXICO.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of New Mexico collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE I.—SUMMARY FOR THE STATE: 1920 AND 1910.

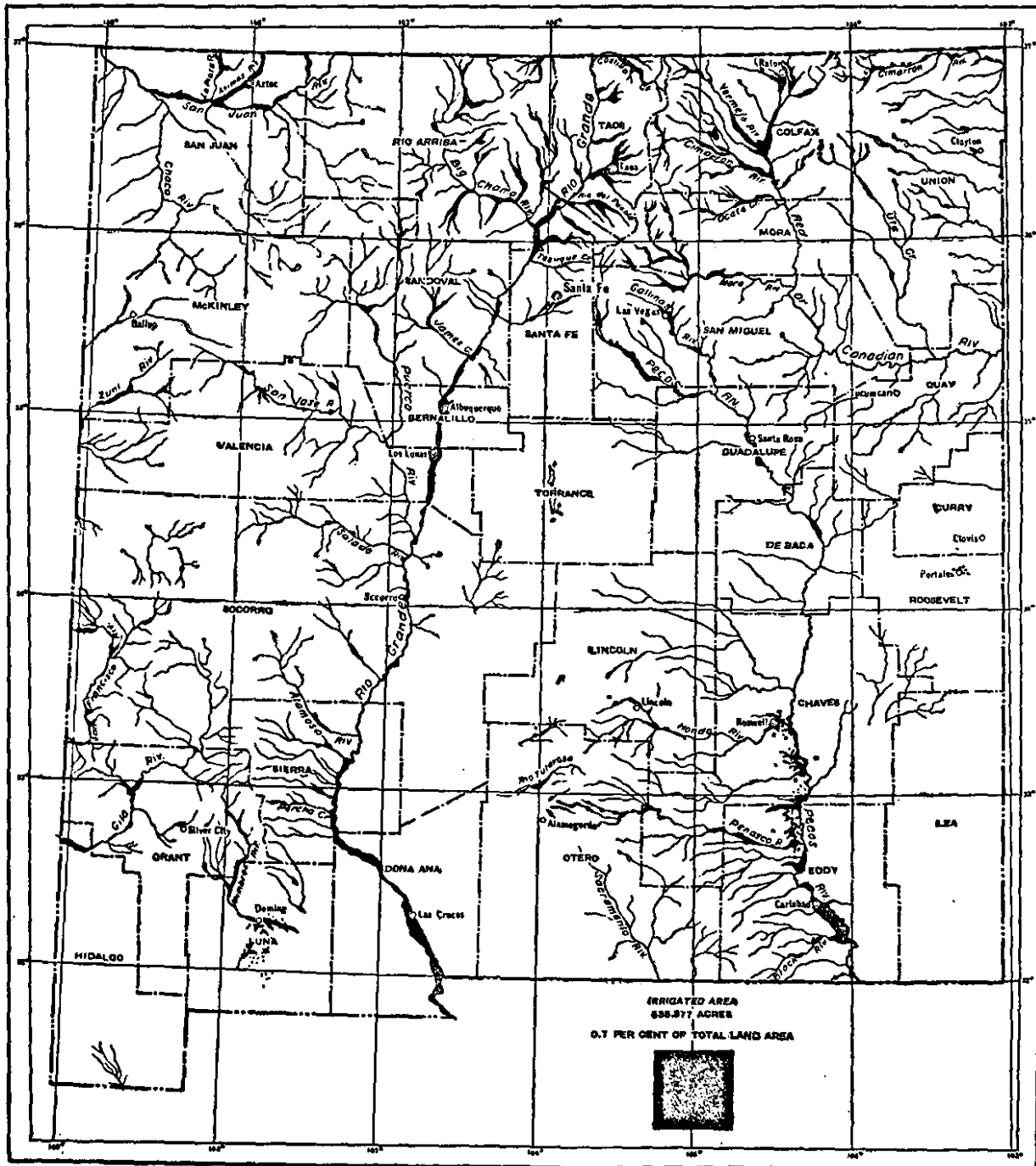
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	29,844	35,676	-5,832	-16.3
Approximate land area of the state.....acres..	78,401,920	78,401,920		
All land in farms.....acres..	24,409,633	11,270,021	13,139,612	116.6
Improved land in farms.....acres..	1,717,224	1,467,191	250,033	17.0
Number of farms irrigated.....	11,390	12,795	-1,405	-11.0
Area irrigated.....acres..	538,377	461,718	76,659	16.6
Area enterprises were capable of irrigating.....acres..	696,119	644,970	51,149	7.9
Area included in enterprises.....acres..	961,879	1,102,297	-140,418	-12.7
Per cent irrigated:				
Number of all farms.....	38.2	35.9	2.3	
Approximate land area of the state.....	0.7	0.6	0.1	
Land in farms.....	2.2	4.1	-1.9	
Improved land in farms.....	31.4	31.5	-0.1	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	157,742	183,252	-25,510	-13.9
Excess of area included in enterprises over area irrigated.....acres..	423,602	640,579	-217,077	-33.9
Area of irrigated land reported as available for settlement.....acres..	66,479	( <sup>2</sup> )		
Capital invested.....	\$18,210,412	\$9,154,897	\$9,055,515	98.9
Average per acre enterprises were capable of irrigating.....	\$26.16	\$14.19	\$11.97	84.4
Estimated final cost of existing enterprises.....	\$20,440,646	\$11,640,091	\$8,800,555	75.6
Average per acre included in enterprises.....	\$21.25	\$10.56	\$10.69	101.2
Average cost of operation and maintenance per acre.....	\$2.41	\$1.36	\$1.05	77.2
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	2,391	2,786	-395	-14.2
Number of main ditches.....	2,228	2,101	127	6.0
Length of main ditches.....miles..	4,469	4,664	-195	-4.2
Capacity of main ditches.....second-feet..	23,432	29,646	-6,214	-21.0
Number of lateral ditches.....	2,158	1,280	878	68.6
Length of lateral ditches.....miles..	1,463	1,190	273	22.9
Number of reservoirs.....	328	522	-194	-37.2
Capacity of reservoirs.....acre-feet..	2,960,718	454,162	2,506,556	552.1
Number of flowing wells.....	556	673	-117	-17.4
Capacity of flowing wells.....gallons per minute..	376,222	669,268	-293,046	-43.8
Number of pumped wells.....	461	466	-5	-1.1
Capacity of pumped wells.....gallons per minute..	265,618	190,690	74,928	39.3
Number of pumping plants.....	472	413	59	14.3
Engine capacity.....horsepower..	8,488	14,226	-5,738	-40.3
Pump capacity.....gallons per minute..	304,789	216,355	88,434	40.9
Average lift.....feet..	40	( <sup>2</sup> )	40	

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not reported in 1910.

# NEW MEXICO

## APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

The climatic conditions having the greatest influence in determining the necessity for irrigation are the amount and seasonal distribution of precipitation, especially rainfall, although temperature, relative humidity, and wind movement have an influence.

The surface of New Mexico is very much broken, and the state does not lie in the path of the large storm movements of the country; consequently there is a great variety of both temperature and moisture conditions, depending on local influences.

The San Juan Valley, in the northwestern corner of the state, has the lowest precipitation in the state, the annual total falling below 6 inches in the lower valley. The precipitation increases with elevation to the north, east, and south of this valley, reaching about 15 inches where San Juan River crosses the Colorado-New Mexico boundary, and 20 inches in the mountains between the San Juan and the Rio Grande and on the high lands in the west-central part of the state.

The northeastern part of the state has the heaviest precipitation in the state. The precipitation of this section is mostly received in the form of showers during the months from April to September, inclusive, July and August being the months of greatest rainfall. The smallest precipitation in this section occurs in a strip passing along the eastern side of Colfax County, through central Mora and San Miguel Counties and eastern Guadalupe County. In this strip the annual precipitation falls below 14 inches in southern Colfax County, and averages 15 to 16 inches over the rest of the strip. To the east the annual precipitation increases to 16 or 18 inches in Union and Quay Counties. To the west of this strip of low precipitation the annual average increases to 18 inches in the western parts of Colfax, Mora, and San Miguel Counties, and exceeds 20 inches on the mountain slopes at an altitude of 8,000 feet.

The Rio Grande flows through the central part of the state from north to south. Over the greater part of the Rio Grande Valley the average annual precipitation is less than 10 inches; in the Pecos Valley it rises to about 15 inches; over the great plains east of the Pecos it ranges from 15 to 20 inches, while on the mountains between the two river valleys it ranges from 15 to more than 25 inches.

Over the high plateaus and mountains west of the Rio Grande the annual precipitation ranges from about 20 inches in the northern and higher elevations

to less than 10 inches on the lower plains near the Mexican boundary.

In the eastern part of the state fully 75 per cent of the annual precipitation occurs during the months from May to October, making it possible to grow cereals and forage crops without irrigation. In the state generally, the larger part of the precipitation occurs in the summer.

In 1919 the precipitation was far above the normal, the average for the state being nearly 21 inches, while the normal is between 15 and 16 inches.

**WATER SUPPLY FOR IRRIGATION.**

The Rio Grande flows through the state of New Mexico from north to south, slightly west of the center of the state. The river rises in the mountains of southern Colorado. In New Mexico it flows in a narrow valley, but at places the hills recede, forming a succession of valleys containing considerable areas of arable land. In its natural condition the river is subject to heavy floods when the snows in the mountains melt in spring and during heavy rains at other times, and at times between floods is dry, or nearly so. In 1907 the construction of the Elephant Butte Dam to store the flood water was begun, and the dam was completed in 1916. This reservoir supplies water in New Mexico only to the lower part of the valley, leaving the valleys above to use the stream in its natural condition. Water from the reservoir at Elephant Butte is used for lands in Texas, as well as New Mexico, and under treaty with Mexico a fixed quantity of water is to be supplied for land in that country.

The northeastern part of the state is drained by the Canadian River and its tributaries. This stream rises in the mountains and flows out onto the plains and, like other such streams, loses in the sands and by evaporation most of the water entering it in the mountains. Without storage it is not a reliable source of water for irrigation, except in flood seasons.

The southeastern part of the state is drained by the Pecos and its tributaries. Like the Rio Grande and the Canadian, the Pecos at times carries large floods and at other times carries very little water. Storage of water for use along the lower part of the stream in New Mexico has been provided by the United States Reclamation Service.

There has been a large development of both flowing and pumped wells in the Pecos Valley in the vicinity of Roswell, in Chaves County.

In the southwestern part of the state, near Deming, there has been a large development of underground water from pumped wells. Farther west the Gila and San Francisco Rivers supply water for land in their valleys. These rivers within New Mexico are perennial streams, furnishing a reliable supply of water.

San Juan River and its tributaries rise in high mountains in Colorado and New Mexico, and furnish an abundant supply of water for the San Juan Valley.

In the west-central part of the state there is a high plateau region that has many small streams rising in the hills and losing their waters in the valleys. There is so little water in this section that there is no large opportunity for irrigation.

Throughout the state there are many valleys containing large areas of fine land which have no surface supply of water. In many of these it is possible to obtain water from wells, and this may be done where the value of crops will justify the expense.

**FARMS AND ACREAGE IRRIGATED.**

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	11,360	-11.0	26.2	538,377	16.6	0.7	2.2	31.4
1910.....	12,795	40.2	35.9	461,718	126.5	0.6	4.1	31.5
1900.....	9,128	195.9	74.1	263,893	122.2	0.3	4.0	62.4
1890.....	8,065		69.2	91,745		0.1	11.5	34.9

<sup>1</sup> A minus sign (-) denotes decrease.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	2,391	961,879	538,377	56.0	696,119
Before 1860.....	116	48,962	28,032	59.8	41,073
1860-1869.....	108	34,775	26,597	76.5	28,628
1870-1879.....	176	51,249	33,720	65.8	37,601
1880-1889.....	278	98,832	71,909	72.8	78,785
1890-1899.....	221	82,523	55,223	66.9	60,947
1900-1904.....	156	49,681	27,312	55.0	35,997
1905-1909.....	328	145,064	71,848	49.5	117,623
1910-1914.....	380	195,842	89,720	45.8	128,866
1915-1919.....	336	153,439	60,919	39.7	78,982
Not reported.....	301	103,462	73,067	70.6	87,617

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	538,377	461,718	76,659	16.6	696,119	961,879
Streams, gravity.....	432,478	397,059	35,419	8.9	558,292	748,646
Streams, pumped.....	1,890	1,533	357	23.3	2,930	3,320
Wells, pumped.....	15,709	5,952	9,757	163.9	23,141	42,563
Wells, flowing.....	30,030	48,877	-18,847	-38.6	33,394	50,968
Wells, flowing and pumped.....	6,556	( <sup>2</sup> )	6,556		7,452	9,084
Lakes, gravity.....	1,945	862	1,083	125.6	12,245	23,150
Springs.....	10,791	6,163	4,628	75.1	11,127	19,332
Stored storm water.....	6,448	1,272	5,176	406.9	6,774	15,839
City water.....	40	( <sup>2</sup> )	40		150	350
Streams, gravity, and pumped wells.....	1,341	( <sup>2</sup> )	1,341		1,584	1,792
Streams, gravity, and flowing wells.....	685	( <sup>2</sup> )	685		685	740
Other mixed.....	29,787	( <sup>2</sup> )	29,787		37,368	45,367
Other and not reported.....	677	( <sup>2</sup> )	677		977	878

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.

**ACREAGE, BY CHARACTER OF ENTERPRISE.**

Irrigation was practiced in parts of what is now New Mexico for hundreds of years before this territory became a part of the United States, and water for irrigation was supplied by "community ditches" or "public acequias," owned and controlled by the water users in accordance with old Spanish customs. New Mexico was organized as a territory in 1850, and in 1852 the territorial legislature enacted a law declaring "All rivers and streams of water in this territory, formerly known as public ditches (acequias), are hereby established and declared to be public ditches (acequias)." This law provided for annual elections of officers, under the supervision of justices of the peace, and contained regulations requiring each party receiving water to furnish labor for repairs and cleaning, and fixed fines for refusal or failure to furnish labor. Similar laws are still in force in New Mexico, and a large part of the irrigated land in the state is watered by such ditches. They are classed as cooperative in Table 5.

A law enacted in 1887 provided for the organization of corporations for constructing irrigation and other canals and the colonization and improvement of lands. Such companies were authorized to issue bonds and to collect rates for water, but were not empowered to levy and collect taxes, as are the irrigation districts provided for by the later laws. Such companies are classed as commercial in Table 5.



An irrigation district law containing the bonding and taxing powers was enacted in 1909. It has been amended from time to time, and revised in 1919.

The conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894) were accepted in 1909.

The small area credited to the state belongs to a state institution and does not represent a scheme of state construction of irrigation works.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	538,377	461,718	76,659	16.6
Individual and partnership.....	151,351	144,212	7,139	5.0
Cooperative.....	264,610	251,011	12,599	5.0
Irrigation district.....	15,008		15,008	
Carey Act.....				
Commercial.....	19,871	28,190	-8,319	-29.5
U. S. Reclamation Service.....	77,678	13,398	64,280	479.8
U. S. Indian Service.....	9,072	24,007	-14,935	-62.2
State.....	77	( <sup>2</sup> )	77	
City.....	600	( <sup>2</sup> )	600	
Other.....	110	( <sup>2</sup> )	110	
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	696,119	644,970	51,149	7.9
Individual and partnership.....	215,618	185,283	30,335	16.4
Cooperative.....	305,540	355,327	-49,787	-14.0
Irrigation district.....	24,808		24,808	
Carey Act.....	7,500		7,500	
Commercial.....	33,743	63,150	-29,407	-42.0
U. S. Reclamation Service.....	96,751	21,467	75,284	350.7
U. S. Indian Service.....	11,372	23,743	-12,371	-54.0
State.....	77	( <sup>2</sup> )	77	
City.....	600	( <sup>2</sup> )	600	
Other.....	110	( <sup>2</sup> )	110	
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	961,879	1,102,297	-140,418	-12.7
Individual and partnership.....	313,170	295,171	17,999	6.1
Cooperative.....	404,028	482,054	-78,026	-16.2
Irrigation district.....	28,520	16,400	12,120	73.9
Carey Act.....	7,500	16,000	-8,500	-53.1
Commercial.....	87,050	224,950	-137,900	-70.2
U. S. Reclamation Service.....	127,226	30,267	96,959	320.3
U. S. Indian Service.....	13,570	37,455	-23,885	-63.8
State.....	77	( <sup>2</sup> )	77	
City.....	600	( <sup>2</sup> )	600	
Other.....	138	( <sup>2</sup> )	138	

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.

**ACREAGE, BY CHARACTER OF WATER RIGHTS.**

The laws of New Mexico relating to water rights are summarized in the following paragraphs:

The territory of New Mexico was organized under the act of Congress approved September 9, 1850, and the first territorial legislature passed an act declaring "All the inhabitants of the territory of New Mexico shall have the right to construct either private or common acequias, and to take water for said acequias from wherever they can."

A law enacted in 1891 required the filing of descriptions of all works built after the enactment of the law within 90 days after the beginning of construction, and provided that no right should accrue because of such construction until the filing was made.

In 1905 a law requiring filing in advance of construction was enacted.

In the same year a comprehensive water law was passed. It declared that "All natural waters within the limits of New Mexico are hereby declared to belong to the public, and no person shall be denied the right to appropriate said waters for beneficial use." It created the office of territorial engineer, and gave to this officer

supervision of the administration of the public waters of the territory. It created also a board of control, consisting of the engineer and six water commissioners, and gave to this board authority to adjudicate and define all existing rights to water. However, no funds for the enforcement of this law were appropriated, and it was inoperative.

In 1907 the act of 1905 was repealed and a new law differing in many respects was enacted. This law placed the adjudication of rights in the courts, but provided for the collection of information for such adjudication by the territorial engineer, and for the initiation of actions by the attorney general of the territory. Any party wishing to acquire rights was required to apply to the territorial engineer for a permit to appropriate water and to submit proof of the completion of works and of the use of water in accordance with the terms of the permit. When satisfactory proof of completion of works is made, a certificate of completion is issued by the engineer, and when satisfactory proof of use of water is submitted a license setting forth the rights acquired is issued by the engineer. This law is still in force.

New Mexico was admitted as a state in 1911. The state constitution adopted at that time contained the following sections relating to water rights (Art. XVI):

Sec. 1. "All existing rights to the use of any waters in this state for any useful or beneficial purpose are hereby recognized and confirmed."

Sec. 2. "The unappropriated water of every natural stream, perennial or torrential, within the state of New Mexico, is hereby declared to belong to the public and to be subject to appropriation for beneficial use, in accordance with the laws of the state. Priority of appropriation shall give the better right."

Sec. 3. "Beneficial use shall be the basis, the measure and the limit of the right to the use of water."

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	538,377	100.0	100.0
Appropriation and use.....	152,746	28.4	83.9
Notice filed and posted.....	54,356	10.1	2.2
Adjudicated by court.....	91,807	17.1	5.6
Permit from state.....	103,459	19.2	8.0
Certificate or license from state.....	20,096	3.7	0.1
Riparian rights.....	400	0.1	0.1
Underground.....	52,325	9.7	( <sup>1</sup> )
Other and mixed.....	8	( <sup>2</sup> )	( <sup>1</sup> )
Not reported.....	63,180	11.7	( <sup>1</sup> )

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."  
<sup>2</sup> Less than one-tenth of 1 per cent.

**ACREAGE, BY DRAINAGE BASIN.**

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams.

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This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	538,377	254,945	111.2	961,879	696,119
Canadian River and tributaries..	90,185	56,203	60.5	179,462	136,947
Canadian River direct.....	1,690	1,156	45.3	1,690	1,690
Cimarron River.....	31,967	8,122	293.9	70,318	45,628
Vermajo River.....	23,678	4,110	476.1	23,978	23,878
Ocate Creek.....	4,861	1,380	252.2	13,908	13,095
Mora River.....	17,057	32,796	-48.0	36,670	29,528
Ute Creek.....	77	4,061	-98.1	709	519
Other tributaries of Canadian River.....	10,865	* 4,578	137.3	32,199	22,619
Cimarron River.....	5,757	* 6,554	-12.2	14,173	12,383
Trinchera River.....	890	691	-43.7	911	469
Pecos River and tributaries.....	119,040	56,497	110.7	225,400	160,658
Pecos River direct.....	62,430	12,333	406.2	102,300	77,794
Gallinas River.....	4,097	6,281	-34.8	41,810	24,261
Hondo River.....	20,561	24,808	-16.4	33,118	23,525
Penasco River.....	13,375	5,102	162.2	19,889	13,733
Other tributaries of Pecos River.....	18,577	* 8,173	127.3	28,383	21,405
Rio Grande and tributaries.....	250,206	96,836	158.4	421,363	298,663
Rio Grande direct.....	108,844	49,520	109.7	172,747	123,464
Rio Costilla.....	4,417	2,115	108.8	7,385	4,803
Pueblo River.....	11,780	7,075	66.6	12,443	11,791
Rio Chama.....	26,166	8,549	206.1	42,235	30,237
Rio Santa Cruz.....	9,171	3,086	197.2	9,863	9,221
Tesugue Creek.....	3,012	4,744	-36.5	3,411	3,183
Rio Puerco.....	14,309	2,927	388.9	42,877	25,991
Other tributaries of Rio Grande.....	77,507	* 18,820	311.8	130,402	89,973
Rio Mimbres.....	12,557	* 6,546	91.8	24,243	19,554
Gila River and tributaries.....	9,983	9,342	6.9	14,938	10,493
Gila River direct.....	6,424	4,647	38.2	7,027	6,587
San Francisco River.....	3,162	4,668	-32.8	6,986	3,883
Other tributaries of Gila River.....	397	* 27	.....	923	523
San Juan River and tributaries..	48,825	20,467	114.1	71,608	49,655
San Juan River direct.....	12,026	6,285	91.3	21,388	12,651
Los Pinos River.....	1,260	468	172.1	2,640	1,260
Animas River.....	23,356	10,502	122.4	35,370	28,455
La Plata River.....	5,830	3,005	94.0	9,445	5,830
Other tributaries of San Juan River.....	1,364	* 212	538.7	2,767	1,459
Independent streams.....	6,435	1,809	255.7	9,783	7,298
Fresno River.....	1,798	200	799.0	3,598	2,331
Rio Tularosa.....	4,547	1,568	190.0	6,095	4,877
Other independent streams..	90	* 41	.....	90	90

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.  
<sup>2</sup> Includes springs and wells.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$18,210,412	98.9	\$26.16	84.4
1910.....	9,154,897	119.8	14.19	-30.5
1900.....	4,165,312	713.6	20.43	266.1
1890.....	511,937	.....	5.58	.....

<sup>1</sup> A minus sign (-) denotes decrease.

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$18,210,412	100.0	\$26.16
Before 1860.....	263,876	1.5	6.55
1860-1869.....	384,754	2.1	13.44
1870-1879.....	482,843	2.6	12.84
1880-1889.....	2,568,298	14.1	32.60
1890-1899.....	1,262,916	6.9	20.72
1900-1904.....	1,122,232	6.2	31.18
1905-1909.....	4,692,515	25.8	39.89
1910-1914.....	4,594,735	25.2	35.66
1915-1919.....	2,021,448	11.1	25.69
Not reported.....	811,795	4.5	9.27

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$18,210,412	100.0	\$26.16	336,387	\$2.41
Streams, gravity.....	13,624,889	74.2	24.23	257,818	1.65
Streams, pumped.....	36,520	0.2	12.46	1,132	1.30
Wells, pumped.....	925,003	5.1	39.97	12,388	7.51
Wells, flowing.....	1,220,519	6.7	36.55	14,394	2.15
Wells, flowing and pumped.....	388,166	2.1	52.09	4,601	8.99
Lake, gravity.....	18,750	0.1	1.53	1,945	1.41
Springs.....	257,179	1.4	23.11	7,452	1.92
Stored storm water.....	686,047	3.8	101.28	6,207	1.67
City water.....	1,000	(*)	6.67	40	1.25
Streams, gravity, and pumped wells.....	176,000	1.0	110.48	1,319	38.77
Streams, gravity, and flowing wells.....	14,000	0.1	20.44	500	1.00
Other mixed.....	958,740	5.3	25.66	23,534	4.84
Other and not reported.....	4,600	(*)	4.71	57	4.91

<sup>1</sup> Based on area irrigated in 1919.  
<sup>2</sup> Less than one-tenth of 1 per cent.

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TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$18,210,412	\$4,301,915	\$13,908,497	823.3
Canadian River and tributaries.....	5,039,780	424,442	4,615,338	.....
Canadian River direct.....	23,625	10,690	21,935	205.2
Cimarron River.....	2,188,908	130,580	2,058,328	.....
Vermelo River.....	1,248,537	131,020	1,117,517	852.9
Ocate Creek.....	319,529	9,400	310,129	.....
Mora River.....	262,575	99,475	163,100	164.0
Ute Creek.....	7,000	10,000	-3,000	-30.0
Other tributaries of Canadian River.....	980,606	* 33,277	947,329	.....
Cimarron River.....	308,147	* 46,200	261,947	567.0
Trinchera River.....	3,513	1,010	2,503	247.8
Pecos River and tributaries.....	5,263,454	2,734,810	2,528,644	92.5
Pecos River direct.....	3,294,504	2,284,176	1,010,328	44.2
Gallinas River.....	519,566	30,931	488,635	.....
Hondo River.....	578,094	261,863	316,231	120.8
Panasco River.....	222,093	50,303	172,330	342.2
Other tributaries of Pecos River.....	648,597	*107,477	541,120	503.5
Rio Grande and tributaries.....	5,158,057	599,836	4,558,221	759.9
Rio Grande direct.....	3,605,725	265,898	3,339,827	.....
Rio Costilla.....	11,471	4,697	6,774	144.2
Pueblo River.....	19,982	11,560	8,422	72.9
Rio Chama.....	141,891	29,849	112,042	375.4
Rio Santa Cruz.....	18,281	12,862	5,419	42.1
Teague Creek.....	16,864	22,680	-5,816	-25.6
Rio Puerco.....	88,109	53,523	34,586	64.6
Other tributaries of Rio Grande.....	1,255,734	*168,767	1,086,967	644.1
Rio Mimbres.....	318,062	*112,192	205,870	183.5
Gila River and tributaries.....	70,423	73,769	-3,346	-4.5
Gila River direct.....	47,182	46,014	1,168	2.5
San Francisco River.....	9,809	21,455	-11,646	-54.3
Other tributaries of Gila River.....	13,432	* 6,300	7,132	113.2
San Juan River and tributaries.....	1,715,867	295,298	1,420,569	481.1
San Juan River direct.....	807,700	164,994	642,706	389.5
Los Pinos River.....	3,000	4,550	-1,550	-34.1
Animas River.....	824,450	101,535	722,915	712.0
La Plata River.....	47,975	23,144	24,831	107.3
Other tributaries of San Juan River.....	32,742	* 1,075	31,667	.....
Independent streams.....	333,109	14,358	318,751	.....
Fresno River.....	297,724	2,440	295,284	.....
Rio Tularosa.....	33,900	5,868	28,032	477.7
Other independent streams.....	1,485	* 6,050	-4,565	-75.6

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and walls.

In classifying capital invested by type of enterprise the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of some of the other classes shown in the table, and a part of its expenditure is properly chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes. The Reclamation Service also supplies water to land in Mexico, under treaty with that country.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$18,210,412	100.0	836,387	\$2.41
Individual and partnership.....	5,588,372	30.7	97,967	4.43
Cooperative.....	3,558,833	19.6	176,594	1.29
Irrigation district.....	914,479	5.0	15,000	3.30
Commercial.....	1,877,842	10.3	17,071	1.64
Carey Act.....	232,713	1.4	.....	.....
U. S. Reclamation Service.....	5,020,230	27.6	22,233	2.76
U. S. Indian Service.....	691,194	3.8	6,922	0.97
State.....	18,544	0.1	.....	.....
City.....	276,299	1.5	800	4.17
Other.....	876	.....	.....	.....

<sup>1</sup> Based on area irrigated in 1919.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	203
Acreage included in enterprises reporting land drained or needing drainage..	212,353
Acreage for which drains have been installed.....	74,783
Additional acreage needing drainage.....	60,277
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	35.2
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	7.8
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state..	14.0

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-foot.....	4,041	1,306	2,735
Area irrigated in 1919.....acres.....	184,253	106,922	78,331
Average number of acres per second-foot.....	46	81	29
Total quantity of water entering canals, acre-foot.....	1,007,575	688,428	319,147
Area irrigated in 1919.....acres.....	199,869	126,090	73,769
Average quantity per acre.....acre-foot.....	5.0	5.5	4.3
Total quantity of water delivered.....acre-foot.....	274,748	212,359	62,387
Area irrigated in 1919.....acres.....	160,996	119,013	41,983
Average quantity per acre.....acre-foot.....	1.7	1.8	1.5





## IRRIGATION—NEW MEXICO.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipelines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse- power).	Pumps.		Aver- age lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	60.8	556	376,222	461	265,618	472	3,488	491	304,789	40
Canadian River and tributaries.....	14.8			5	3,311	6	68	7	1,522	60
Cimarron River.....	4.8					1	10	1	1,500	22
Vermejo River.....	1.1			2		1	50	2		100
Ocate Creek.....	1.5									
Mora River.....				1	3,300	2	5	2	10	35
Other tributaries of Canadian River.....	7.4			2	11	2	1	2	12	72
Cimarron River.....	0.2			2	36	3	32	4	532	36
Pecos River and tributaries.....	18.2	549	375,275	245	153,429	243	4,455	256	193,036	28
Pecos River direct.....	5.5	286	198,415	96	70,598	105	2,379	106	96,448	28
Gallinas River.....	0.5			1	3	1		1	3	75
Hondo River.....	11.0	178	125,606	79	45,585	74	1,041	79	57,275	21
Pecosco River.....	0.5	51	30,132	10	7,210	11	216	11	9,000	29
Other tributaries of Pecos River.....	0.7	36	21,122	59	28,033	52	819	59	30,310	36
Rio Grande and tributaries.....	16.8	2	27	121	61,898	127	1,852	128	62,245	49
Rio Grande direct.....	2.3			26	11,356	29	336	30	14,828	38
Rio Santa Cruz.....	0.1									
Rio Puerco.....						1		1		96
Other tributaries of Rio Grande.....	13.9	2	27	95	50,542	97	1,516	97	47,417	53
Rio Mimbres.....	1.1	1	75	85	46,825	86	2,065	90	46,660	57
Gila River and tributaries.....	2.5					2	4	2	675	17
Gila River direct.....	0.3									
San Francisco River.....						1		1	275	20
Other tributaries of Gila River.....	2.2					1	4	1	400	14
San Juan River and tributaries.....		4	845	1		2	5	2		170
Other tributaries of San Juan River.....		4	845	1		2	5	2		170
Independent streams.....	7.7			2	119	3	9	2	119	68
Fresno River.....	7.7									
Rio Tularosa.....				2	119	3	9	2	119	68

IRRIGATION—NEW MEXICO.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	38,954	17.1	34,430	40.0	13.1	Bu.....	948,594	20.0	714,710	61.4	32.7
2 Oats.....	8,880	22.2	18,221	54.1	-51.3	Bu.....	280,102	23.0	440,500	61.1	-43.2
3 Winter wheat.....	9,059	9.8	25,757	79.6	21.6	Bu.....	186,479	10.6	456,531	91.3	27.3
4 Spring wheat.....	22,251	51.5				Bu.....	395,679	57.6			
5 Barley.....	2,889	32.2	1,409	68.9	96.7	Bu.....	62,070	32.0	35,391	81.4	75.4
<b>Hay and forage:</b>											
6 Timothy alone.....	1,766	28.0	894	37.7	97.5	Tons.....	2,658	34.7	1,505	48.6	76.0
7 Timothy and clover mixed.....	1,338	55.3	115	6.1		Tons.....	2,074	59.6	189	7.1	997.4
8 Clover alone.....	821	55.9	25	12.7		Tons.....	1,581	69.2	47	11.5	
9 Alfalfa.....	87,105	74.5	98,963	96.4	-12.0	Tons.....	211,351	75.9	261,989	98.6	-19.3
10 Other tame or cultivated grasses.....	4,015	17.1	2,278	7.8	76.4	Tons.....	5,356	20.2	2,652	13.0	102.0
11 Annual legumes cut for hay.....	701	20.5				Tons.....	1,011	27.9			
12 Small grains cut for hay.....	6,459	24.1	3,353	25.5	113.5	Tons.....	10,287	30.0	4,419	25.5	155.7
13 Wild, salt, or prairie grasses.....	8,513	19.9	13,024	46.5	-34.6	Tons.....	6,337	16.9	14,512	65.8	-66.3
14 Silage crops.....	1,188	33.5				Tons.....	8,409	50.6			
15 Corn cut for forage.....	3,456	10.7				Tons.....	5,805	17.6			
16 Kafir, sorghum, etc., for forage.....	5,748	8.3				Tons.....	10,848	4.4			
<b>Vegetables:</b>											
17 Potatoes.....	504	18.4	1,119	18.0	-55.0	Bu.....	19,650	17.7	33,224	28.2	-76.4
18 Green peppers.....	400	72.6									
19 Cantaloupes and muskmelons.....	421	41.2									
<b>Fruits:</b>											
20 Grapes.....	176,520	62.9				Lbs.....	630,440	62.8			
21 Apples.....	321,233	46.7				Bu.....	487,878	52.0			
22 Peaches.....	56,484	36.4				Bu.....	93,140	47.0			
23 Pears.....	21,681	44.0				Bu.....	26,007	39.7			
24 Plums and prunes.....	9,351	21.4				Bu.....	11,123	37.0			
25 Cherries.....	8,204	29.1				Bu.....	5,876	49.0			
<b>Miscellaneous:</b>											
26 Clover and alfalfa seed.....	2,583	49.3				Bu.....	6,354	41.2			
27 Kafir, milo, etc.....	2,205	1.5				Bu.....	66,683	1.8			
28 Dry beans, navy, etc.....	5,630	5.0	2,741	13.2	105.4	Bu.....	63,269	7.4	26,268	30.6	140.7
29 Dry peas, Canada.....	3,606	62.7	1,541	62.0	134.0	Bu.....	51,202	78.1	21,839	70.8	134.5
30 Cotton.....	7,627	70.6				Bales.....	4,077	75.5			

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	Per state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	20.9	20.1	24.4	116.7	121.4	\$1,422,891	20.0	\$636,151	64.6	123.7
2 Oats.....	Bu.....	27.1	26.8	28.2	104.1	105.2	262,607	23.0	309,911	67.5	-15.3
3 Winter wheat.....	Bu.....	19.0	18.9	20.5	107.9	108.5	370,958	10.6	447,704	88.0	159.6
4 Spring wheat.....	Bu.....	15.9	13.9	17.8	111.9	128.1	791,358	57.6			
5 Barley.....	Bu.....	21.6	21.7	21.5	99.5	99.1	80,691	32.0	27,960	78.5	188.6
<b>Hay and forage:</b>											
6 Timothy alone.....	Tons.....	1.22	1.10	1.51	123.8	137.3	53,160	34.7	17,073	48.1	211.4
7 Timothy and clover mixed.....	Tons.....	1.44	1.30	1.55	107.6	109.2	37,332	59.6	2,214	7.9	
8 Clover alone.....	Tons.....	1.56	1.09	1.93	123.7	177.1	25,296	69.2	488	13.6	
9 Alfalfa.....	Tons.....	2.38	2.25	2.43	102.1	108.0	4,861,073	75.9	2,795,987	98.2	78.9
10 Other tame or cultivated grasses.....	Tons.....	1.13	1.09	1.33	117.7	122.0	112,476	20.2	27,433	11.7	310.0
11 Annual legumes cut for hay.....	Tons.....	1.06	0.96	1.44	135.8	150.0	15,165	27.9			
12 Small grains cut for hay.....	Tons.....	1.28	1.18	1.59	124.2	134.7	200,597	30.0	46,636	24.0	362.2
13 Wild, salt, or prairie grasses.....	Tons.....	0.87	0.91	0.74	85.1	81.3	101,392	16.9	149,075	62.3	-32.0
14 Silage crops.....	Tons.....	4.69	3.48	7.08	151.0	203.4	79,836	50.6			
15 Corn cut for forage.....	Tons.....	1.02	0.94	1.68	164.7	178.7	69,660	17.6			
16 Kafir, sorghum, etc., for forage.....	Tons.....	1.41	1.39	1.89	134.0	136.0	162,720	4.4			
<b>Vegetables:</b>											
17 Potatoes.....	Bu.....	36.1	35.5	39.0	108.0	109.9	46,178	17.7	65,625	28.0	-29.6
18 Green peppers.....							58,290	72.3			
19 Cantaloupes and muskmelons.....							54,590	58.8			
<b>Fruits:</b>											
20 Grapes.....	Lbs.....	3.6	3.6	3.6	100.0	100.0	50,435	62.8			
21 Apples.....	Bu.....	1.4	1.2	1.5	107.1	125.0	730,605	52.0			
22 Peaches.....	Bu.....	1.3	1.1	1.6	123.1	145.5	200,251	47.0			
23 Pears.....	Bu.....	1.3	1.4	1.2	92.3	85.7	45,513	39.7			
24 Plums and prunes.....	Bu.....	0.7	0.5	1.2	171.4	240.0	23,914	37.0			
25 Cherries.....	Bu.....	0.4	0.3	0.7	175.0	223.3	19,978	49.0			
<b>Miscellaneous:</b>											
26 Clover and alfalfa seed.....	Bu.....	2.9	2.4	2.5	86.2	73.5	127,090	41.2			
27 Kafir, milo, etc.....	Bu.....	24.9	24.9	30.2	121.3	121.3	63,354	1.8			
28 Dry beans, navy, etc.....	Bu.....	7.6	7.4	11.2	147.4	151.4	221,442	7.4	74,551	32.1	197.0
29 Dry peas, Canada.....	Bu.....	12.2	8.3	14.2	116.4	161.4	128,005	73.1	23,606	67.3	442.3
30 Cotton.....	Bales.....	0.51	0.42	0.54	105.9	128.6	913,248	75.5			

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1910.  
<sup>3</sup> Number of vines of bearing age.  
<sup>4</sup> Number of trees of bearing age.

<sup>5</sup> Not including red clover seed.  
<sup>6</sup> Yield per vine.  
<sup>7</sup> Yield per tree.

## IRRIGATION—NEW MEXICO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.]

	THE STATE.	Bernalillo.	Chaves. <sup>1</sup>	Colfax.	De Baca. <sup>2</sup>	Doña Ana.	Eddy. <sup>3</sup>	Grant. <sup>4</sup>	Guadalupe. <sup>5</sup>	
1	Number of all farms in 1920.....	29,844	1,200	744	1,052	477	1,054	785	545	982
2	Number of farms irrigated in 1919.....	11,890	504	319	305	51	975	555	166	275
3	Per cent of all farms.....	38.2	42.0	42.9	29.0	10.7	92.5	70.7	30.5	28.0
4	Number of farms irrigated in 1909.....	12,795	700	733	270	.....	778	605	256	305
5	Per cent of increase, 1909-1919.....	-11.0	-28.0	.....	13.0	.....	25.3	.....	.....	.....
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres..	73,401,920	776,960	3,886,880	2,430,720	1,536,000	2,445,440	2,716,800	2,547,840	1,939,840
7	All land in farms.....acres..	24,409,633	220,708	1,924,179	1,952,760	1,233,305	195,316	794,543	474,169	996,406
8	Improved land in farms.....acres..	1,717,224	29,144	50,450	111,293	22,041	42,164	52,311	31,230	31,441
9	Area irrigated in 1919.....acres..	538,377	14,536	42,259	66,187	3,035	52,265	51,353	6,987	3,206
10	Per cent of improved land in farms.....	31.4	49.9	33.8	59.5	13.8	124.0	98.2	22.4	10.2
11	Area irrigated in 1909.....acres..	461,718	14,832	56,064	30,750	.....	32,232	47,141	14,834	4,395
12	Per cent of increase, 1909-1919.....	15.6	-2.0	.....	115.2	.....	62.2	.....	.....	.....
13	Area enterprises were capable of irrigating in 1920.....acres..	696,119	15,218	47,433	90,881	6,928	65,057	59,784	7,243	4,800
14	Area enterprises were capable of irrigating in 1910.....acres..	644,970	20,375	64,385	52,391	.....	48,744	74,004	10,668	13,952
15	Per cent of increase, 1910-1920.....	7.9	-25.3	.....	73.5	.....	33.5	.....	.....	.....
16	Area included in enterprises in 1920.....acres..	961,879	19,056	57,785	117,715	9,128	88,023	87,661	7,781	5,102
17	Area included in enterprises in 1910.....acres..	1,102,297	25,510	106,948	156,503	.....	77,530	94,680	18,821	26,212
18	Per cent of increase, 1910-1920.....	-12.7	-25.3	.....	-24.8	.....	13.5	.....	.....	.....
19	Area of irrigated land reported as available for settlement.....acres..	66,479	650	.....	27,729	.....	.....	2,550	.....	.....
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	2,391	44	339	86	3	12	240	70	16
21	Number, 1910.....	2,786	34	471	115	.....	37	270	102	18
Main ditches:										
22	Number, 1920.....	2,228	85	191	150	3	7	258	61	16
23	Number, 1910.....	2,101	22	49	166	.....	29	51	75	14
24	Length, 1920.....miles.....	4,469	172	217	374	18	53	266	100	66
25	Length, 1910.....miles.....	4,604	120	174	398	.....	139	136	154	60
26	Capacity, 1920.....second-feet..	23,432	137	836	5,889	153	1,231	1,215	331	82
27	Capacity, 1910.....second-feet..	29,646	710	801	5,443	.....	2,020	1,203	241	678
Laterals:										
28	Number, 1920.....	2,158	61	184	161	8	11	235	39	75
29	Number, 1910.....	1,280	108	68	82	.....	10	54	11	11
30	Length, 1920.....miles.....	1,403	56	93	233	13	.....	323	8	22
31	Length, 1910.....miles.....	1,190	112	80	286	.....	81	39	7	17
Reservoirs:										
32	Number, 1920.....	328	10	74	38	.....	6	27	10	.....
33	Number, 1910.....	522	19	54	51	.....	4	65	23	7
34	Capacity, 1920.....acre-feet..	2,960,718	1,001	313	65,658	.....	6	81,855	55	.....
35	Capacity, 1910.....acre-feet..	454,162	5	40,560	181,320	.....	2	52,008	9	162
Flowing wells:										
36	Number, 1920.....	556	.....	318	.....	.....	.....	230	.....	.....
37	Number, 1910.....	673	.....	404	.....	.....	.....	267	.....	.....
38	Capacity, 1920.....gallons per minute..	376,222	.....	228,885	.....	.....	.....	146,230	.....	.....
39	Capacity, 1910.....gallons per minute..	669,268	.....	423,640	.....	.....	.....	240,549	.....	.....
Pumped wells:										
40	Number, 1920.....	461	13	143	2	1	8	48	4	1
41	Number, 1910.....	466	12	130	.....	.....	19	25	30	5
42	Capacity, 1920.....gallons per minute..	265,618	5,261	99,328	.....	1,500	1,575	27,118	400	800
43	Capacity, 1910.....gallons per minute..	190,690	3,980	50,315	.....	.....	7,938	8,450	10,652	89
Pumping plants:										
44	Number, 1920.....	472	12	146	2	1	8	52	3	1
45	Number, 1910.....	413	12	131	4	.....	22	27	31	6
46	Engine capacity, 1920.....horsepower..	8,483	126	2,810	60	15	109	843	32	60
47	Engine capacity, 1910.....horsepower..	14,226	105	10,445	60	.....	304	219	110	71
48	Pump capacity, 1920.....gallons per minute..	304,789	6,351	135,605	1,500	1,500	2,277	30,633	800	800
49	Pump capacity, 1910.....gallons per minute..	216,355	3,960	58,648	1,890	.....	13,838	9,144	11,002	4,289
50	Average lift, 1920.....feet.....	40	37	26	61	.....	10	28	35	20
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars..	18,210,412	165,784	1,323,948	4,526,888	66,512	2,485,908	2,952,707	54,162	87,195
52	Capital invested to July 1, 1910.....dollars..	9,154,897	130,450	1,757,561	1,653,408	.....	165,505	1,607,244	72,242	191,287
53	Per cent of increase, 1910-1920.....	93.9	27.1	.....	168.9	.....	.....	.....	.....	.....
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	26.16	10.89	27.91	49.81	9.60	38.21	49.39	7.48	18.17
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	14.19	6.40	27.30	32.13	.....	8.40	21.72	4.33	13.71
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars..	20,440,646	165,784	1,334,688	4,626,388	93,112	2,488,908	3,503,207	56,967	93,195
57	Estimated final cost of existing enterprises in 1910.....dollars..	11,640,091	130,450	1,953,424	2,512,336	.....	165,505	1,635,990	72,242	226,787
58	Per cent of increase, 1910-1920.....	76.6	27.1	.....	84.1	.....	.....	.....	.....	.....
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	21.25	8.70	23.10	39.30	10.09	38.28	39.96	7.32	18.27
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	10.56	5.11	18.27	16.06	.....	2.13	17.81	3.84	8.65

<sup>1</sup> Parts taken to form parts of De Baca and Lea Counties, and part annexed to Roosevelt County in 1917.<sup>2</sup> Organized from parts of Chaves, Guadalupe, and Roosevelt Counties in 1917.<sup>3</sup> Part taken to form part of Lea County in 1917.<sup>4</sup> Part taken to form Hidalgo County in 1910.<sup>5</sup> Part taken to form part of De Baca County in 1917.<sup>6</sup> Includes \$41,241 for Indian reservations, which was not reported by counties.



# IRRIGATION—NEW MEXICO.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (—) denotes decrease.]

		Hidalgo. <sup>1</sup>	Lincoln.	Luna.	McKinley.	Mora.	Otero.	Rio Arriba.	Sandoval.	San Juan.
1	Number of all farms in 1920.....	238	640	267	668	1,911	459	2,058	1,110	874
2	Number of farms irrigated in 1919.....	64	194	168	263	437	220	1,478	957	584
3	Per cent of all farms.....	26.9	30.3	58.5	39.4	22.9	47.9	71.6	86.2	66.8
4	Number of farms irrigated in 1909.....		229	116	172	620	241	1,437	1,038	706
5	Per cent of increase, 1909-1919.....		-18.8	44.8	52.9	-29.5	-8.7	-0.6	-7.8	-17.8
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres..	2,206,080	3,058,660	1,904,640	3,523,840	1,584,000	4,280,960	3,767,440	2,477,440	3,504,640
7	All land in farms.....acres..	242,479	495,643	1,032,827	177,952	1,013,981	261,796	364,881	185,595	78,877
8	Improved land in farms.....acres..	22,044	20,425	19,533	15,538	106,995	15,869	41,625	24,258	30,231
9	Area irrigated in 1919.....acres..	2,840	6,128	11,323	6,919	17,833	7,556	46,036	23,214	42,470
10	Per cent of improved land in farms.....	12.5	30.0	58.0	44.5	16.7	47.6	110.6	95.7	140.5
11	Area irrigated in 1909.....acres..		7,355	5,347	2,564	19,083	6,378	45,673	18,259	29,520
12	Per cent of increase, 1909-1919.....		-16.7	111.8	169.9	-6.6	18.5	0.8	27.1	43.9
13	Area enterprises were capable of irrigating in 1920.....acres..	2,940	6,341	21,143	7,229	29,749	8,565	50,247	26,659	48,195
14	Area enterprises were capable of irrigating in 1910.....acres..		7,907	9,763	4,200	28,137	8,359	51,635	21,791	52,656
15	Per cent of increase, 1910-1920.....		-19.8	116.6	72.1	6.7	2.5	-2.7	22.3	-8.5
16	Area included in enterprises in 1920.....acres..	3,340	11,899	34,786	9,057	37,673	12,117	66,691	32,988	68,515
17	Area included in enterprises in 1910.....acres..		9,678	15,291	10,200	32,668	12,173	67,284	37,136	77,169
18	Per cent of increase, 1910-1920.....		23.9	127.5	-11.2	15.3	-0.5	1.9	-11.2	-11.2
19	Area of irrigated land reported as available for settlement.....acres..	500			860					3,210
<b>IRRIGATION WORKS.</b>										
<b>Independent enterprises:</b>										
20	Number, 1920.....	5	102	153	15	102	96	274	82	54
21	Number, 1910.....		121	101	9	116	99	338	92	91
<b>Main ditches:</b>										
22	Number, 1920.....	4	102	51	19	110	115	273	86	52
23	Number, 1910.....		117	38	4	117	89	242	100	88
24	Length, 1920.....miles..	20	142	41	35	231	155	454	337	255
25	Length, 1910.....miles..		161	43	22	254	145	574	299	383
26	Capacity, 1920.....second-feet..	47	193	3,171	126	1,081	576	1,526	363	1,871
27	Capacity, 1910.....second-feet..		440	2,141	136	1,344	454	2,186	842	2,543
<b>Laterals:</b>										
28	Number, 1920.....	11	94	37	41	277	75	192	22	106
29	Number, 1910.....		11	16	11	89	56	83	59	22
30	Length, 1920.....miles..	8	124	7	89	45	77	87	9	85
31	Length, 1910.....miles..		3	9	10	28	26	64	29	45
<b>Reservoirs:</b>										
32	Number, 1920.....		8	16	11	16	13	10	5	2
33	Number, 1910.....		21	34	10	12	30	12	22	6
34	Capacity, 1920.....acre-feet..		12	87	6,685	672	110	753	44,049	150
35	Capacity, 1910.....acre-feet..		21	158	20,547	3,166	88	1,444	241	4,820
<b>Flowing wells:</b>										
36	Number, 1920.....			1	4					
37	Number, 1910.....									
38	Capacity, 1920.....gallons per minute..			75	845					
39	Capacity, 1910.....gallons per minute..			75						
<b>Pumped wells:</b>										
40	Number, 1920.....		2	156	1	1	4			
41	Number, 1910.....		14	94		8	18			
42	Capacity, 1920.....gallons per minute..		18	95,300		3,300	419			
43	Capacity, 1910.....gallons per minute..		240	32,078		28	3,805			
<b>Pumping plants:</b>										
44	Number, 1920.....		4	153	2	2	4			
45	Number, 1910.....		14	94		3	15	2		2
46	Engine capacity, 1920.....horsepower..		8	3,471	5	6	9			
47	Engine capacity, 1910.....horsepower..		27	1,034		3	102	41		10
48	Pump capacity, 1920.....gallons per minute..		118	91,010		10	419			
49	Pump capacity, 1910.....gallons per minute..		240	32,078		28	3,805	3,069		655
50	Average lift, 1920.....feet..		82	57	170	35	44			
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars..	31,935	51,939	422,450	697,280	316,097	361,284	245,425	108,419	1,666,875
52	Capital invested to July 1, 1910.....dollars..		39,645	110,264	364,256	133,604	182,211	244,156	136,371	789,927
53	Per cent of increase, 1910-1920.....		31.0	283.1	91.4	136.6	98.3	0.5	-21.6	111.0
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	10.86	8.19	19.98	96.46	10.63	42.18	4.88	4.07	34.59
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..		5.01	11.29	86.73	4.75	21.80	4.73	6.35	15.00
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars..	46,935	52,014	430,350	702,290	327,786	364,489	259,670	124,939	2,716,875
57	Estimated final cost of existing enterprises in 1910.....dollars..		39,645	110,264	516,256	183,604	182,211	244,156	136,371	800,147
58	Per cent of increase, 1910-1920.....		31.2	290.3	36.3	145.3	100.0	6.4	-9.7	239.5
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	14.05	4.37	12.37	77.54	8.70	30.08	3.78	3.79	39.65
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..		4.10	7.21	50.52	4.09	14.97	3.62	3.73	10.27

<sup>1</sup> Organized from part of Grant County in 1919.

## IRRIGATION—NEW MEXICO.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	San Miguel.	Santa Fe.	Sierra.	Socorro.	Taos.	Terrance. <sup>1</sup>	Union.	Valencia.	All other counties. <sup>2</sup>	
1	Number of all farms in 1920.....	1,643	896	395	1,191	1,116	1,365	2,652	1,097	4,400
2	Number of farms irrigated in 1919.....	470	529	240	567	1,022	41	47	839	120
3	Per cent of all farms.....	28.6	59.0	60.8	47.6	91.6	3.0	1.8	76.5	2.7
4	Number of farms irrigated in 1909.....	594	844	209	710	949	.....	94	1,093	36
5	Per cent of increase, 1909-1919.....	-20.9	-37.3	14.8	-20.1	7.7	.....	.....	-23.2	.....
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres..	3,132,160	1,262,720	1,995,520	9,644,800	1,441,230	2,156,160	3,436,800	3,621,760	7,162,640
7	All land in farms.....acres..	1,452,379	522,788	330,872	1,180,546	84,878	776,789	2,515,522	1,000,985	4,969,562
8	Improved land in farms.....acres..	58,534	49,439	7,712	32,770	23,497	88,526	273,748	28,818	486,968
9	Area irrigated in 1919.....acres..	16,565	10,582	8,491	11,110	59,607	1,085	6,774	19,241	775
10	Per cent of improved land in farms.....	28.3	21.4	110.1	33.9	253.7	1.2	2.6	66.8	0.2
11	Area irrigated in 1909.....acres..	14,318	16,180	8,637	14,289	41,486	653	6,315	30,302	105
12	Per cent of increase, 1909-1919.....	15.7	-34.6	133.5	-22.2	43.7	66.2	7.8	-36.5	.....
13	Area enterprises were capable of irrigating in 1920.....acres..	43,277	10,858	9,533	13,256	67,061	1,165	17,688	32,666	1,805
14	Area enterprises were capable of irrigating in 1910.....acres..	16,902	16,707	5,959	22,532	44,395	653	8,766	51,948	2,141
15	Per cent of increase, 1910-1920.....	156.0	-35.0	60.0	-40.7	51.1	78.4	105.2	-37.1	.....
16	Area included in enterprises in 1920.....acres..	68,806	12,244	18,432	29,780	88,265	1,550	20,056	48,780	2,649
17	Area included in enterprises in 1910.....acres..	52,417	51,758	10,426	41,760	60,426	1,103	30,107	74,814	11,553
18	Per cent of increase, 1910-1920.....	31.3	-76.3	76.8	-28.7	46.1	40.5	-33.4	-34.8	.....
19	Area of irrigated land reported as available for settlement.....acres..	940	.....	.....	4,640	4,400	.....	1,500	20,000	.....
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	101	102	66	95	168	7	70	46	43
21	Number, 1910.....	152	122	63	99	205	.....	48	62	32
Main ditches:										
22	Number, 1920.....	115	103	64	88	168	8	84	49	21
23	Number, 1910.....	153	141	57	89	238	3	48	64	7
24	Length, 1920.....miles..	213	142	119	289	326	30	122	278	4
25	Length, 1910.....miles..	264	229	84	242	343	4	95	334	7
26	Capacity, 1920.....second-feet..	1,459	226	523	814	1,268	2	407	360	45
27	Capacity, 1910.....second-feet..	2,378	853	149	991	1,513	10	452	2,105	2
Laterals:										
28	Number, 1920.....	104	17	35	48	57	22	178	40	28
29	Number, 1910.....	43	42	6	69	100	.....	114	265	.....
30	Length, 1920.....miles..	33	11	15	18	50	10	58	30	4
31	Length, 1910.....miles..	64	28	6	63	105	.....	31	111	.....
Reservoirs:										
32	Number, 1920.....	21	8	14	11	8	1	11	6	12
33	Number, 1910.....	32	41	9	12	11	2	25	8	13
34	Capacity, 1920.....acre-feet..	38,419	160	2,688,862	80,003	1,735	75	76	14	8
35	Capacity, 1910.....acre-feet..	72,335	75,451	104	24	327	26	1,324	14	6
Flowing wells:										
36	Number, 1920.....	.....	.....	1	1	.....	.....	.....	.....	1
37	Number, 1910.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
38	Capacity, 1920.....gallons per minute..	.....	.....	20	7	.....	.....	.....	.....	60
39	Capacity, 1910.....gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pumped wells:										
40	Number, 1920.....	2	2	11	8	.....	.....	4	.....	50
41	Number, 1910.....	2	8	4	3	.....	1	2	2	94
42	Capacity, 1920.....gallons per minute..	3	.....	1,269	3,600	.....	.....	47	.....	24,680
43	Capacity, 1910.....gallons per minute..	513	1,026	140	208	.....	6	609	50	70,558
Pumping plants:										
44	Number, 1920.....	2	1	15	11	.....	.....	5	2	41
45	Number, 1910.....	2	10	4	4	.....	1	2	1	26
46	Engine capacity, 1920.....horsepower..	.....	2	59	94	.....	.....	33	20	727
47	Engine capacity, 1910.....horsepower..	25	107	10	10	.....	1	8	2	1,542
48	Pump capacity, 1920.....gallons per minute..	3	.....	2,539	8,875	.....	.....	544	2,000	24,495
49	Pump capacity, 1910.....gallons per minute..	518	1,710	140	298	.....	6	609	50	70,558
50	Average lift, 1920.....feet..	62	1	31	27	.....	.....	50	52	111
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars..	777,482	69,975	758,484	235,051	160,896	21,100	363,939	194,471	64,216
52	Capital invested to July 1, 1910.....dollars..	300,708	123,834	19,089	187,682	190,940	1,010	70,925	254,063	855,274
53	Per cent of increase, 1910-1920.....	158.6	-43.5	.....	25.2	-15.7	.....	413.1	-23.5	.....
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	17.97	6.44	79.56	17.60	2.40	18.11	20.23	5.96	35.58
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	17.79	7.41	3.20	8.33	4.30	1.55	8.09	4.89	165.94
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars..	788,502	69,975	1,060,459	259,351	177,176	23,600	382,399	227,991	64,616
57	Estimated final cost of existing enterprises in 1910.....dollars..	1,189,706	347,056	19,089	301,582	190,940	1,010	70,981	254,063	355,274
58	Per cent of increase, 1910-1920.....	-33.7	-79.8	.....	-14.0	-7.2	.....	438.7	-10.3	.....
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	11.46	5.72	57.53	8.71	2.01	15.23	19.07	4.67	24.39
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	22.70	6.71	1.83	7.22	3.16	0.92	2.36	3.40	30.67

<sup>1</sup> Included in "All other counties" in 1910.<sup>2</sup> Includes Curry, Lea, Quay, and Roosevelt Counties. Lea County formed from parts of Chaves and Eddy Counties in 1917.

# NORTH DAKOTA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of North Dakota collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the

purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	77,690	74,360	3,330	4.5
Approximate land area of the state.....acres..	44,917,120	44,917,120		
All land in farms.....acres..	36,214,751	28,426,650	7,788,101	27.4
Improved land in farms.....acres..	24,563,178	20,455,092	4,108,086	20.1
Number of farms irrigated.....	340	69	271	
Area irrigated.....acres..	12,072	10,248	1,824	17.8
Area enterprises were capable of irrigating.....acres..	34,235	21,917	12,318	56.2
Area included in enterprises.....acres..	57,476	38,173	19,303	50.6
Per cent irrigated:				
Number of all farms.....	0.4	0.1	0.3	
Approximate land area of the state.....	(2)	(2)		
Land in farms.....	(2)	(2)		
Improved land in farms.....	(2)	0.1		
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	22,163	11,669	10,494	89.9
Excess of area included in enterprises over area irrigated.....acres..	45,404	27,925	17,479	62.6
Capital invested.....	\$1,857,118	\$836,482	\$1,020,636	122.0
Average per acre enterprises were capable of irrigating.....	\$54.25	\$38.17	\$16.08	42.1
Estimated final cost of existing enterprises.....	\$2,072,766	\$836,482	\$1,236,284	147.8
Average per acre included in enterprises.....	\$36.06	\$21.91	\$14.15	64.6
Average cost of operation and maintenance per acre.....	\$5.50	\$28.40	-\$22.90	-80.6
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	30	49	-19	
Number of main ditches.....	32	47	-15	
Length of main ditches.....miles..	58	52	6	
Capacity of main ditches.....second-feet..	836	2,161	-1,325	-61.3
Number of lateral ditches.....	58	46	12	
Length of lateral ditches.....miles..	93	74	19	
Number of reservoirs.....	9	22	-13	
Capacity of reservoirs.....acre-feet..	1,110	132,187	-131,077	-99.2
Number of pumped wells.....	(3)	1	-1	
Capacity of pumped wells.....gallons per minute..	(3)	15	15	
Number of pumping plants.....	4	4		
Engine capacity.....horsepower..	2,068	2,038	30	1.5
Pump capacity.....gallons per minute..	51,250	182,115	-130,865	-71.9
Average lift.....feet..	38	(4)	38	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.  
<sup>2</sup> Less than one-tenth of 1 per cent.

<sup>3</sup> Not reported in 1920.  
<sup>4</sup> Not reported in 1910.



CLIMATIC CONDITIONS.

Throughout the state of North Dakota the precipitation is, in normal years, sufficient for the maturing of crops, without irrigation, the normal rainfall for the state being 17.92 inches. In the western part of the state, however, the precipitation is below the average for the state, and irrigation is practiced to a limited extent. In 1919 the precipitation was below the normal, being below 15 inches over most of the western half of the state, and below 10 inches over the southwestern part of the state. This low precipitation resulted in a short supply of water for irrigation where water is taken from small local streams, and it is probable that some land was not irrigated in 1919 which would have been if water had been available.

WATER SUPPLY FOR IRRIGATION.

The whole of that part of the state of North Dakota within which irrigation is practiced lies within the drainage basin of Missouri River and its tributaries. With the exception of the Missouri itself these streams are plains streams and subject to drouth when local rainfall fails. The Missouri is fed by mountain streams, and supplies sufficient water for the limited area receiving water from it.

There are many artesian wells in the state, but they are not used for irrigation.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	340	392.8	0.4	12,072	17.8	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
1910.....	69	27.8	0.1	10,248	110.3	( <sup>1</sup> )	( <sup>1</sup> )	0.1
1900.....	54	871.4	0.1	4,872	994.8	( <sup>1</sup> )	( <sup>1</sup> )	0.1
1890.....	7		( <sup>1</sup> )	445		( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	30	87,476	12,072	21.0	34,235
1890-1899 <sup>1</sup> .....	3	2,100	595	28.3	1,060
1890-1899.....	5	2,130	458	21.5	1,520
1900-1904.....	9	4,967	955	19.2	3,255
1905-1909.....	2	46,031	8,766	19.0	26,238
1910-1914.....	1	325	265	87.7	325
1915-1919.....	0	1,128	330	29.3	1,042
Not reported.....	4	795	683	85.9	795

<sup>1</sup> Dakota Territory.

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	12,072	10,248	1,824	17.8	34,235	57,476
Streams, gravity.....	9,030	7,153	1,877	26.2	21,241	30,740
Streams, pumped.....	2,469	1,614	855	53.0	12,298	26,040
Wells, pumped.....		1	-1			
Springs.....		200	-200			
Stored storm water.....	508	1,280	-772	-60.3	608	606
Other mixed.....	65		65		90	90

<sup>1</sup> A minus sign (-) denotes decrease.

ACREAGE, BY CHARACTER OF ENTERPRISE.

An irrigation district law was enacted in North Dakota in 1917, and a district has been organized to take over the Williston project of the United States Reclamation Service, but this project is credited to the Reclamation Service in Table 5 because the Government built the works and still controls them to a large extent.

North Dakota has not accepted the conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894).

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	12,072	10,248	1,824	17.8
Individual and partnership.....	3,306	8,638	-5,332	-61.7
U. S. Reclamation Service.....	8,766	1,610	7,156	444.5
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	34,235	21,917	12,318	56.2
Individual and partnership.....	7,997	9,821	-1,824	-18.6
U. S. Reclamation Service.....	26,238	12,096	14,142	116.9
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	57,476	38,173	19,303	50.6
Individual and partnership.....	11,445	13,693	-2,248	-16.4
U. S. Reclamation Service.....	46,031	24,480	21,551	88.0

<sup>1</sup> A minus sign (-) denotes decrease.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of North Dakota relating to water rights are summarized in the following paragraphs:

North Dakota was organized from a part of Dakota territory and admitted to the Union in 1889.

The constitution of the state made the following declaration regarding water: "All flowing streams and natural water sources shall forever remain the property of the state for mining, irrigation, and manufacturing purposes." (Sec. 210.)

In 1905 the state adopted a comprehensive code covering the subject of water rights.

This code contained the following general provision: "All waters within the limits of the state from all sources of water supply belong to the public and, except as to navigable waters, are subject to appropriation for beneficial use." (Laws 1905, ch. 34, sec. 1.)

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Under this law any party wishing to acquire water rights is required to apply to the state engineer for a permit. When works are completed the state engineer issues a certificate of completion, and when water has been put to use a license is issued.

The law of 1905 provided the machinery for a complete adjudication of all rights to water. The state engineer was to make hydrographic surveys of all streams and ditches, and, when these surveys were completed, file reports with the attorney general of the state, "who shall, within 60 days thereafter, enter suit on behalf of the state for the determination of all rights to the use of such water." (Laws 1905, ch. 34, secs. 14 and 15.) Table 6 indicates that this provision of the law has not been carried out.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909 Per cent of total.
	Acres.	Per cent of total.	
Total.....	12,072	100.0	100.0
Appropriation and use.....	8,348	52.6	88.9
Notice filed and posted.....	2,328	19.3	6.8
Permit from state.....	2,936	24.3	4.8
Not reported.....	460	3.8	(1)

<sup>1</sup> All land for which the class of water rights was reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special irrigation census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were reported separately in such a way that it is not possible to tell in what drainage basin these areas are situated. This area is so small, however, that the comparisons are not affected seriously.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase.		
Total.....	12,072	10,384	16.3	57,476	34,235
Missouri River and tributaries.....	12,072	9,444	27.8	57,476	34,235
Mouse River and tributaries.....	(1)	676			
Red River of the North and tributaries.....	(1)	6			
Springs.....	(2)	256			
Wells.....	(3)	2			

<sup>1</sup> Not reported in 1919.

<sup>2</sup> Included in figures for streams.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase. <sup>1</sup>	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$1,857,118	122.0	\$54.25	42.1
1910.....	836,482		38.17	93.7
1900.....	16,980		3.49	
1890.....	(4)			

<sup>1</sup> Per cent not shown when more than 1,000.

<sup>2</sup> Not reported in 1890.

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$1,857,118	100.0	\$54.25
1880-1889 <sup>1</sup> .....	8,000	0.4	7.55
1890-1899.....	17,669	1.0	11.62
1900-1904.....	37,714	2.0	11.59
1905-1909.....	1,777,570	95.7	67.75
1910-1914.....	2,000	0.1	6.15
1915-1919.....	11,207	0.6	10.76
Not reported.....	2,958	0.2	3.72

<sup>1</sup> Dakota Territory.

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendances.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$1,857,118	100.0	\$54.25	10,951	\$5.50
Streams, gravity.....	1,299,951	70.0	61.20	8,485	3.55
Streams, pumped.....	552,007	29.7	44.89	2,466	12.21
Stored storm water.....	4,660	0.3	7.69		
Other mixed.....	500		5.56		

<sup>1</sup> Based on area irrigated in 1919.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	Increase.
Total.....	\$1,857,118	\$45,087	\$1,812,031
Missouri River and tributaries.....	1,857,118	40,375	1,816,743
Mouse River and tributaries.....	(1)	3,637	
Red River of the North and tributaries.....	(1)	300	
Springs.....	(2)	600	
Wells.....	(3)	175	

<sup>1</sup> Not reported in 1920.

<sup>2</sup> Included in figures for streams.

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**TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.**  
[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$1,857,118	100.0	10,951	\$5.50
Individual and partnership.....	81,693	4.4	2,185	0.79
U. S. Reclamation Service.....	1,775,425	95.6	8,766	6.67

<sup>1</sup> Based on area irrigated in 1919.

### DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

**TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.**

Number of enterprises reporting land drained or needing drainage.....	8
Acreage included in enterprises reporting land drained or needing drainage.....	49,581
Acreage for which drains have been installed.....	1,613
Additional acreage needing drainage.....	659
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	3.3
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	2.8
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	4.0

### QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages. In all cases in which the quantity is reported the water was measured.

**TABLE 14.—QUANTITY OF WATER USED IN 1919.**

Average volume of water entering canals.....second-feet..	130
Area irrigated in 1919.....acres..	8,766
Average number of acres per second-foot.....	67.4
Total quantity of water entering canals.....acre-feet..	28,106
Area irrigated in 1919.....acres..	8,766
Average quantity per acre.....acre-feet..	3.2
Total quantity of water delivered.....acre-feet..	11,636
Area irrigated in 1919.....acres..	8,766
Average quantity per acre.....acre-feet..	1.3

### IRRIGATION WORKS.

**TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPING PLANTS.			
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-foot).		Number.	Engine capacity (horse-power).	Pumps.	
				Number.	Capacity (gallons per minute).							Number.	Capacity (gallons per minute).	
Total.....	26	11	32	836	58	58	93	9	1,110	0.3	4	2,068	10	51,250
1880-1889 <sup>1</sup> .....	8	2	4	28	6	5	2	1	140	.....	1	8	1	250
1890-1899.....	3	4	7	327	11	4	3	6	563	.....	.....	.....	.....	.....
1900-1904.....	9	2	10	371	26	22	6	.....	.....	0.3	2	2,040	8	50,000
1905-1909.....	2	1	3	100	1	25	81	.....	.....	.....	1	20	1	1,000
1910-1914.....	4	2	6	10	4	2	1	2	407	.....	.....	.....	.....	.....
1915-1919.....	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Not reported.....	1	.....	3	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> Dakota Territory.

**TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.**

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.		Pipe lines, length (miles).	PUMPING PLANTS.			
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-foot).		Number.	Engine capacity (horse-power).	Pumps.	
				Number.	Capacity (gallons per minute).							Number.	Capacity (gallons per minute).	
Total.....	26	11	32	836	58	58	93	9	1,110	0.3	4	2,068	10	51,250
Individual and partnership.....	26	11	30	455	32	33	12	9	1,110	.....	2	28	2	1,250
U. S. Reclamation Service.....	.....	.....	2	371	26	25	81	.....	.....	0.3	2	2,040	8	50,000

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## CROPS.

TABLE 17.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Oats.....	2,870	0.1	544	( <sup>2</sup> )	427.6	Bu.....	30,555	0.1	25,655	( <sup>2</sup> )	19.1
2 Spring wheat.....	15,713	0.2	1,268	( <sup>2</sup> )		Bu.....	80,292	0.1	28,011	( <sup>2</sup> )	186.8
3 Barley.....	1,186	0.1	( <sup>2</sup> )			Bu.....	10,565	0.1	( <sup>2</sup> )		
4 Rye.....	2,040	0.1	( <sup>2</sup> )			Bu.....	8,673	0.1	( <sup>2</sup> )		
<b>Hay and forage:</b>											
5 Small grains cut for hay.....	1,664	0.3	( <sup>2</sup> )			Tons.....	906	0.2	( <sup>2</sup> )		
6 Other tame or cultivated grasses.....	1,028	0.4	( <sup>2</sup> )			Tons.....	453	0.1	( <sup>2</sup> )		
7 Wild, salt, or prairie grasses.....	779	( <sup>2</sup> )	1,057	( <sup>2</sup> )	-26.3	Tons.....	301	( <sup>2</sup> )	1,424	0.1	-78.9

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Oats.....	Bu.....	14.6	14.6	10.6	72.6	72.6	\$24,444	0.1	\$9,368		192.1
2 Spring wheat.....	Bu.....	6.8	6.8	5.1	75.0	75.0	192,701	0.1	26,145		637.0
3 Barley.....	Bu.....	11.1	11.1	8.9	80.2	80.2	12,150	0.1	( <sup>2</sup> )		
4 Rye.....	Bu.....	6.7	6.7	4.3	64.2	64.2	12,576	0.1	( <sup>2</sup> )		
<b>Hay and forage:</b>											
5 Small grains cut for hay.....	Tons.....	0.60	0.60	0.54	90.0	90.0	13,137	0.2	( <sup>2</sup> )		
6 Other tame or cultivated grasses.....	Tons.....	1.23	1.23	0.44	35.8	35.8	7,474	0.1	( <sup>2</sup> )		
7 Wild, salt, or prairie grasses.....	Tons.....	0.77	0.77	0.39	50.6	50.6	4,666	( <sup>2</sup> )	9,513	0.1	-51.0

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.<sup>2</sup> Less than one-tenth of 1 per cent.<sup>3</sup> Not reported separately in 1909.



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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.**

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100, or when per cent is more than 1,000.]

		THE STATE.	McKenzie.	Williams.	All other counties.
1	Number of all farms in 1920.....	77,690	2,033	2,437	73,220
2	Number of farms irrigated in 1919.....	340	156	184	.....
3	Per cent of all farms.....	0.4	7.7	7.6	.....
4	Number of farms irrigated in 1909.....	69	7	53	9
5	Per cent of increase, 1909-1919.....	.....	.....	.....	.....
<b>LAND AND FARM AREA.</b>					
6	Approximate land area..... acres.....	44,917,120	1,822,080	1,368,320	41,726,720
7	All land in farms..... acres.....	35,214,751	1,231,370	887,569	33,935,812
8	Improved land in farms..... acres.....	24,563,178	363,760	508,372	23,691,046
9	Area irrigated in 1919..... acres.....	12,072	6,630	5,442	.....
10	Per cent of improved land in farms.....	(1)	1.8	1.1	.....
11	Area irrigated in 1909..... acres.....	10,248	850	8,043	1,856
12	Per cent of increase, 1909-1919.....	17.8	680.0	-32.3	.....
13	Area enterprises were capable of irrigating in 1920..... acres.....	34,235	14,726	19,509	.....
14	Area enterprises were capable of irrigating in 1910..... acres.....	21,917	850	19,664	1,403
15	Per cent of increase, 1910-1920.....	56.2	.....	-0.8	.....
16	Area included in enterprises in 1920..... acres.....	57,476	21,424	36,052	.....
17	Area included in enterprises in 1910..... acres.....	38,173	1,532	34,865	1,776
18	Per cent of increase, 1910-1920.....	50.6	.....	3.4	.....
<b>IRRIGATION WORKS.</b>					
Independent enterprises:					
19	Number, 1920.....	30	4	26	.....
20	Number, 1910.....	49	6	34	9
Main ditches:					
21	Number, 1920.....	32	4	28	.....
22	Number, 1910.....	47	5	35	7
23	Length, 1920..... miles.....	58	26	32	.....
24	Length, 1910..... miles.....	52	8	40	4
25	Capacity, 1920..... second-feet.....	836	276	560	.....
26	Capacity, 1910..... second-feet.....	2,161	162	1,703	296
Laterals:					
27	Number, 1920.....	58	.....	58	.....
28	Number, 1910.....	46	16	30	.....
29	Length, 1920..... miles.....	93	34	59	.....
30	Length, 1910..... miles.....	74	1	73	.....
Reservoirs:					
31	Number, 1920.....	0	1	8	.....
32	Number, 1910.....	22	8	13	1
33	Capacity, 1920..... acre-feet.....	1,110	400	710	.....
34	Capacity, 1910..... acre-feet.....	132,187	25	132,157	6
Pumped wells:					
35	Number, 1920.....	1	.....	.....	1
36	Number, 1910.....	.....	.....	.....	.....
37	Capacity, 1920..... gallons per minute.....	.....	.....	.....	.....
38	Capacity, 1910..... gallons per minute.....	15	.....	.....	15
Pumping plants:					
39	Number, 1920.....	4	.....	4	.....
40	Number, 1910.....	4	1	1	2
41	Engine capacity, 1920..... horsepower.....	2,068	1,080	88	.....
42	Engine capacity, 1910..... horsepower.....	2,038	30	2,000	8
43	Pump capacity, 1920..... gallons per minute.....	51,250	.....	51,250	.....
44	Pump capacity, 1910..... gallons per minute.....	182,115	2,000	180,000	115
45	Average lift, 1920..... feet.....	38	.....	38	.....
<b>CAPITAL INVESTED.</b>					
46	Capital invested to Jan. 1, 1920..... dollars.....	1,857,118	1,235,209	621,909	.....
47	Capital invested to July 1, 1910..... dollars.....	838,482	6,663	781,100	48,719
48	Per cent of increase, 1910-1920.....	122.0	.....	-20.4	.....
49	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars.....	54.25	83.88	31.88	.....
50	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars.....	33.17	7.84	39.72	34.72
<b>ESTIMATED FINAL COST.</b>					
51	Estimated final cost of existing enterprises in 1920..... dollars.....	2,072,766	1,321,457	751,309	.....
52	Estimated final cost of existing enterprises in 1910..... dollars.....	830,482	6,663	781,100	48,719
53	Per cent of increase, 1910-1920.....	147.6	.....	-3.8	.....
54	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....	38.06	61.68	20.84	.....
55	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....	21.91	4.35	22.40	27.43

1 Less than one-tenth of 1 per cent.

# OKLAHOMA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Oklahoma collected at the census of 1920. Statistics of acreage irrigated, of acreage and yield of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage and yield of crops grown on irrigated land were

collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

Alfalfa and corn are the only crops for which the area reported as irrigated exceeds 100 acres. The area of irrigated alfalfa reported is 417 acres, with a yield of 615 tons, or 1.47 tons per acre. The average yield for the whole state is 1.96 tons per acre. The area of corn reported as irrigated is 237 acres, with a yield of 4,124 bushels, or 17.4 bushels per acre. The average yield for the state is 21.8 bushels per acre. The remaining irrigated area is divided among other farm crops, gardens, and pastures.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	191,988	190,192	1,796	0.9
Approximate land area of the state..... acres..	44,424,960	44,424,960		
All land in farms..... acres..	31,951,934	28,859,353	3,092,581	10.7
Improved land in farms..... acres..	18,125,321	17,551,337	573,984	3.3
Number of farms irrigated.....	73	137	-64	-46.7
Area irrigated..... acres..	2,969	4,388	-1,419	-32.3
Area enterprises were capable of irrigating..... acres..	9,672	6,397	3,275	51.2
Area included in enterprises..... acres..	11,742	8,528	3,214	37.7
Per cent irrigated:				
Number of all farms.....	( <sup>2</sup> )	0.1		
Approximate land area of the state.....	( <sup>2</sup> )	( <sup>2</sup> )		
Land in farms.....	( <sup>2</sup> )	( <sup>2</sup> )		
Improved land in farms.....	( <sup>2</sup> )	( <sup>2</sup> )		
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	6,703	2,009	4,694	233.6
Excess of area included in enterprises over area irrigated..... acres..	8,773	4,140	4,633	111.9
Capital invested.....	\$151,325	\$47,200	\$104,125	220.6
Average per acre enterprises were capable of irrigating.....	\$15.65	\$7.38	\$8.27	112.1
Estimated final cost of existing enterprises.....	\$162,775	\$47,200	\$115,575	244.9
Average per acre included in enterprises.....	\$13.86	\$5.53	\$8.33	150.6
Average cost of operation and maintenance per acre.....	\$2.92	\$0.51	\$2.41	472.5
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	33	114	-81	-71.1
Number of main ditches.....	18	47	-29	
Length of main ditches..... miles..	38	54	-16	
Capacity of main ditches..... second-feet..	344	155	189	121.9
Number of lateral ditches.....	72	106	-34	-32.1
Length of lateral ditches..... miles..	19	31	-12	
Number of reservoirs.....	8	11	-3	
Capacity of reservoirs..... acre-feet..	52	22	30	
Number of flowing wells.....	1	( <sup>3</sup> )	1	
Capacity of flowing wells..... gallons per minute..	100	( <sup>3</sup> )	100	
Number of pumped wells.....	19	65	-46	
Capacity of pumped wells..... gallons per minute..	3,643	1,791	1,852	103.4
Number of pumping plants.....	22	68	-46	
Engine capacity..... horsepower..	184	107	77	72.0
Pump capacity..... gallons per minute..	7,668	4,541	3,127	68.9
Average lift..... feet..	59	( <sup>3</sup> )	59	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.

<sup>2</sup> Less than one-tenth of 1 per cent.

<sup>3</sup> Not reported in 1910.

CLIMATIC CONDITIONS.

The larger part of the state of Oklahoma receives sufficient rainfall to obviate the necessity for irrigation, the normal annual precipitation for the state being about 34 inches, and of this about three-fourths occurs during the growing season. In the extreme northwestern part of the state the normal annual precipitation is about 20 inches, but a large part of the rainfall in late summer in this section as well as in the rest of the state, comes in local showers, and crops sometimes suffer for moisture.

In the western part of the state the spring and summer precipitation in 1919 was far above normal, and there was little or no need of irrigation.

WATER SUPPLY FOR IRRIGATION.

Most of western Oklahoma is well watered. It is drained by the Salt Fork of the Arkansas, the Cimarron, the North Canadian, the South Canadian, the Washita, and the Red Rivers and their tributaries. As a rule these streams do not carry large volumes of water. They are subject to sudden rises coming from heavy local rains, but the floods are seldom of long duration. Without the storing of flood waters these streams are not reliable sources of water for irrigation.

No doubt ground water can be obtained from wells in the stream valleys, but the demand for water for irrigation has not been sufficient to bring about either the storing of flood water or the sinking of wells.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1900 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Num-ber.	Per cent of in-crease. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of in-crease. <sup>1</sup>	Per cent of total land area.	Per cent of land in farms.	Per cent of im-proved land in farms.
1920.....	73	-46.7	( <sup>2</sup> )	2,969	-32.3	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
1910.....	137	10.6	0.1	4,388	59.0	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
1900.....	124	.....	0.1	2,759	.....	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enter-prises.	Area in-cluded in enter-prises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enter-prises were ca-pable of irrigating in 1920 (acres).
			Acres.	Per cent of acre-age in enter-prises.	
Total.....	33	11,742	2,969	25.3	9,672
1890-1899.....	5	8,812	2,392	27.1	8,112
1900-1904.....	3	159	108	67.9	159
1905-1909.....	2	150	55	36.7	150
1910-1914.....	12	1,983	298	15.0	633
1915-1919.....	9	398	36	9.0	378
Not reported.....	2	240	80	33.3	340

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enter-prises were ca-pable of irrigating in 1920 (acres).	Area in-cluded in enter-prises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	2,969	4,388	-1,419	-32.3	9,672	11,742
Streams, gravity.....	2,522	4,205	-1,683	-40.0	8,972	11,022
Streams, pumped.....	188	50	138	.....	355	355
Wells, pumped.....	107	69	38	.....	118	138
Wells, flowing.....	18	.....	18	.....	18	18
Lakes, gravity.....	.....	28	-28	.....	.....	.....
Springs.....	6	16	-10	.....	6	6
Stored storm water.....	.....	20	-20	.....	.....	.....
City water.....	3	( <sup>2</sup> )	3	.....	3	3
Mixed.....	125	( <sup>2</sup> )	125	.....	200	200

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.

<sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

The constitution of the state of Oklahoma, adopted in 1907, contains the following section relating to organization for land reclamation:

“The legislature shall have the power and shall provide for a system of levees, drains, and ditches and of irrigation in this state when deemed expedient, and provide for a system of taxation on the lands affected or benefited by such levees, drains, and ditches and irrigation, or on crops produced on such land, to discharge such bonded indebtedness or expense necessarily incurred in the establishment of such improvements; and to provide for compulsory issuance of bonds by the owners or lessees of the lands benefited by such levees, drains and ditches, or irrigation.”—Art. XVI, sec. 3.

In 1915 the legislature enacted an irrigation district law under this section of the constitution, but no districts are reported.

The state has never accepted the conditions of the Federal Carey Act (act of Aug. 18, 1894).

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	2,969	4,388	-1,419	-32.3
Individual.....	969	2,388	-1,419	-59.4
Cooperative.....	2,000	2,000	.....	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	9,672	6,397	3,275	51.3
Individual.....	2,072	3,397	-1,325	-39.0
Cooperative.....	7,600	3,000	4,600	153.3
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	11,742	8,528	3,214	37.7
Individual.....	4,142	5,028	-886	-17.6
Cooperative.....	7,600	3,500	4,100	117.1

<sup>1</sup> A minus sign (-) denotes decrease.

An act passed in 1897 provided for the organization of corporations to build irrigation works and authorized such corporations to enter into contracts for the sale of water rights, having these secured by liens on the lands covered, or to lease water and have the rentals secured by liens on the crops grown, or otherwise. No such commercial companies are reported.

The United States Reclamation Service has investigated proposed enterprises in Oklahoma, but has not undertaken any of them.

**ACREAGE, BY CHARACTER OF WATER RIGHTS.**

The laws of Oklahoma relating to water rights are summarized in the following paragraphs:

The territory of Oklahoma was organized in 1890, and in 1897 the territorial legislature enacted its first law relating to water rights. This law contained the following section:

"The unappropriated waters of the ordinary flow or underflow of every running stream or flowing river, and the storm or rain water of every river or natural stream, canon, ravine, depression, or watershed within those portions of the state of Oklahoma in which by reason of the insufficient rainfall, or by reason of the irregularity of the rainfall, irrigation is beneficial for agricultural purposes, are hereby declared to be the property of the public, and may be acquired by appropriation for the uses and purposes and in the manner as hereinafter provided."

This law contained the following proviso recognizing riparian rights: "Provided, that such flow or underflow of water shall not be diverted to the prejudice of the rights of the riparian owner without his consent, except after condemnation thereof in the manner as hereinafter provided."

This law provided for the filing of claims for new enterprises with county recorders of deeds, and required also the filing of claims for previously existing rights.

In 1905, the territory created the office of territorial engineer and provided that parties wishing to acquire rights to water should apply to the engineer for permits. The law provided for the submitting of proof of completion of works and the issuing of certificates of completion and for the submitting of proof of having put the water appropriated to a beneficial use and the issuing of licenses to divert the quantities of water to which rights had been acquired.

The state engineer is directed to make surveys and collect the information necessary for defining rights to water and to transmit the results to the attorney general of the state, who is directed to bring suits on behalf of the state for the adjudication of rights. The attorney general is directed also to intervene in suits brought by other parties, while the courts are directed to call on the state engineer for information when suits involving water rights are brought.

**TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.**

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	2,969	100.0	100.0
Appropriation and use.....	35	1.2	77.4
Notice filed and posted.....	215	7.2	5.4
Adjudicated by court.....	2,200	74.1	17.1
Permit from state.....	310	10.4	
Riparian rights.....	80	2.7	
Underground.....	120	4.0	(1)
Other and mixed.....	3	0.1	(1)
Not reported.....	6	0.2	(1)

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

**ACREAGE, BY DRAINAGE BASIN.**

**TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.**

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	2,969	3,328	-10.8	11,742	9,672
Arkansas River and tributaries.....	2,843	3,207	-11.4	11,449	9,379
Canadian River.....	251	869	-71.1	502	495
Cimarron River.....	2,588	1,963	31.8	10,929	8,879
Other tributaries of Arkansas River.....	4	220	-98.2	18	5
Red River and tributaries.....	126	121	4.1	293	293

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Includes 155 acres irrigated by springs but not shown by drainage basins.

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1900 TO 1920.**

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$151,325	220.6	\$15.65	112.1
1910.....	47,200	115.8	7.38	-6.9
1900.....	21,872		7.98	

<sup>1</sup> A minus sign (-) denotes decrease.

**TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$151,325	100.0	\$15.65
1890-1899.....	54,378	35.9	6.70
1900-1904.....	3,403	2.2	21.40
1905-1909.....	4,085	2.7	37.23
1910-1914.....	67,101	44.3	106.00
1915-1919.....	17,069	11.2	45.00
Not reported.....	5,349	3.5	22.29

**TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$151,325	100.0	\$15.65	2,626	\$2.92
Streams, gravity.....	90,040	59.5	10.04	2,322	1.56
Streams, pumped.....	4,210	2.8	11.96	123	3.74
Wells, pumped.....	47,075	31.1	398.94	32	40.78
Wells, flowing.....	5,000	3.3	277.78	18	55.56
Springs.....	1,000	0.7	166.67	6	4.17
City water.....	1,500	1.0	600.00		
Mixed.....	2,500	1.7	12.50	125	10.00

<sup>1</sup> Based on area irrigated in 1919.

IRRIGATION—OKLAHOMA.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE.	
			Amount.	Per cent.
Total.....	\$151,325	\$36,770	\$114,555	311.5
Arkansas River and tributaries.....	142,597	35,802	106,795	208.2
Canadian River.....	46,234	6,918	39,316	508.3
Cimarron River.....	93,157	15,977	77,180	483.1
Other tributaries of Arkansas River.....	3,206	1,582	1,624	102.7
Red River and tributaries.....	8,728	968	7,760	801.7

1 Includes \$11,325 invested in springs and wells but not shown by drainage basins.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

(When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.)

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$151,325	100.0	2,628	\$2.92
Individual.....	110,658	73.1	628	8.73
Cooperative.....	40,667	26.9	2,000	1.10

<sup>1</sup> Based on area irrigated in 1919.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

[No land is reported as having had drains installed.]	
Number of enterprises reporting land needing drainage.....	3
Acreage included in enterprises reporting land needing drainage.....	1,930
Acreage needing drainage.....	1,820
Per cent that acreage needing drainage is of total acreage in irrigation enterprises in the state.....	15.5

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only one irrigation schedule, and in this instance the water was not measured. The average volume entering the canal was reported as 2 second-feet, and the area irrigated was 125 acres, making an average of 62.5 acres per second-foot.

IRRIGATION WORKS.

TABLE 14.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	7	3	18	344	88	72	19	8	52
1890-1899.....	3	1	5	182	25	28	17	.....	.....
1900-1904.....	1	1	3	31	2	34	.....	2	.....
1905-1909.....	1	.....	2	7	1	8	1	.....	.....
1910-1914.....	1	1	5	70	7	2	1	3	2
1915-1919.....	1	.....	2	54	3	.....	.....	1	.....
Not reported.....	.....	1	1	.....	.....	.....	.....	2	50

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).		
Total.....	4.3	1	100	19	3,643	22	184	26	7,668
1900-1904.....	.....	.....	.....	1	35	1	.....	1	35
1905-1909.....	.....	.....	.....	.....	.....	1	12	1	750
1910-1914.....	1.8	1	100	11	2,980	12	121	15	5,285
1915-1919.....	2.4	.....	.....	7	628	7	39	8	1,618
Not reported.....	0.1	.....	.....	.....	.....	1	12	1	.....

IRRIGATION—OKLAHOMA.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	7	3	18	344	38	72	19	8	53
Individual.....	6	3	17	194	22	49	8	8	52
Cooperative.....	1	.....	1	150	16	23	16	.....	.....

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	4.3	1	100	19	3,643	22	184	26	7,668
Individual.....	4.3	1	100	19	3,643	22	184	26	7,668

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	7	3	18	344	38	72	19	8	52
Arkansas River and tributaries.....	7	2	14	290	36	70	18	7	52
Canadian River.....	7	2	5	8	3	9	17	6	52
Cimarron River.....			9	282	35			1	
Other tributaries of Arkansas River.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Red River and tributaries.....	.....	1	4	54	.....	2	1	1	.....

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horsepower).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	4.3	1	100	19	3,643	22	184	26	7,668	59
Arkansas River and tributaries.....	4.3	.....	.....	19	3,643	18	120	22	4,668	69
Canadian River.....	4.0	.....	.....	12	1,106	12	78	16	3,141	89
Cimarron River.....				5	2,485	4	33	4	1,485	26
Other tributaries of Arkansas River.....	0.3	.....	.....	2	52	2	9	2	42	19
Red River and tributaries.....	.....	1	100	.....	.....	4	64	4	3,000	30

## IRRIGATION—OKLAHOMA.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

		THE STATE.	Beaver.	Cimarron.	All other counties.
1	Number of all farms in 1920.....	191,988	2,518	767	188,703
2	Number of farms irrigated in 1919.....	73	15	17	41
3	Per cent of all farms.....	( <sup>1</sup> )	0.6	2.2	( <sup>1</sup> )
4	Number of farms irrigated in 1909.....	137	11	32	94
5	Per cent of increase, 1909-1919.....	-46.7			
<b>LAND AND FARM AREA.</b>					
6	Approximate land area.....acres	44,424,960	1,160,320	1,183,360	42,081,280
7	All land in farms.....acres	31,951,934	1,099,058	809,024	30,043,852
8	Improved land in farms.....acres	18,125,321	508,103	97,177	17,520,041
9	Area irrigated in 1919.....acres	2,969	2,008	315	646
10	Per cent of improved land in farms.....	( <sup>1</sup> )	0.4	0.3	( <sup>1</sup> )
11	Area irrigated in 1909.....acres	4,388	138	708	3,542
12	Per cent of increase, 1909-1919.....	-32.3		-55.5	-81.8
13	Area enterprises were capable of irrigating in 1920.....acres	9,672	7,609	905	1,158
14	Area enterprises were capable of irrigating in 1910.....acres	6,397	259	995	5,143
15	Per cent of increase, 1910-1920.....	51.2		-9.0	-77.5
16	Area included in enterprises in 1920.....acres	11,742	7,609	2,255	1,878
17	Area included in enterprises in 1910.....acres	8,528	353	1,165	7,010
18	Per cent of increase, 1910-1920.....	37.7		93.6	-73.2
<b>IRRIGATION WORKS.</b>					
Independent enterprises:					
19	Number, 1920.....	33	3	6	24
20	Number, 1910.....	114	11	22	71
Main ditches:					
21	Number, 1920.....	18	3	5	10
22	Number, 1910.....	47	2	16	29
23	Length, 1920.....miles	38	17	14	7
24	Length, 1910.....miles	54	3	10	41
25	Capacity, 1920.....second-feet	344	150	123	71
26	Capacity, 1910.....second-feet	155	2	42	111
Laterals:					
27	Number, 1920.....	72	53	8	11
28	Number, 1910.....	106	13	59	34
29	Length, 1920.....miles	19	16	1	2
30	Length, 1910.....miles	31	3	13	15
Reservoirs:					
31	Number, 1920.....	8	1		7
32	Number, 1910.....	11	5		6
33	Capacity, 1920.....acre-feet	52			52
34	Capacity, 1910.....acre-feet	22	10		12
Flowing wells:					
35	Number, 1920.....	1			1
36	Number, 1910.....				
37	Capacity, 1920.....gallons per minute	100			100
38	Capacity, 1910.....gallons per minute				
Pumped wells:					
39	Number, 1920.....	19	1	1	17
40	Number, 1910.....	65	7	17	41
41	Capacity, 1920.....gallons per minute	3,643	35	1,600	2,008
42	Capacity, 1910.....gallons per minute	1,791	199	400	1,192
Pumping plants:					
43	Number, 1920.....	22	1	1	20
44	Number, 1910.....	68	7	18	43
45	Engine capacity, 1920.....horsepower	184		8	176
46	Engine capacity, 1910.....horsepower	107	7	32	68
47	Pump capacity, 1920.....gallons per minute	7,668	35	600	7,033
48	Pump capacity, 1910.....gallons per minute	4,541	199	1,240	3,102
49	Average lift, 1920.....feet	59		16	62
<b>CAPITAL INVESTED.</b>					
50	Capital invested to Jan. 1, 1920.....dollars	151,325	41,360	33,680	76,285
51	Capital invested to July 1, 1910.....dollars	47,200	3,699	8,360	35,141
52	Per cent of increase, 1910-1920.....	220.0		302.9	117.1
53	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars	15.65	5.44	37.22	65.88
54	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars	7.38	14.28	8.40	6.83
<b>ESTIMATED FINAL COST.</b>					
55	Estimated final cost of existing enterprises in 1920.....dollars	162,775	41,360	42,680	78,735
56	Estimated final cost of existing enterprises in 1910.....dollars	47,200	3,699	8,360	35,141
57	Per cent of increase, 1910-1920.....	244.9		410.5	124.1
58	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars	13.86	5.44	18.93	41.92
59	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars	5.53	10.48	7.18	5.01

<sup>1</sup> Less than one-tenth of 1 per cent.

# OREGON.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Oregon collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of show-

ing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	50,206	45,502	4,704	10.3
Approximate land area of the state.....acres..	61,188,480	61,188,480	.....	.....
All land in farms.....acres..	13,542,318	11,685,110	1,857,208	15.9
Improved land in farms.....acres..	4,913,851	4,274,803	639,048	14.9
Number of farms irrigated.....	9,154	6,669	2,485	37.3
Area irrigated.....acres..	986,162	686,129	300,033	43.7
Area enterprises were capable of irrigating.....acres..	1,344,046	830,526	513,520	61.8
Area included in enterprises.....acres..	1,925,987	2,527,208	-601,221	-23.8
Per cent irrigated:				
Number of all farms.....	18.2	14.7	3.5	.....
Approximate land area of the state.....	1.6	1.1	0.5	.....
Land in farms.....	7.3	5.9	1.4	.....
Improved land in farms.....	20.1	16.1	4.0	.....
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	357,884	144,397	213,487	147.8
Excess of area included in enterprises over area irrigated.....acres..	939,825	1,841,079	-901,254	-49.0
Area of irrigated land reported as available for settlement.....acres..	98,609	(?)	.....	.....
Capital invested.....	\$28,929,151	\$12,760,214	\$16,168,937	126.7
Average per acre enterprises were capable of irrigating.....	\$21.52	\$15.36	\$6.16	40.1
Estimated final cost of existing enterprises.....	\$41,585,742	\$39,216,619	\$2,369,123	6.0
Average per acre included in enterprises.....	\$21.59	\$15.52	\$6.07	39.1
Average cost of operation and maintenance per acre.....	\$1.19	\$0.75	\$0.44	58.7
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	4,710	3,745	965	25.8
Number of main ditches.....	5,252	3,582	1,670	46.6
Length of main ditches.....miles..	7,115	5,539	1,576	28.5
Capacity of main ditches.....second-feet..	28,897	39,686	-10,789	-27.2
Number of lateral ditches.....	2,784	2,518	266	10.6
Length of lateral ditches.....miles..	1,956	2,052	-96	-4.7
Number of reservoirs.....	266	271	-5	-1.8
Capacity of reservoirs.....acre-feet..	1,905,037	1,024,266	880,771	88.0
Number of flowing wells.....	65	51	14	.....
Capacity of flowing wells.....gallons per minute..	11,968	3,035	8,933	294.3
Number of pumped wells.....	208	92	116	.....
Capacity of pumped wells.....gallons per minute..	47,026	20,883	26,143	125.2
Number of pumping plants.....	573	229	344	150.2
Engine capacity.....horsepower..	13,769	3,095	10,674	344.9
Pump capacity.....gallons per minute..	600,045	118,514	481,531	406.3
Average lift.....feet..	28	(?)	28	.....

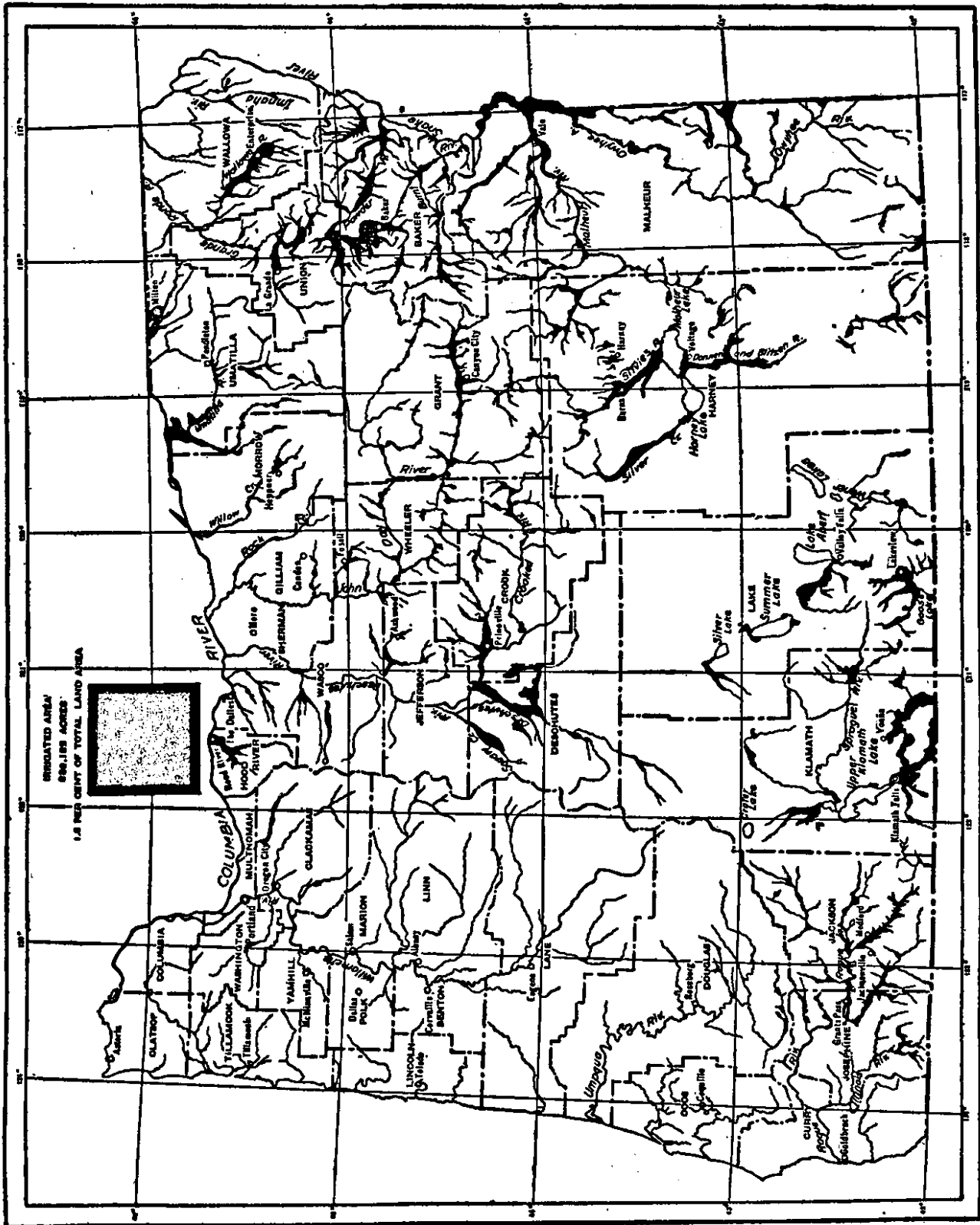
<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.

<sup>2</sup> Not reported in 1910.



# OREGON

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

The climatic conditions determining the necessity for irrigation are the amount and seasonal distribution of precipitation, principally rainfall. From the standpoint of amount of precipitation Oregon is divided into two distinct portions by the Cascade Mountains.

The portion of the state west of the Cascades receives the heaviest rainfall of any part of the United States, while east of the Cascades the rainfall is so small that this part of the state is mostly arid. West of the mountains, however, there is a fairly distinct dry season, only 10 per cent of the annual precipitation occurring in June, July, August, and September. This makes irrigation necessary to the maturing of crops whose growing season extends into the late summer, and makes it desirable for pastures at this season.

The chief characteristics of the climate of the part of the state east of the Cascades are a scanty rainfall, low humidity, rapid evaporation, and an abundance of sunshine. The annual precipitation ranges from 8 to 25 inches. At the summit of the Cascades the annual precipitation exceeds 40 inches; it decreases to the eastward, and reaches 15 inches about the center of the state. East of this there is a section receiving less than 15 inches, extending in a narrow strip to the north line of the state, but expanding to the southward, and occupying the whole southeast third of the state. In the Blue Mountains, in the northeastern part of the state, the precipitation increases to about 25 inches.

The precipitation is heaviest in the winter, but there is a secondary maximum in May and June, with a very dry period during the late summer. The relatively large winter and spring precipitation makes it possible to raise grain crops without irrigation in most sections in normal years, but irrigation is necessary for the growing of other crops except in some of the higher valleys.

The snowfall in the Cascades is very heavy, and snow remains on some of the higher peaks throughout the year.

For the state as a whole, precipitation in 1919 was slightly above the normal. There was a large excess in the western section and a slight deficiency in the eastern section. While the deficiency for the year was small, there was a marked drouth in spring and summer throughout the state, May and June recording the lowest amounts ever recorded for those months, and July having the lowest precipitation on record with two exceptions. In the eastern division of the state the precipitation from May to August, inclusive, was only 0.84 inch, which is but 26 per cent of the normal. As a consequence of this drouth both irrigated and nonirrigated crops suffered.

**WATER SUPPLY FOR IRRIGATION.**

West of the Cascade Mountains the heavy precipitation and the large flow of the streams provide an ample supply of water for the small amount of irrigation practiced during the summer dry season. Only small areas are irrigated in this part of the state.

Deschutes River and its tributaries drain the eastern slope of the Cascade Mountains in Oregon, and a considerable area of the high plains to the east of the mountains. Because of the character of its drainage area this river has a remarkably uniform flow, and, consequently, it is a valuable source of water for irrigation. Throughout its lower course it flows in a deep canyon and is not used for irrigation. In the central part of its course there are several large enterprises in the course of development.

John Day River rises in the Blue Mountains and flows west and north to the Columbia. The river and its tributaries are used for irrigation in the valleys near the headwaters, but for the last 100 miles of its course the river flows in a deep canyon and is not used for irrigation.

Umatilla River also rises in the Blue Mountains and flows in a northwesterly direction to the Columbia. There are large level areas along its lower course near the Columbia, and works have been built to utilize its waters.

Grande Ronde River, also, rises in the Blue Mountains. It flows to the northeast into Snake River. Near its source it flows through Grande Ronde Valley, where there is a large area of agricultural land.

Powder and Burnt Rivers rise in these same mountains and flow to the southeast into Snake River, supplying water to considerable areas.

Malheur River rises in the southern part of the Blue Mountains and flows in an easterly direction to Snake River. Its waters are used for irrigation.

Owyhee River rises in northern Nevada, flows through the southwest corner of Idaho, and then in a northerly direction in Oregon to Snake River. Its waters are used for irrigation in all three of the states through which it flows.

In south central Oregon there are many streams rising in the hills and flowing into lakes or sinks which have no outlets. The larger streams are Silvies River and Donner and Blitzen River. These flow into Malheur Lake, one from the north and the other from the south. Both are used for irrigation. There are many small streams of a similar character.

West of this Great Basin drainage is the drainage basin of Klamath River. There are large projects on this stream in the vicinity of Klamath Lake.

Taking the state as a whole, there are still large opportunities for irrigation development, since there are immense areas of tillable land, and large unused supplies of water.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	9,154	37.3	18.2	986,162	43.7	1.6	7.3	20.1
1910.....	6,669	43.9	14.7	686,129	76.7	1.1	5.9	16.1
1900.....	4,636	47.2	12.9	388,310	118.2	0.6	3.9	11.7
1890.....	3,150	.....	12.3	177,944	.....	0.4	2.6	5.1

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	4,710	1,925,987	986,162	51.2	1,344,046
Before 1860.....	64	10,528	8,206	77.9	9,409
1860-1869.....	211	56,754	46,917	82.7	51,216
1870-1879.....	433	130,199	90,950	69.9	101,727
1880-1889.....	889	276,788	198,653	71.8	248,987
1890-1899.....	782	181,282	123,043	67.9	143,186
1900-1904.....	461	237,259	123,643	52.1	172,549
1905-1909.....	390	434,996	142,756	32.8	237,680
1910-1914.....	513	257,931	91,426	35.5	111,068
1915-1919.....	478	214,025	62,458	29.2	151,145
Not reported.....	539	126,324	96,106	77.7	117,109

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	986,162	686,129	300,033	43.7	1,344,046	1,925,987
Streams, gravity.....	796,354	643,281	143,073	22.2	1,070,244	1,423,039
Streams, pumped.....	64,576	8,585	60,991	.....	81,138	96,562
Streams, pumped and gravity.....	258	( <sup>2</sup> )	258	.....	263	263
Wells, pumped.....	1,993	805	1,188	147.6	2,418	2,723
Wells, flowing.....	72	655	-583	-80.0	146	436
Wells, flowing and pumped.....	340	( <sup>2</sup> )	340	.....	340	340
Lakes, pumped.....	1,820	821	799	97.5	1,787	1,875
Lakes, gravity.....	5,750	22,915	-17,165	-74.9	31,779	31,779
Springs.....	9,584	10,783	-1,204	-11.2	10,610	13,813
Stored storm water.....	3,763	3,279	484	14.3	5,322	9,635
City water.....	258	( <sup>2</sup> )	258	.....	264	264
Sewage.....	10	( <sup>2</sup> )	10	.....	10	10
Streams, gravity, and pumped wells.....	105	( <sup>2</sup> )	105	.....	105	130
Streams, gravity, and flowing wells.....	200	( <sup>2</sup> )	200	.....	200	450
Other mixed.....	111,137	( <sup>2</sup> )	111,137	.....	139,073	344,475
Other and not reported.....	147	( <sup>2</sup> )	147	.....	147	163

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not included in 1909 classification.

ACREAGE, BY CHARACTER OF ENTERPRISE.

Oregon enacted its original irrigation district law in 1895, and this act, as amended from time to time, is still in force.

The conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894) were accepted by Oregon in

1901, and several large projects were begun under this act. These were not successful and in 1913 the state took over one of these projects and is completing it. This is reported under "Carey Act" in Table 5. The small area credited to the state belongs to a state institution, and does not represent a scheme of state construction.

The land in the Klamath project of the United States Reclamation Service has been organized into an irrigation district, but the acreage is credited to the Reclamation Service because the Government constructed the works and still controls them to a large extent. The Reclamation Service also supplies some water under special contract to lands included in another irrigation district and, to that extent, the acreage credited to the Reclamation Service in Table 5 does not represent the entire acreage receiving water from its works.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
ACREAGE IRRIGATED.				
Total.....	986,162	686,129	300,033	43.7
Individual and partnership.....	590,626	410,078	180,548	44.0
Cooperative.....	186,037	149,985	36,052	24.0
Irrigation district.....	92,081	1,500	90,581	.....
Carey Act.....	30,665	24,750	5,915	23.9
Commercial.....	27,338	77,387	-50,049	-64.7
U. S. Reclamation Service.....	54,981	22,000	32,981	149.9
U. S. Indian Service.....	4,000	429	3,571	832.4
State.....	.....	.....	.....	.....
City.....	330	( <sup>2</sup> )	330	.....
Other.....	104	( <sup>2</sup> )	104	.....
ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.				
Total.....	1,344,046	830,526	513,520	61.9
Individual and partnership.....	689,723	454,074	235,649	51.9
Cooperative.....	236,171	169,944	66,227	36.0
Irrigation district.....	198,540	1,500	197,040	.....
Carey Act.....	67,580	65,500	2,080	3.2
Commercial.....	67,163	93,750	-26,587	-28.4
U. S. Reclamation Service.....	76,525	45,319	31,206	68.9
U. S. Indian Service.....	7,600	439	7,161	.....
State.....	300	( <sup>2</sup> )	300	.....
City.....	340	( <sup>2</sup> )	340	.....
Other.....	104	( <sup>2</sup> )	104	.....
ACREAGE INCLUDED IN ENTERPRISES.				
Total.....	1,925,987	2,527,208	-601,221	-23.8
Individual and partnership.....	828,471	619,986	208,485	33.6
Cooperative.....	329,241	399,632	-70,391	-17.6
Irrigation district.....	271,172	5,980	265,192	.....
Carey Act.....	184,970	623,264	-438,294	-73.5
Commercial.....	150,289	692,467	-542,178	-78.3
U. S. Reclamation Service.....	171,444	185,000	-13,556	-7.3
U. S. Indian Service.....	9,600	879	8,721	992.2
State.....	300	( <sup>2</sup> )	300	.....
City.....	390	( <sup>2</sup> )	390	.....
Other.....	110	( <sup>2</sup> )	110	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not included in 1910 classification.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Oregon relating to water rights are summarized in the following paragraphs:

Although Oregon was admitted to the Union in 1859, there was no legislation relating to water rights until 1891, when a law relating principally to the rights of corporations organized to supply water for hire was enacted. This law contained the following general declaration regarding water rights:

"All existing appropriations of water made for beneficial purposes, by any person, corporation, or company, in accordance with the laws of the United States, or in accordance with the laws of the state of Oregon, or the decisions of its supreme court, or the established customs and regulations of the district in which such appropriations have been made, shall be respected and upheld to the extent of the amount of water actually appropriated."

In the same year, 1891, it was provided that in any suit regarding water rights all parties taking water from the same source might be made parties to the suit, in order that all rights might be settled in a single action.

In 1905 the office of state engineer was created, but he was given no control over the waters of the state.

In 1909 a new code of water laws was adopted. The state board of control was created and given control over the waters of the state. This board consisted of the state engineer and the superintendents of the two water divisions into which the state was divided. Parties wishing to acquire rights are required to make application to the state engineer for a permit. When rights have been perfected in accordance with a permit proof is submitted to the board of control, which issues a certificate showing what rights have been acquired.

This law also provided a new procedure for adjudicating existing rights. The state engineer and the superintendent of the water division in which the source, the rights to which are being adjudicated, is located, collect all information regarding rights, make surveys of streams, ditches, and lands, and prepare findings and an order defining all rights. All testimony, reports of surveys, and the findings and order are filed with the court, which holds hearings, and issues a decree fixing all rights. Certificates are issued to all claimants in accordance with the decree of court.

Riparian rights are recognized to some extent in Oregon.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	986,162	100.0	100.0
Appropriation and use.....	148,523	15.1	58.3
Notice filed and posted.....	150,332	15.3	29.0
Adjudicated by court.....	293,913	29.8	5.4
Permit from state.....	131,540	13.3	3.8
Certificate or license from state.....	217,228	22.0	.....
Riparian rights.....	14,277	1.5	3.5
Underground.....	3,235	0.3	(1)
Other and mixed.....	12,159	1.2	(1)
Not reported.....	14,955	1.5	(1)

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	986,162	439,981	124.1	1,925,987	1,344,046
Columbia River and tributaries.....	638,223	232,145	174.9	1,145,451	846,918
Columbia River direct.....	92	198	-53.5	223	123
Snake River and tributaries.....	394,205	167,790	134.9	623,538	489,719
Snake River direct.....	22,199	415	.....	31,925	25,469
Owyhee River.....	36,295	13,215	174.7	73,311	42,093
Malheur River.....	52,850	40,636	29.9	117,633	79,613
Burnt River.....	34,287	16,042	113.7	54,467	37,506
Powder River.....	146,036	58,482	149.7	186,463	165,322
Pine Creek.....	12,635	10,149	24.5	40,637	39,321
Imnaha River.....	4,828	3,781	27.7	10,148	8,069
Grande Ronde River.....	79,191	22,628	260.0	98,774	87,191
Other tributaries of Snake River.....	5,884	* 2,392	146.0	8,177	6,626
Walla Walla River.....	17,514	3,321	427.4	18,457	17,730
Umatilla River.....	43,571	4,485	871.5	99,012	83,341
Willow Creek.....	5,553	3,013	84.3	7,159	6,618
John Day River.....	36,141	27,604	30.9	48,191	41,492
Deschutes River.....	111,916	21,108	430.2	291,014	174,790
Hood River.....	19,765	2,837	596.7	39,660	21,101
Willamette River.....	2,892	448	545.5	4,656	4,302
Other tributaries of Columbia River.....	6,574	* 1,341	390.2	8,491	7,652
Rogue River and tributaries.....	38,669	13,900	177.5	131,131	52,816
Rogue River direct.....	3,256	638	505.2	14,166	4,073
Little Butte Creek.....	6,706	1,208	455.1	54,383	8,417
Bear Creek.....	8,319	2,902	186.7	28,275	14,573
Evans Creek.....	1,333	225	492.4	2,746	1,014
Applegate River.....	10,659	4,239	151.5	17,385	13,012
Illinois River.....	4,961	2,804	76.9	8,705	6,323
Other tributaries of Rogue River.....	3,335	* 1,984	68.1	5,521	4,204
Klamath River and tributaries.....	90,570	27,724	226.7	239,940	135,099
Klamath River direct.....	3,185	105	.....	5,910	5,800
Lost River.....	58,568	1,180	.....	194,748	95,304
Sprague River.....	7,800	3,690	111.4	10,150	9,980
Other tributaries of Klamath River.....	21,017	* 22,749	-7.6	29,132	24,015
Other Pacific Ocean streams.....	2,134	(?)	.....	8,695	3,663
Independent streams.....	216,666	166,212	30.4	400,770	305,660
Deep Creek.....	1,906	2,165	-12.0	2,118	2,088
Donner and Blitzen River.....	21,356	34,701	-38.5	54,331	27,956
Silver Creek.....	16,819	13,609	23.6	42,779	17,394
Silvies River.....	64,842	26,041	149.0	102,253	95,867
Thomas Creek.....	5,336	1,950	172.0	5,866	5,466
Other independent streams.....	106,357	* 87,716	21.3	192,818	156,789

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
\* Includes springs and wells.  
\* Not reported separately in 1902.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$28,929,151	126.7	\$21.52	40.1
1910.....	12,780,214	592.1	15.35	223.4
1900.....	1,843,771	123.3	4.75	2.4
1890.....	826,660	.....	4.64	.....

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$28,929,151	100.0	\$21.52
Before 1850.....	151,216	0.5	16.07
1860-1869.....	398,603	1.4	7.78
1870-1879.....	1,072,943	3.7	10.55
1880-1889.....	2,321,551	8.0	9.33
1890-1899.....	1,666,226	5.8	11.64
1900-1904.....	4,193,262	14.5	24.30
1905-1909.....	10,876,802	37.6	45.78
1910-1914.....	2,741,335	9.5	24.68
1915-1919.....	4,759,181	16.4	31.49
Not reported.....	748,032	2.6	6.39

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$28,929,151	100.0	\$21.52	801,891	\$1.19
Streams, gravity.....	20,028,187	69.2	18.71	631,124	1.00
Streams, pumped.....	2,807,806	9.7	34.61	59,087	3.09
Streams, pumped and gravity.....	3,700	(*)	14.07	253	2.55
Wells, pumped.....	118,306	0.4	48.93	1,419	3.04
Wells, flowing.....	6,900	(*)	47.26	66	9.47
Wells, pumped and flowing.....	2,600	(*)	7.65	20	18.00
Lakes, pumped.....	26,553	0.1	14.88	457	2.52
Lakes, gravity.....	783,702	2.7	24.66	1,735	0.90
Springs.....	165,946	0.6	15.64	6,735	0.92
Stored storm water.....	124,499	0.4	22.55	3,287	1.28
City water.....	153,650	0.5	582.01	252	23.89
Sewage.....	1,500	(*)	150.00	.....	.....
Streams, gravity, and pumped wells.....	11,500	(*)	109.52	95	17.89
Streams, gravity, and flowing wells.....	1,000	(*)	5.00	200	4.00
Other mixed.....	4,091,073	16.2	33.73	97,014	1.13
Not reported.....	2,200	(*)	14.97	147	0.78

<sup>1</sup> Based on area irrigated in 1919.  
<sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE.	
			Amount.	Per cent. <sup>1</sup>
Total.....	\$28,929,151	\$2,089,609	\$26,839,542	.....
Columbia River and tributaries.....	18,480,068	1,385,671	17,094,397	.....
Columbia River direct.....	11,150	3,500	7,650	218.6
Snake River and tributaries.....	7,093,652	971,743	6,121,909	630.0
Snake River direct.....	909,478	15,154	894,324	.....
Owyhee River.....	1,154,185	191,736	962,449	502.0
Malheur River.....	2,027,683	282,898	1,744,785	616.8
Burnt River.....	639,491	65,691	573,800	873.5
Powder River.....	1,552,987	268,101	1,284,886	479.3
Pine Creek.....	97,522	36,595	60,927	186.5
Imnaha River.....	206,378	10,885	195,493	.....
Grande Ronde River.....	471,436	82,011	389,425	474.8
Other tributaries of Snake River.....	34,492	* 13,672	15,820	84.7
Walla Walla River.....	280,934	4,885	276,049	.....
Umatilla River.....	4,308,862	61,430	4,247,432	.....
Willow Creek.....	60,139	20,375	39,764	195.2
John Day River.....	510,248	120,080	390,168	325.0
Deschutes River.....	5,078,636	138,755	4,939,881	.....
Hood River.....	807,269	54,000	753,269	.....
Willamette River.....	100,561	3,240	97,321	.....
Other tributaries of Columbia River.....	228,587	* 7,683	220,904	.....
Rogue River and tributaries.....	1,783,989	147,223	1,636,766	.....
Rogue River direct.....	166,665	7,540	159,125	.....
Little Butte Creek.....	604,794	10,490	594,304	.....
Bear Creek.....	615,878	20,595	595,283	.....
Evans Creek.....	40,836	2,676	38,161	.....
Applegate River.....	180,894	60,325	120,569	199.9
Illinois River.....	87,066	27,743	60,218	217.0
Other tributaries of Rogue River.....	87,066	* 17,650	70,406	401.2
Klamath River and tributaries.....	3,811,982	247,660	3,564,322	.....
Klamath River direct.....	43,141	1,100	42,041	.....
Lost River.....	3,451,383	17,650	3,433,733	.....
Sprague River.....	32,368	26,660	5,808	21.9
Other tributaries of Klamath River.....	265,040	* 202,350	62,690	40.9
Other Pacific Ocean streams.....	191,200	(*)	191,200	.....
Independent streams.....	4,661,962	309,155	4,352,807	.....
Deep Creek.....	6,829	6,100	729	12.0
Donner and Blitzen River.....	131,750	85,400	46,350	272.2
Silver Creek.....	26,016	21,845	4,171	19.1
Silvies River.....	1,005,862	74,310	931,552	.....
Thomas Creek.....	5,366	5,366	1,146	21.4
Other independent streams.....	3,484,999	* 166,140	3,318,859	.....

<sup>1</sup> Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.  
<sup>3</sup> Not reported separately in 1902.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of some of the other classes shown in the table and a part of its expenditure is properly chargeable to those lands, but it is not possible to tell how much should be so charged or how it should be distributed among the various classes.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$28,929,151	100.0	801,891	\$1.19
Individual and partnership.....	6,584,382	22.8	463,527	0.95
Cooperative.....	3,143,698	10.8	157,111	1.09
Irrigation district.....	6,313,753	21.8	72,535	1.56
Carey Act.....	3,231,296	11.2	30,665	2.26
Commercial.....	3,281,034	11.3	18,638	2.47
U. S. Reclamation Service.....	5,956,950	20.6	54,981	1.85
U. S. Indian Service.....	230,038	0.8	4,000	1.00
State.....	16,107	0.1	.....	.....
City.....	171,068	0.6	330	18.39
Other.....	823	(*)	104	0.44

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	176
Acreage included in enterprises reporting land drained or needing drainage.....	347,750
Acreage for which drains have been installed.....	93,799
Additional acreage needing drainage.....	46,115
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	27.0
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	4.9
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	7.3

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. Those representing estimates are reported separately in Table 14.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-foot.....	8,311	2,926	5,385
Area irrigated in 1919.....acres.....	446,014	180,022	265,992
Average number of acres per second-foot.....	54	62	49
Total quantity of water entering canals, acre-foot.....	2,237,727	1,016,713	1,221,014
Area irrigated in 1919.....acres.....	498,843	212,100	286,743
Average quantity per acre.....acre-foot.....	4.5	4.8	4.3
Total quantity of water delivered.....acre-foot.....	458,890	159,035	299,855
Area irrigated in 1919.....acres.....	206,448	109,326	97,122
Average quantity per acre.....acre-foot.....	2.2	1.5	3.1



## IRRIGATION—OREGON.

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	3,285	300	5,252	28,997	7,115	2,784	1,956	266	1,005,037
Columbia River and tributaries.....	2,458	168	3,901	19,161	5,300	1,866	1,256	163	798,736
Columbia River direct.....			4	2	1			3	1
Snake River and tributaries.....	1,162	103	2,150	10,917	3,121	772	499	109	634,850
Snake River direct.....			40	330	105	9	7	1	4,743
Owyhee River.....	96	18	125	1,555	236	8	11	15	19,195
Malheur River.....	256	34	350	2,022	540	92	84	31	368,448
Burnt River.....	213	8	318	781	400	20	14	14	12,331
Powder River.....	291	19	651	3,754	1,133	287	202	37	13,484
Pine Creek.....	51	4	83	178	107	7	18	3	10,350
Imnaha River.....	34	1	86	102	73	16	13	1	200
Grande Ronde River.....	203	19	475	1,883	483	329	138	6	205,230
Other tributaries of Snake River.....	18		22	314	44	4	2	1	880
Walla Walla River.....	101	7	170	404	140	331	66	4	15,000
Umatilla River.....	139	10	229	2,007	318	201	143	4	54,700
Willow Creek.....	71	7	94	110	94	18	11		
John Day River.....	504	8	670	1,052	655	151	52	10	39,236
Deschutes River.....	361	25	390	4,023	768	226	233	8	52,927
Hood River.....	34	5	72	435	89	86	132	5	13
Willamette River.....	15		40	148	53	15	5	2	
Other tributaries of Columbia River.....	71	3	82	63	62	66	25	8	
Rogue River and tributaries.....	257	18	645	1,978	837	169	117	47	35,882
Rogue River direct.....	8		26	149	38	2	3	9	1
Little Butte Creek.....	13	2	58	161	108	86	50	3	5,350
Bear Creek.....	29	6	99	512	159	18	37	10	30,507
Evans Creek.....	22		34	66	41	11	3		
Applegate River.....	55	4	164	434	241	17	8	15	16
Illinois River.....	87	3	135	400	127	19	10	4	1
Other tributaries of Rogue River.....	43	3	129	266	123	16	6	6	7
Klamath River and tributaries.....	57	18	121	3,162	231	259	324	20	927,311
Klamath River direct.....	4		22	62	43	3			
Lost River.....	8	13	39	1,889	71	113	232	14	925,923
Sprague River.....	9	5	15	212	34	6	8	6	1,368
Other tributaries of Klamath River.....	36		45	999	83	137	84		
Other Pacific Ocean streams.....	78	8	107	238	92	39	20	5	10,005
Independent streams.....	435	97	478	4,358	655	451	239	41	135,108
Deep Creek.....	1		10	18	11				
Donner and Blitzen River.....	44	6	30	239	74	122	84	6	57,590
Silver Creek.....	24	1	24	398	39	31	2		
Silvies River.....	206	72	187	876	230	115	54	17	360
Thomas Creek.....			10	10	28			1	
Other independent streams.....	150	18	217	2,817	283	183	99	17	77,168

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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse- power).	Pumps.		Aver- age lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	159.6	65	11,968	208	47,026	573	13,769	614	600,045	28
Columbia River and tributaries.....	132.2	19	1,182	178	32,077	415	11,470	442	491,607	28
Columbia River direct.....	2.5			9	178	11	42	12	2,418	45
Snake River and tributaries.....	29.2	12	1,102	39	9,818	176	9,289	190	377,160	24
Snake River direct.....	14.4			46	5,594	46	5,594	60	185,022	31
Owyhee River.....	2.4	4	787	2	240	60	1,812	60	80,153	28
Malheur River.....	2.0			2	60	10	521	10	30,010	17
Burnt River.....	1.0					3	24	3	965	17
Powder River.....	7.9	8	315	13	4,780	14	1,601	14	69,132	33
Imnaha River.....	0.1					4	23	4	500	40
Grande Ronde River.....	1.1			20	4,203	35	189	35	10,743	12
Other tributaries of Snake River.....	0.3			2	535	4	25	4	636	12
Walla Walla River.....	23.6	1		88	19,325	90	467	93	19,425	25
Umatilla River.....	14.3	2		6	171	13	115	13	4,246	34
Willow Creek.....	0.3					1	2	1	200	12
John Day River.....	5.7			6	475	45	413	47	41,230	25
Deschutes River.....	8.5			3	336	22	764	26	36,564	33
Hood River.....	38.6	3	10	1	17	5	36	5	755	70
Willamette River.....	3.2			15	1,339	30	220	32	7,813	24
Other tributaries of Columbia River.....	6.3	1	70	11	338	23	122	23	1,748	52
Rogue River and tributaries.....	20.5	3	10,000	23	11,499	102	723	111	38,147	26
Rogue River direct.....	7.1			11	6,964	44	347	44	16,597	30
Little Butte Creek.....	0.8					1	9	1		28
Bear Creek.....	6.3			9	1,133	28	120	36	8,138	23
Evans Creek.....	0.5					5	77	5	1,175	29
Applegate River.....	2.1					8	93	8	3,200	26
Illinois River.....	1.0			2	402	7	32	8	3,067	11
Other tributaries of Rogue River.....	2.7	3	10,000	1	3,000	9	45	9	5,970	25
Klamath River and tributaries.....	3.0	1	35	2	1,600	31	1,301	36	62,475	31
Klamath River direct.....	1.7					14	453	15	30,775	31
Lost River.....	0.6			2	1,600	14	786	18	21,100	22
Other tributaries of Klamath River.....	0.7	1	35			3	62	5	10,600	30
Other Pacific Ocean streams.....	3.2	1				10	66	10	3,705	49
Independent streams.....	0.7	41	751	5	1,850	14	209	15	4,111	26
Deep Creek.....		1				1	6	2	1,000	10
Donner and Blitzen River.....		1	10			1		1		16
Silver Creek.....		1	2			2	6	3	550	15
Silvies River.....				2	450	2	26	2	1,265	22
Other independent streams.....	0.7	38	739	1	200	7	171	7	1,296	51



IRRIGATION—OREGON.

CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	1,784	5.5	686	4.0	187.1	Bu.....	62,167	7.3	17,921	4.0	246.9
2 Oats.....	7,980	2.8	20,415	6.0	-60.9	Bu.....	235,637	2.8	896,427	8.2	-73.7
3 Winter wheat.....	4,511	0.6	21,059	2.8	24.9	Bu.....	78,649	0.5	569,942	4.6	-18.2
4 Spring wheat.....	21,799	8.3	18,305	16.9	-58.7	Bu.....	387,487	11.3	565,074	23.8	-61.7
5 Barley.....	7,602	11.4	1,458	11.3	32.3	Bu.....	216,493	15.1	17,662	12.0	4.6
6 Rye.....	1,929	4.5									
<b>Hay and forage:</b>											
7 Timothy alone.....	5,340	17.4	15,297	40.6	-67.2	Tons.....	7,066	15.5	31,871	47.4	-77.8
8 Timothy and clover mixed.....	23,377	28.6	17,592	26.4	32.9	Tons.....	33,494	24.7	31,009	24.0	8.0
9 Clover alone.....	5,275	9.9	1,549	3.3	240.5	Tons.....	9,795	9.5	3,337	4.0	103.5
10 Alfalfa.....	102,409	48.6	100,623	83.6	1.8	Tons.....	309,206	52.2	331,515	83.3	-6.7
11 Other tame grasses.....	7,094	8.6	3,442	5.6	106.1	Tons.....	9,759	6.8	6,329	5.9	54.2
12 Small grains cut for hay.....	23,022	4.9	14,172	3.8	73.2	Tons.....	26,695	4.8	21,530	4.2	29.7
13 Annual legumes cut for hay.....	1,523	6.2				Tons.....	1,219	3.1			
14 Wild, salt, or prairie grasses.....	51,453	22.7	138,143	63.8	-62.8	Tons.....	49,792	18.6	157,100	63.1	-68.3
15 Silage crops.....	1,432	4.2	( <sup>2</sup> )			Tons.....	6,578	3.6	( <sup>2</sup> )		
<b>Vegetables:</b>											
16 Potatoes.....	1,880	4.7	3,402	7.7	-44.7	Bu.....	181,986	5.1	413,167	8.6	-56.0
<b>Fruits:</b>											
17 Grapes.....	8,525	2.4	( <sup>3</sup> )			Lbs.....	110,395	3.9	( <sup>3</sup> )		
18 Apples.....	177,789	5.4	( <sup>3</sup> )			Bu.....	402,912	5.8	( <sup>3</sup> )		
19 Peaches.....	25,953	8.3	( <sup>3</sup> )			Bu.....	50,692	10.0	( <sup>3</sup> )		
20 Pears.....	115,520	15.9	( <sup>3</sup> )			Bu.....	141,258	18.6	( <sup>3</sup> )		
21 Plums and prunes.....	21,664	0.7	( <sup>3</sup> )			Bu.....	36,930	1.7	( <sup>3</sup> )		
22 Cherries.....	6,656	1.7	( <sup>3</sup> )			Bu.....	7,803	2.6	( <sup>3</sup> )		

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919	Per cent of total for state.	1909	Per cent of total for state.	Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on nonirrigated land.					
<b>Cereals:</b>											
1 Corn.....	Bu.....	26.5	26.0	85.2	132.8	135.4	\$102,576	7.3	\$15,187	4.9	575.4
2 Oats.....	Bu.....	29.4	29.4	29.5	100.3	100.3	223,855	2.8	485,570	9.6	-53.9
3 Winter wheat.....	Bu.....	19.7	19.7	17.4	88.3	88.3	165,949	0.5	507,089	4.7	94.0
4 Spring wheat.....	Bu.....	18.0	12.6	17.8	136.9	141.3	817,598	11.3			
5 Barley.....	Bu.....	31.5	20.6	28.5	132.6	138.3	335,564	15.1	380,643	26.2	-11.8
6 Rye.....	Bu.....	7.4	7.3	9.6	129.7	131.5	38,787	5.9	14,463	10.9	168.2
<b>Hay and forage:</b>											
7 Timothy alone.....	Tons.....	1.48	1.52	1.32	89.2	86.8	176,650	15.5	235,065	39.4	-38.0
8 Timothy and clover mixed.....	Tons.....	1.66	1.75	1.43	86.1	81.7	770,132	24.7	286,819	19.5	168.6
9 Clover alone.....	Tons.....	1.94	1.95	1.86	95.9	95.4	200,797	9.5	41,106	4.4	388.5
10 Alfalfa.....	Tons.....	2.81	2.62	3.02	107.5	115.3	6,493,326	52.2	2,756,575	84.2	135.5
11 Other tame grasses.....	Tons.....	1.74	1.77	1.38	79.3	78.0	175,662	6.8	61,342	5.7	186.4
12 Small grains cut for hay.....	Tons.....	1.24	1.25	1.16	93.5	92.8	560,695	4.6	228,339	4.0	156.2
13 Annual legumes for hay.....	Tons.....	1.61	1.66	0.80	49.7	48.2	24,380	3.1			
14 Wild, salt, or prairie grasses.....	Tons.....	1.18	1.24	0.97	82.2	78.2	796,672	18.6	1,056,442	62.7	-24.6
15 Silage crops.....	Tons.....	5.43	5.47	4.59	84.5	83.9	68,780	3.6	( <sup>2</sup> )		
<b>Vegetables:</b>											
16 Potatoes.....	Bu.....	88.4	87.9	96.8	109.5	110.1	382,171	5.1	243,019	11.6	57.3
<b>Fruits:</b>											
17 Grapes.....	Lbs.....	7.9	7.7	12.9	163.3	167.5	6,624	3.9	( <sup>3</sup> )		
18 Apples.....	Bu.....	2.1	2.1	2.3	109.5	109.5	543,931	5.8	( <sup>3</sup> )		
19 Peaches.....	Bu.....	1.2	1.2	2.0	166.7	166.7	78,573	10.0	( <sup>3</sup> )		
20 Pears.....	Bu.....	1.0	1.0	1.2	120.0	120.0	226,013	18.6	( <sup>3</sup> )		
21 Plums and prunes.....	Bu.....	0.7	0.7	1.7	242.9	242.9	81,246	1.7	( <sup>3</sup> )		
22 Cherries.....	Bu.....	0.8	0.8	1.2	150.0	150.0	27,310	2.6	( <sup>3</sup> )		

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not reported separately in 1909.

<sup>3</sup> Number of vines of bearing age.  
<sup>4</sup> Number of trees of bearing age.

<sup>5</sup> Yield per vine.  
<sup>6</sup> Yield per tree.

IRRIGATION—OREGON.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.]

	THE STATE.	Baker. <sup>1</sup>	Crook. <sup>2</sup>	Deschutes. <sup>2</sup>	Douglas.	Gilliam.	Grant.	
1	Number of all farms in 1920.....	50,206	1,509	861	751	2,275	454	728
2	Number of farms irrigated in 1919.....	9,154	1,102	301	550	78	53	364
3	Per cent of all farms.....	18.2	73.0	53.7	73.2	3.4	11.7	50.0
4	Number of farms irrigated in 1909.....	6,669	1,051	546	.....	132	51	341
5	Per cent of increase, 1909-1919.....	37.3	4.9	.....	.....	-40.9	.....	6.7
<b>LAND AND FARM AREA.</b>								
6	Approximate land area.....acres..	61,188,480	1,975,040	1,877,760	1,961,600	3,194,240	768,640	2,892,800
7	All land in farms.....acres..	13,542,318	493,145	554,960	144,979	566,305	486,941	750,160
8	Improved land in farms.....acres..	4,913,851	163,317	93,657	51,744	136,553	259,002	74,729
9	Area irrigated in 1919.....acres..	986,162	171,490	42,708	57,293	1,901	3,298	32,409
10	Per cent of improved land in farms.....	20.1	105.0	45.5	110.7	1.4	1.3	43.4
11	Area irrigated in 1909.....acres..	688,129	129,673	55,900	.....	1,708	2,087	36,069
12	Per cent of increase, 1909-1919.....	43.7	32.2	.....	.....	11.3	58.0	-10.1
13	Area enterprises were capable of irrigating in 1920.....acres..	1,344,046	218,671	52,757	106,246	3,328	3,810	38,728
14	Area enterprises were capable of irrigating in 1910.....acres..	830,526	136,014	111,360	.....	4,500	2,367	38,631
15	Per cent of increase, 1910-1920.....	61.8	60.8	.....	.....	-28.0	61.0	0.3
16	Area included in enterprises in 1920.....acres..	1,925,987	259,361	62,449	176,387	8,370	4,621	42,079
17	Area included in enterprises in 1910.....acres..	2,527,208	241,919	453,811	.....	9,349	3,370	73,578
18	Per cent of increase, 1910-1920.....	-23.8	7.2	.....	.....	-10.5	37.1	-42.8
19	Area of irrigated land reported as available for settlement.....acres..	98,609	2,002	1,278	23,675	.....	.....	.....
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
20	Number, 1920.....	4,710	825	158	38	93	52	289
21	Number, 1910.....	3,745	566	202	.....	107	43	310
<b>Main ditches:</b>								
22	Number, 1920.....	5,252	959	212	35	98	51	512
23	Number, 1910.....	3,532	606	217	.....	86	47	396
24	Length, 1920.....miles..	7,115	1,461	313	255	87	60	516
25	Length, 1910.....miles..	5,539	1,175	594	.....	79	54	513
26	Capacity, 1920.....second-feet..	28,897	3,925	734	2,898	234	64	801
27	Capacity, 1910.....second-feet..	39,686	7,631	2,907	.....	320	202	1,771
<b>Laterns:</b>								
28	Number, 1920.....	2,784	302	97	93	38	19	90
29	Number, 1910.....	2,518	313	222	.....	31	96	140
30	Length, 1920.....miles..	1,856	201	111	142	20	5	41
31	Length, 1910.....miles..	2,052	309	340	.....	8	33	37
<b>Reservoirs:</b>								
32	Number, 1920.....	266	53	3	4	4	1	8
33	Number, 1910.....	271	75	11	.....	4	4	5
34	Capacity, 1920.....acre-feet..	1,905,037	36,145	47,101	5,123	10,005	.....	36,896
35	Capacity, 1910.....acre-feet..	1,024,266	100,938	11,856	.....	5	2	8
<b>Flowing wells:</b>								
36	Number, 1920.....	65	8	.....	.....	1	.....	.....
37	Number, 1910.....	51	3	.....	.....	.....	.....	.....
38	Capacity, 1920.....gallons per minute..	11,968	315	.....	.....	.....	.....	.....
39	Capacity, 1910.....gallons per minute..	3,035	19	.....	.....	.....	.....	.....
<b>Pumped wells:</b>								
40	Number, 1920.....	208	13	2	.....	.....	1	1
41	Number, 1910.....	92	4	.....	.....	.....	4	1
42	Capacity, 1920.....gallons per minute..	47,026	4,780	371	.....	.....	20	30
43	Capacity, 1910.....gallons per minute..	20,883	1,003	.....	.....	.....	66	35
<b>Pumping plants:</b>								
44	Number, 1920.....	573	19	11	1	9	8	2
45	Number, 1910.....	239	8	5	.....	3	10	1
46	Engine capacity, 1920.....horsepower..	13,769	1,668	430	200	56	41	12
47	Engine capacity, 1910.....horsepower..	8,095	159	512	.....	13	43	1
48	Pump capacity, 1920.....gallons per minute..	600,045	71,297	23,121	7,500	3,225	1,710	22,630
49	Pump capacity, 1910.....gallons per minute..	118,514	5,964	5,648	.....	583	2,621	35
50	Average lift, 1920.....feet..	28	31	32	120	54	21	28
<b>CAPITAL INVESTED.</b>								
51	Capital invested to Jan. 1, 1920.....dollars..	28,929,151	2,153,639	1,789,917	2,758,084	188,894	110,909	261,332
52	Capital invested to July 1, 1910.....dollars..	12,760,214	1,446,334	1,061,817	.....	78,127	32,809	241,086
53	Per cent of increase, 1910-1920.....	126.7	48.9	.....	.....	141.8	238.0	8.4
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	21.52	9.85	33.93	25.96	56.76	29.11	6.75
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	15.36	10.63	17.62	.....	17.36	13.86	6.24
<b>ESTIMATED FINAL COST.</b>								
56	Estimated final cost of existing enterprises in 1920.....dollars..	41,585,742	2,941,589	2,115,043	4,747,115	294,994	111,409	266,607
57	Estimated final cost of existing enterprises in 1910.....dollars..	39,216,619	5,272,463	4,842,062	.....	78,127	32,809	250,936
58	Per cent of increase, 1910-1920.....	6.0	-44.2	.....	.....	277.6	239.6	6.2
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	21.59	11.34	33.87	26.91	35.24	24.11	6.38
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	15.52	21.79	10.67	.....	8.36	9.74	8.41

<sup>1</sup> Part of Union County annexed in 1902.

<sup>2</sup> Parts of Crook County were taken to form Jefferson County in 1915 and Deschutes County in 1916.

IRRIGATION—OREGON.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease.]

	Harney.	Hood River. <sup>1</sup>	Jackson.	Jefferson. <sup>2</sup>	Josephine.	Klamath.	Lake.
1 Number of all farms in 1920.....	589	878	1,720	572	727	992	549
2 Number of farms irrigated in 1919.....	295	811	754	53	419	508	286
3 Per cent of all farms.....	50.1	92.4	43.8	9.3	57.6	51.2	46.6
4 Number of farms irrigated in 1909.....	256	464	428	.....	401	266	198
5 Per cent of increase, 1909-1919.....	15.2	74.8	77.0	.....	4.5	91.0	29.3
<b>LAND AND FARM AREA.</b>							
6 Approximate land area..... acres..	6,357,120	345,600	1,788,160	1,138,560	1,047,630	3,839,360	5,068,800
7 All land in farms..... acres.....	524,678	28,075	312,936	440,826	97,299	357,333	526,218
8 Improved land in farms..... acres..	176,934	19,664	92,810	132,812	29,537	152,742	183,396
9 Area irrigated in 1919..... acres..	119,429	19,765	24,002	3,320	14,903	90,993	90,220
10 Per cent of improved land in farms.....	67.5	100.5	26.0	2.5	50.5	59.6	54.1
11 Area irrigated in 1909..... acres..	129,135	8,071	12,239	.....	12,866	46,975	57,078
12 Per cent of increase, 1909-1919.....	-7.5	144.9	96.1	.....	15.8	93.7	73.8
13 Area enterprises were capable of irrigating in 1920..... acres..	157,588	21,101	34,931	3,943	18,294	135,449	149,467
14 Area enterprises were capable of irrigating in 1910..... acres..	136,621	14,150	17,978	.....	14,503	62,785	59,612
15 Per cent of increase, 1910-1920.....	15.3	49.1	94.3	.....	26.1	115.7	150.7
16 Area included in enterprises in 1920..... acres..	224,301	39,660	107,195	6,171	25,127	229,478	183,997
17 Area included in enterprises in 1910..... acres..	561,548	48,964	82,427	.....	24,059	208,105	273,546
18 Per cent of increase, 1910-1920.....	-60.1	-19.0	30.0	.....	4.4	15.1	-32.7
19 Area of irrigated land reported as available for settlement..... acres..	2,000	15,060	2,200	.....	394	2,000	.....
<b>IRRIGATION WORKS.</b>							
<b>Independent enterprises:</b>							
20 Number, 1920.....	328	77	345	51	309	90	149
21 Number, 1910.....	228	75	276	.....	269	52	171
<b>Main ditches:</b>							
22 Number, 1920.....	299	72	363	62	292	115	153
23 Number, 1910.....	143	61	245	.....	221	42	133
24 Length, 1920..... miles..	413	88	537	82	311	237	267
25 Length, 1910..... miles..	306	88	305	.....	220	162	247
26 Capacity, 1920..... second-feet..	1,752	435	1,048	117	952	3,135	2,778
27 Capacity, 1910..... second-feet..	1,826	369	1,748	.....	931	2,964	2,212
<b>Laterals:</b>							
28 Number, 1920.....	278	86	124	10	49	255	181
29 Number, 1910.....	327	59	53	.....	35	59	99
30 Length, 1920..... miles..	153	132	100	3	20	321	98
31 Length, 1910..... miles..	151	68	57	.....	17	160	54
<b>Reservoirs:</b>							
32 Number, 1920.....	32	5	23	1	24	14	17
33 Number, 1910.....	28	13	25	.....	19	8	17
34 Capacity, 1920..... acre-feet..	133,765	13	35,871	700	11	926,361	77,513
35 Capacity, 1910..... acre-feet..	363,140	5	45,907	.....	7	181,274	64,901
<b>Flowing wells:</b>							
36 Number, 1920.....	32	3	.....	.....	3	1	9
37 Number, 1910.....	25	.....	2	.....	1	20	.....
38 Capacity, 1920..... gallons per minute..	179	10	.....	.....	10,000	35	572
39 Capacity, 1910..... gallons per minute..	54	.....	225	.....	17	2,720	.....
<b>Pumped wells:</b>							
40 Number, 1920.....	5	1	12	1	11	2	1
41 Number, 1910.....	1	1	14	.....	11	.....	.....
42 Capacity, 1920..... gallons per minute..	1,650	17	10,133	15	1,366	1,600	300
43 Capacity, 1910..... gallons per minute..	400	100	5,533	.....	2,200	.....	.....
<b>Pumping plants:</b>							
44 Number, 1920.....	9	5	51	6	51	31	6
45 Number, 1910.....	2	2	21	.....	32	2	.....
46 Engine capacity, 1920..... horsepower..	38	36	345	9	378	1,303	171
47 Engine capacity, 1910..... horsepower..	10	10	165	.....	168	224	.....
48 Pump capacity, 1920..... gallons per minute..	1,815	755	18,410	240	19,737	62,475	2,296
49 Pump capacity, 1910..... gallons per minute..	496	231	19,086	.....	9,831	9,720	.....
50 Average lift, 1920..... feet..	18	70	28	10	24	26	44
<b>CAPITAL INVESTED.</b>							
51 Capital invested to Jan. 1, 1920..... dollars..	1,280,776	807,142	1,462,938	84,300	265,575	3,802,551	3,504,761
52 Capital invested to July 1, 1910..... dollars..	410,980	361,714	457,936	.....	239,327	1,910,580	769,906
53 Per cent of increase, 1910-1920.....	211.6	123.1	219.5	.....	11.0	99.0	355.2
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	8.13	38.25	41.58	21.38	14.52	28.07	23.45
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	3.01	25.56	25.47	.....	16.50	30.43	12.92
<b>ESTIMATED FINAL COST.</b>							
56 Estimated final cost of existing enterprises in 1920..... dollars..	2,036,295	1,174,817	4,807,783	85,943	285,645	5,566,847	3,896,351
57 Estimated final cost of existing enterprises in 1910..... dollars..	2,501,980	392,214	1,770,936	.....	239,327	5,110,580	7,338,681
58 Per cent of increase, 1910-1920.....	-18.6	199.6	171.5	.....	13.2	8.9	-46.9
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	9.08	29.62	44.85	13.93	11.37	23.25	21.18
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	4.46	3.01	21.48	.....	9.95	24.56	26.83

<sup>1</sup> Organized from part of Wasco County in 1903.

<sup>2</sup> Organized from part of Crook County in 1915.

# IRRIGATION—OREGON.

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COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

		Malheur.	Morrow.	Umatilla.	Union. <sup>1</sup>	Wallowa.	Wasco. <sup>2</sup>	Wheeler.	All other counties.
1	Number of all farms in 1920.....	1,323	692	2,353	1,279	1,149	1,339	359	29,408
2	Number of farms irrigated in 1919.....	946	191	1,149	469	427	267	187	24
3	Per cent of all farms.....	71.6	27.6	48.8	36.7	37.2	19.9	52.2	0.1
4	Number of farms irrigated in 1909.....	623	143	432	293	203	88	184	90
5	Per cent of increase, 1909-1919.....	52.1	33.6	67.7	8.6	45.7	.....	-25.5	.....
<b>LAND AND FARM AREA.</b>									
6	Approximate land area..... acres..	6,325,120	1,296,000	2,049,920	1,284,480	2,028,160	1,499,520	1,090,560	13,359,360
7	All land in farms..... acres..	465,851	781,613	1,076,400	441,735	524,029	728,226	485,178	3,746,331
8	Improved land in farms..... acres..	129,365	290,290	621,660	178,021	141,404	213,553	40,104	1,782,767
9	Area irrigated in 1919..... acres..	109,463	10,031	58,050	53,183	52,445	9,332	7,475	7,402
10	Per cent of improved land in farms.....	84.6	3.5	9.0	29.9	37.1	4.4	13.6	0.4
11	Area irrigated in 1909..... acres..	67,628	7,541	31,022	35,831	39,370	5,703	6,253	982
12	Per cent of increase, 1909-1919.....	61.9	80.0	80.7	48.4	33.2	64.5	19.5	653.8
13	Area enterprises were capable of irrigating in 1920..... acres..	143,266	15,561	91,543	61,444	56,601	13,611	8,692	9,015
14	Area enterprises were capable of irrigating in 1910..... acres..	79,210	8,116	50,213	37,260	42,855	5,989	6,983	1,379
15	Per cent of increase, 1910-1920.....	80.9	61.7	82.8	64.9	32.1	127.8	24.5	553.7
16	Area included in enterprises in 1920..... acres..	219,475	19,941	104,015	69,414	64,513	48,742	11,005	9,686
17	Area included in enterprises in 1910..... acres..	208,025	14,937	94,169	45,517	54,692	17,276	9,414	102,502
18	Per cent of increase, 1910-1920.....	5.5	33.5	10.5	52.5	18.0	182.1	16.9	-90.6
19	Area of irrigated land reported as available for settlement..... acres..	10,000	.....	6,000	.....	.....	24,000	.....	.....
<b>IRRIGATION WORKS.</b>									
Independent enterprises:									
20	Number, 1920.....	354	109	497	311	230	148	156	101
21	Number, 1910.....	330	121	281	225	160	79	164	86
Main ditches:									
22	Number, 1920.....	496	110	375	362	295	144	185	62
23	Number, 1910.....	311	148	278	164	144	83	206	51
24	Length, 1920..... miles..	320	124	418	404	337	160	179	48
25	Length, 1910..... miles..	645	123	350	255	249	62	164	40
26	Capacity, 1920..... second-feet..	4,013	551	1,932	1,331	1,398	328	271	161
27	Capacity, 1910..... second-feet..	4,168	542	2,267	7,062	1,913	199	490	164
Laterals:									
28	Number, 1920.....	86	50	507	197	160	90	46	26
29	Number, 1910.....	271	94	283	159	62	108	64	64
30	Length, 1920..... miles..	82	45	175	97	87	99	16	8
31	Length, 1910..... miles..	350	27	254	87	56	26	16	2
Reservoirs:									
32	Number, 1920.....	43	.....	8	1	7	10	1	7
33	Number, 1910.....	42	2	10	1	1	2	1	3
34	Capacity, 1920..... acre-feet..	317,979	.....	69,700	20	205,430	1	2,400	3
35	Capacity, 1910..... acre-feet..	169,443	1	54,154	1	12,500	1	1,120	3
Flowing wells:									
36	Number, 1920.....	4	.....	3	.....	.....	1	.....	.....
37	Number, 1910.....	.....	.....	.....	.....	.....	.....	.....	.....
38	Capacity, 1920..... gallons per minute..	787	.....	.....	.....	.....	70	.....	.....
39	Capacity, 1910..... gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....
Pumped wells:									
40	Number, 1920.....	5	.....	94	20	.....	20	.....	19
41	Number, 1910.....	.....	3	29	12	.....	5	.....	7
42	Capacity, 1920..... gallons per minute..	835	.....	19,498	4,203	.....	516	.....	1,794
43	Capacity, 1910..... gallons per minute..	.....	220	7,892	2,045	.....	459	.....	630
Pumping plants:									
44	Number, 1920.....	117	2	103	34	5	41	21	41
45	Number, 1910.....	29	4	39	22	2	15	6	26
46	Engine capacity, 1920..... horsepower..	7,409	22	582	186	26	273	266	318
47	Engine capacity, 1910..... horsepower..	410	24	259	96	56	169	69	707
48	Pump capacity, 1920..... gallons per minute..	294,620	1,700	23,671	10,578	665	8,974	14,195	10,531
49	Pump capacity, 1910..... gallons per minute..	26,513	1,125	10,840	4,136	850	3,856	4,940	12,089
50	Average lift, 1920..... feet..	27	18	26	12	32	49	21	26
<b>CAPITAL INVESTED.</b>									
51	Capital invested to Jan. 1, 1920..... dollars..	4,057,373	1,393,045	3,309,599	260,912	497,791	486,527	159,590	293,396
52	Capital invested to July 1, 1910..... dollars..	2,032,636	187,716	2,019,161	136,204	198,064	96,167	76,305	103,345
53	Per cent of increase, 1910-1920.....	99.8	642.1	63.9	91.6	151.3	406.0	109.1	183.9
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	28.32	89.52	36.15	4.25	8.79	35.75	18.36	32.55
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	25.66	23.13	40.21	3.66	4.62	16.06	10.93	74.94
<b>ESTIMATED FINAL COST.</b>									
56	Estimated final cost of existing enterprises in 1920..... dollars..	4,835,543	1,628,878	4,428,916	262,522	618,521	993,752	167,495	314,746
57	Estimated final cost of existing enterprises in 1910..... dollars..	5,057,171	187,716	2,593,387	136,204	211,114	96,167	76,305	3,028,370
58	Per cent of increase, 1910-1920.....	-4.4	767.7	70.8	92.7	193.0	938.6	119.5	-89.6
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	22.03	81.63	42.58	3.78	9.59	20.49	15.22	32.49
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	24.31	12.57	27.64	2.99	3.86	5.57	8.11	25.94

<sup>1</sup> Part annexed to Baker County in 1902.

<sup>2</sup> Part taken from Hood River County in 1908.

# SOUTH DAKOTA.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of South Dakota collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

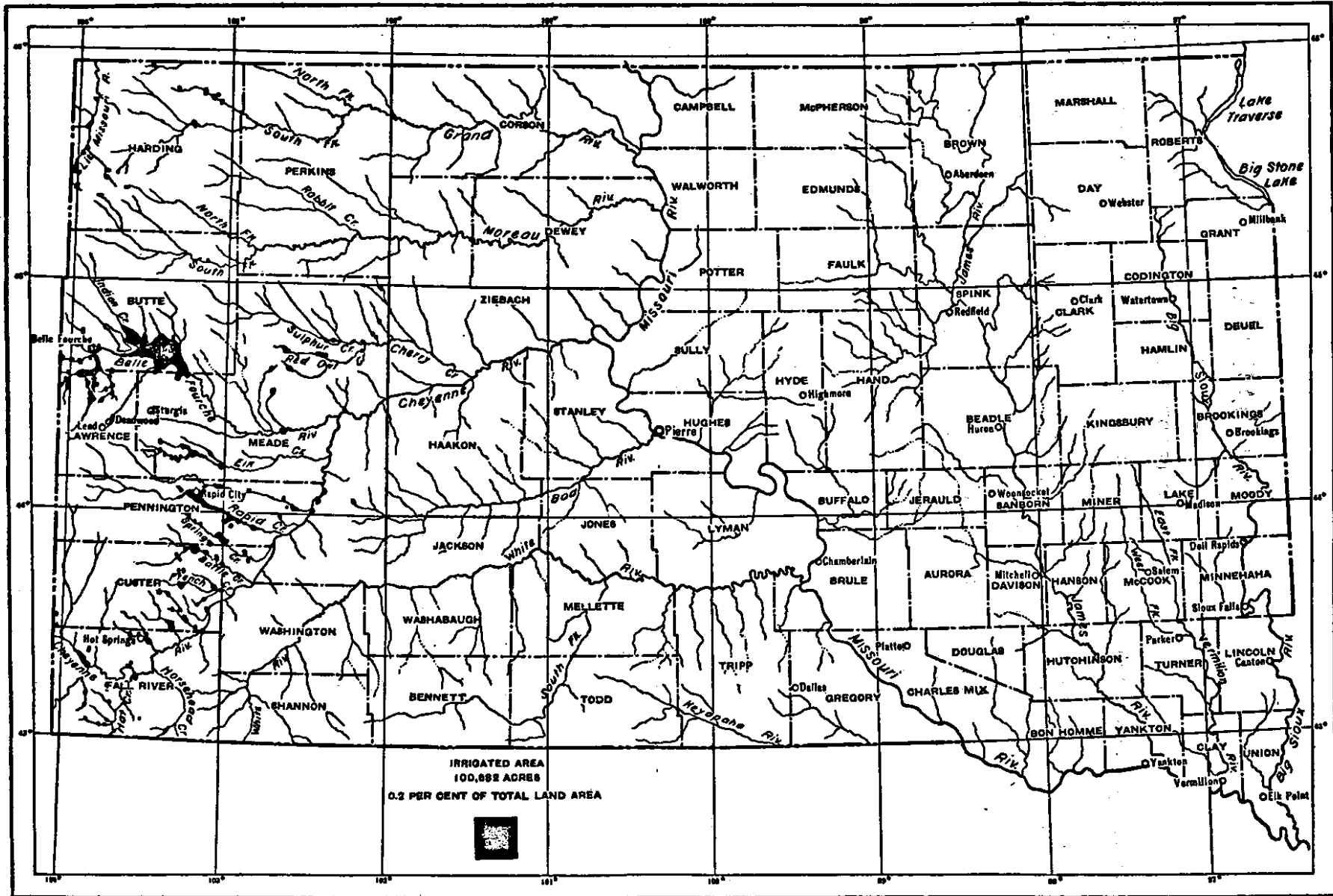
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	74,637	77,644	-3,007	-3.9
Approximate land area of the state..... acres..	49,195,520	49,195,520		
All land in farms..... acres..	34,636,491	26,016,892	8,619,599	33.1
Improved land in farms..... acres..	18,199,250	15,827,208	2,372,042	15.0
Number of farms irrigated.....	1,198	500	698	139.6
Area irrigated..... acres..	100,682	63,248	37,434	59.2
Area enterprises were capable of irrigating..... acres..	150,914	128,481	22,433	17.5
Area included in enterprises..... acres..	188,382	201,625	-13,243	-6.6
Per cent irrigated:				
Number of all farms.....	1.6	0.6	1.0	
Approximate land area of the state.....	0.2	0.1	0.1	
Land in farms.....	0.3	0.2	0.1	
Improved land in farms.....	0.6	0.4	0.2	
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	50,232	65,233	-15,001	-23.0
Excess of area included in enterprises over area irrigated..... acres..	87,700	138,377	-50,677	-36.6
Capital invested.....	\$5,465,248	\$3,043,140	\$2,422,108	79.6
Average per acre enterprises were capable of irrigating.....	\$36.21	\$23.69	\$12.52	52.8
Estimated final cost of existing enterprises.....	\$5,500,748	\$3,800,556	\$1,700,192	44.7
Average per acre included in enterprises.....	\$29.20	\$18.85	\$10.35	54.9
Average cost of operation and maintenance per acre.....	\$1.26	\$0.64	\$0.62	96.9
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	292	395	-103	-26.1
Number of main ditches.....	370	348	22	6.3
Length of main ditches..... miles..	653	631	22	3.5
Capacity of main ditches..... second-feet..	5,427	3,598	1,829	50.8
Number of lateral ditches.....	632	332	300	90.4
Length of lateral ditches..... miles..	605	625	-20	-3.2
Number of reservoirs.....	119	314	-195	-62.1
Capacity of reservoirs..... acre-feet..	212,264	216,205	-3,941	-1.8
Number of flowing wells.....	4	42	-38	
Capacity of flowing wells..... gallons per minute..	2,750	14,382	-11,632	-80.9
Number of pumped wells.....	1	4	-3	
Capacity of pumped wells..... gallons per minute..	800	24	776	
Number of pumping plants.....	25	8	17	
Engine capacity..... horsepower..	498	63	435	
Pump capacity..... gallons per minute..	23,320	5,289	18,031	340.9
Average lift..... feet..	21	(2)	21	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.

<sup>2</sup> Not reported in 1910.

# SOUTH DAKOTA

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND



**CLIMATIC CONDITIONS.**

South Dakota lies in the semiarid region, the normal annual precipitation at the eastern border being between 20 and 25 inches, and at the western border about 15 inches. For the western half of the state it averages about 17 inches, and more than 80 per cent of this occurs during the growing season. In the Black Hills the precipitation is higher than in the surrounding territory, but in that section there is little arable land.

The average precipitation for the state in 1919 was slightly above normal, but in the north central and northwestern parts of the state there was a deficiency during the latter part of the growing season.

Crops are grown throughout the state without irrigation, but in the extreme western counties considerable areas are irrigated.

**WATER SUPPLY FOR IRRIGATION.**

The streams of western South Dakota are all tributaries of the Missouri, which flows across the state from north to south about midway of the state.

The Little Missouri flows across the northwest corner of the state, in a northerly direction. It is a typical plains stream with a flood flow in early summer and a very limited supply of water in the late summer.

The Belle Fourche rises in eastern Wyoming and flows into South Dakota around the northern base of the Black Hills and discharges into Cheyenne River. It receives many tributaries from the Black Hills as well as from the north. The United States Reclamation Service has built a large reservoir near the town of Belle Fourche to store flood waters. This reservoir supplies water to more than half of the irrigated land in the state.

Cheyenne River also rises in eastern Wyoming and flows into South Dakota. It skirts the southern base of the Black Hills, from which it receives many tributaries. Proposals for storing the flood waters of this stream, as has been done on the Belle Fourche, have been investigated, but they have not been carried out.

White River lies south of the Cheyenne and Moreau River lies north of the Cheyenne. These are plains streams that supply little water in late summer, and have been little used for irrigation. Here, as on the other streams, water is available for storage, if economically feasible projects can be found.

In western South Dakota there are many drainage channels that carry water only after storms or when snows are melting, and the state has enacted laws to encourage the construction of reservoirs in such channels to store water for irrigation.

South Dakota has many artesian wells, but most of these are in the valleys of the Missouri and the James where rainfall is sufficient for the growing of crops.

**FARMS AND ACREAGE IRRIGATED.**

**TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.**

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase. <sup>1</sup>	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	1,198	129.6	1.6	100,682	59.2	0.2	0.2	0.6
1910.....	500	-17.5	0.6	68,248	44.8	0.1	0.2	0.4
1900.....	606	220.6	1.2	43,878	177.9	0.1	0.2	0.4
1890.....	189		0.4	15,717		( <sup>2</sup> )	0.1	0.2

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Less than one-tenth of 1 per cent.

**TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.**

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	202	168,382	100,682	59.4	150,914
1870-1879.....	22	14,495	11,302	78.0	12,486
1880-1889.....	43	17,682	11,441	64.7	13,215
1890-1899.....	30	7,956	2,965	37.5	5,591
1900-1904.....	35	104,773	58,570	55.9	87,539
1905-1909.....	80	21,791	8,927	41.0	18,368
1910-1914.....	51	13,471	5,633	41.8	8,220
1915-1919.....	16	2,604	1,126	43.2	2,536
Not reported.....	15	5,650	718	12.7	3,210

**TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.**

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	100,682	68,248	37,434	59.2	150,914	183,382
Streams, gravity.....	92,491	47,122	45,369	96.3	130,476	160,199
Streams, pumped.....	869	540	829	60.9	2,211	4,308
Wells, pumped.....		5	-8	-100.0		
Wells, flowing.....	180	1,448	-1,318	-91.0	130	250
Lakes, gravity.....	170	200	-30	-15.0	300	520
Springs.....	328	395	-69	-17.5	326	836
Stored storm water.....	2,312	13,635	-11,223	-82.9	7,652	11,907
Streams, gravity, and pumped wells.....	500	( <sup>2</sup> )	500		1,000	1,000
Streams, gravity, and flowing wells.....	20	( <sup>2</sup> )	20		40	160
Other mixed.....	3,864	( <sup>2</sup> )	3,864		7,779	9,102

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

**ACREAGE, BY CHARACTER OF ENTERPRISE.**

Early legislation in South Dakota relating to organization for supplying water for irrigation all referred to the development of artesian wells. A law of 1890 provided for the organization of artesian well companies; another dated 1891 provided for the sinking of artesian wells by civil townships and the supplying of water for rentals; and another law passed in 1893 provided for the sinking of wells by counties, the counties bearing one-fourth of the expense, and the land benefited three-fourths. The small area reported

in Table 4 as irrigated from artesian wells indicates that these laws have not been effective, at least so far as irrigation is concerned.

An irrigation district law was enacted in 1917, but no irrigation districts were reported in 1920.

South Dakota accepted the conditions of the Federal Carey Act (act of Aug. 18, 1894) in 1909, but no Carey Act enterprises were reported in 1920.

The United States Reclamation Service has one project in the state.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	100,682	63,248	37,434	59.2
Individual and partnership.....	31,664	37,684	-6,020	-16.0
Cooperative.....	10,080	13,601	-3,521	-25.9
Commercial.....	2,280	6,300	-4,020	-63.8
U. S. Reclamation Service.....	56,638	5,613	51,025	909.1
U. S. Indian Service.....	20	50	-30	-60.0
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	150,914	128,481	22,433	17.5
Individual and partnership.....	56,032	55,820	212	0.4
Cooperative.....	10,615	18,243	-7,628	-41.8
Commercial.....	1,600	6,300	-5,200	-76.5
U. S. Reclamation Service.....	82,592	47,568	35,024	73.6
U. S. Indian Service.....	75	50	25	50.0
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	188,382	201,625	-13,243	-6.6
Individual and partnership.....	76,683	69,971	6,712	9.6
Cooperative.....	11,410	22,687	-11,277	-49.7
Commercial.....	2,280	6,900	-4,620	-67.0
U. S. Reclamation Service.....	97,034	101,967	-4,933	-4.0
U. S. Indian Service.....	75	100	-25	-25.0

<sup>1</sup> A minus sign (-) denotes decrease.

#### ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of South Dakota relating to water rights are summarized in the following paragraphs:

The state of South Dakota was created in 1889 from a part of Dakota territory. In 1881 Dakota territory enacted the following general declaration regarding rights to water:

"Any person or persons, corporation or company, who may have or hold a possessory right or title to any mineral or agricultural lands within the limits of this state shall be entitled to the usual enjoyment of the waters of the streams or creeks in said state for mining, milling, agricultural, or domestic purposes; provided, that the right to such use shall not interfere with any prior right or claim to such waters when the law has been complied with in doing the necessary work." The same law provided for securing rights of way over the lands lying between the streams and the places of use, and for the posting and filing of notices of intended appropriations.

In 1905 South Dakota adopted a new water law. This law provided that "all the waters within the limits of the state from all sources of water supply belong to the public and, except as to navigable waters, are subject to appropriation for beneficial use." It created the office of state engineer, provided that parties wishing to acquire rights must apply to the engineer for permits to appropriate water; for the submitting of proof of completion of works and the issuing of certificates of completion; and for the submitting of proof of use of water and the issuing of licenses defining the rights acquired.

This law provided also that the state engineer should make surveys and collect the information necessary for the adjudication of

rights acquired previous to the passage of the act; that, on the advice of the engineer, the attorney general of the state should intervene in suits relating to water rights or initiate such suits; and that when suits were brought in the courts the courts should call on the engineer to make surveys of the streams in question at the expense of the litigants.

The supreme court of the state has held this law unconstitutional so far as it interferes with vested riparian rights and so far as it relates to participation in adjudication by the state engineer at the expense of litigants. (*St. Germain Irrigating Ditch Co. v. Hawthorne Ditch Co.*, 32 S. D., 260.)

Under this decision riparian rights seem to be paramount in South Dakota.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	100,682	100.0	100.0
Appropriation and use.....	1,774	1.8	21.2
Notice filed and posted.....	62,054	61.6	35.0
Adjudicated by court.....	7,651	7.6	14.8
Permit from state.....	17,600	17.4	7.4
Certificate or license from state.....	8,612	8.6	17.5
Riparian rights.....	1,599	1.6	3.6
Underground.....	130	0.1	( <sup>1</sup> )
Other and mixed.....	190	0.2	( <sup>1</sup> )
Not reported.....	1,172	1.2	( <sup>1</sup> )

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

#### ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	100,682	53,137	89.5	188,382	150,914
Missouri River and tributaries.....	100,682	53,137	89.5	188,382	150,914
Missouri River direct.....				600	150
Cheyenne River.....	99,333	49,547	100.5	176,715	143,847
Little Missouri River.....	640	700	-8.6	4,133	3,323
Moreau River.....	305	335	-9.0	3,094	1,721
Other tributaries of Missouri River.....	404	2,555	-84.2	3,840	1,873

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Includes Belle Fourche River. <sup>3</sup> Includes springs and wells.



**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

**TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.**

CENTURY YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$5,465,248	79.6	\$36.21	52.8
1910.....	3,043,140	968.7	23.69	263.3
1900.....	284,747	345.1	6.52	60.2
1890.....	63,968		4.07	

**TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$5,465,248	100.0	\$36.21
1870-1879.....	281,476	4.8	21.03
1880-1889.....	149,465	2.7	11.31
1890-1899.....	94,851	1.7	16.96
1900-1904.....	4,543,349	83.1	51.90
1905-1908.....	221,514	4.1	12.06
1910-1914.....	106,127	1.9	12.91
1915-1919.....	63,308	1.2	27.10
Not reported.....	25,158	0.5	7.84

**TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$5,465,248	100.0	\$36.21	88,329	\$1.26
Streams, gravity.....	5,122,271	93.7	39.26	83,672	1.21
Streams, pumped.....	93,340	1.7	29.07	807	4.03
Wells, flowing.....	5,000	0.1	38.46		
Lakes, gravity.....	2,100	(*)	7.00		
Springs.....	18,421	0.3	56.51	81	17.74
Stored storm water.....	155,121	2.8	20.27	1,203	2.78
Streams, gravity, and pumped wells.....	3,000	0.1	3.00		
Streams, gravity, and flowing wells.....	480	(*)	12.00		
Other mixed.....	65,515	1.2	8.42	2,616	1.14

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.**

DRAINAGE BASIN.	1920	1902	INCREASE.	
			Amount.	Per cent. <sup>1</sup>
Total.....	\$5,465,248	\$361,509	\$5,083,679	.....
Missouri River and tributaries.....	5,465,248	881,509	5,083,679	.....
Missouri River direct.....	3,512		3,512	.....
Cheyenne River <sup>2</sup> .....	5,277,782	325,657	4,952,125	.....
Little Missouri River.....	65,818	3,740	62,078	.....
Moreau River.....	40,927	3,731	37,196	996.9
Other tributaries of Missouri River.....	87,209	48,441	38,768	80.0

<sup>1</sup> Per cent not shown when more than 1,000.  
<sup>2</sup> Includes Belle Fourche River.  
<sup>3</sup> Includes springs and wells.

**TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.**

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$5,465,248	100.0	88,329	\$1.26
Individual and partnership.....	743,880	13.6	20,711	1.26
Cooperative.....	240,030	4.4	8,680	0.66
Commercial.....	15,058	0.3	2,280	0.61
U. S. Reclamation Service.....	4,464,780	81.7	56,638	1.37
U. S. Indian Service.....	1,500	(*)	20	2.50

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

**DRAINAGE OF IRRIGATED LAND.**

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

**TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.**

Number of enterprises reporting land drained or needing drainage.....	17
Acreage included in enterprises reporting land drained or needing drainage.....	106,129
Acreage for which drains have been installed.....	2,109
Additional acreage needing drainage.....	4,714
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	2.0
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	1.1
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	3.6

**QUANTITY OF WATER USED.**

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

**TABLE 14.—QUANTITY OF WATER USED IN 1919.**

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals...second-feet..	531	171	410
Area irrigated in 1919.....acres..	60,286	56,638	12,348
Average number of acres per second-foot.....	119	333	30
Total quantity of water entering canals.....acre-feet..	168,186	121,487	46,699
Area irrigated in 1919.....acres..	67,366	56,638	10,728
Average quantity per acre.....acre-feet..	2.5	2.1	4.4
Total quantity of water delivered.....acre-feet..	83,574	81,568	2,006
Area irrigated in 1919.....acres..	59,618	56,638	2,980
Average quantity per acre.....acre-feet..	1.4	1.4	0.7



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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	207	182	370	5,427	653	632	605	119	212,264
Missouri River and tributaries.....	207	182	370	5,427	653	632	605	119	212,264
Missouri River direct.....	182	95	297	5,210	568	511	530	64	205,941
Cheyenne River <sup>1</sup> .....	9	16	26	90	34	24	13	19	2,283
Little Missouri River.....	3	55	29	33	24	26	4	19	2,262
Moreau River.....	13	16	17	91	24	71	8	17	1,778
Other tributaries of Missouri River.....									

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Number.	Capacity (gallons per minute).	Average lift (feet).
Total.....	7.2	4	2,750	1	800	25	498	25	23,320	21
Missouri River and tributaries.....	7.2	4	2,750	1	800	25	498	25	23,320	21
Missouri River direct.....						1	40	1	1,500	25
Cheyenne River <sup>1</sup> .....	6.8	4	2,750	1	800	14	173	14	9,550	18
Little Missouri River.....	0.1					4	175	4	8,000	32
Moreau River.....	0.3					3	60	3	1,800	30
Other tributaries of Missouri River.....						3	50	3	2,470	19

<sup>1</sup> Includes Belle Fourche River.

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CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	2,176	0.1	1,166	0.1	86.6	Bu.....	39,667	0.1	25,476	(*)	55.7
2 Oats.....	3,026	0.2	2,526	0.2	19.8	Bu.....	71,692	0.1	91,045	0.2	-21.3
3 Winter wheat.....	759	0.6	1,329	(*)	781.0	(Bu.....)	7,335	0.6	25,590	0.1	449.7
4 Spring wheat.....	10,949	0.3				(Bu.....)	133,341	0.4			
5 Barley.....	1,026	0.1	317	(*)	223.7	Bu.....	17,841	0.1	6,068	(*)	193.1
<b>Other grains and seeds:</b>											
6 Clover and alfalfa seed <sup>2</sup> .....	1,040	3.3	(*)			Bu.....	2,358	4.3	(*)		
<b>Hay and forage:</b>											
7 Timothy alone.....	539	0.5	1,927	1.1	-72.0	Tons...	566	0.4	3,352	1.3	-83.1
8 Timothy and clover mixed.....	1,989	2.0	2,116	1.6	-6.0	Tons...	1,953	2.2	3,189	1.5	-38.8
9 Alfalfa.....	38,519	8.3	10,005	15.1	285.0	Tons...	74,193	9.7	28,520	18.5	160.1
10 Small grains out for hay.....	1,708	1.6	(*)			Tons...	1,720	2.3	(*)		
11 Wild, salt, or prairie grasses.....	3,825	0.1	17,652	0.6	-78.3	Tons...	2,026	0.1	20,334	0.7	-85.1
<b>Vegetables:</b>											
12 Potatoes.....	413	0.7	439	0.9	-5.9	Bu.....	35,065	1.2	35,666	1.0	-1.7
<b>Miscellaneous:</b>											
13 Sugar beets grown for sugar.....	1,052	95.1	(*)			Tons...	11,782	98.6	(*)		

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	25.1	25.1	18.2	72.5	72.5	\$51,567	0.1	\$17,532	0.1	194.1
2 Oats.....	Bu.....	27.8	27.8	23.7	85.3	85.3	53,769	0.1	42,035	0.3	27.9
3 Winter wheat.....	Bu.....	9.3	9.3	10.0	107.5	107.5	16,357	0.6	21,100	(*)	
4 Spring wheat.....	Bu.....	7.9	7.9	12.2	154.4	154.4	297,350	0.4			
5 Barley.....	Bu.....	17.0	17.0	17.4	102.4	102.4	21,409	0.1	8,143	(*)	581.2
<b>Other grains and seeds:</b>											
6 Clover and alfalfa seed <sup>2</sup> .....	Bu.....	1.8	1.7	2.3	127.8	135.3	53,055	4.3	(*)		
<b>Hay and forage:</b>											
7 Timothy alone.....	Tons...	1.13	1.14	1.05	92.9	92.1	8,490	0.4	25,290	2.0	-66.4
8 Timothy and clover mixed.....	Tons...	1.31	1.32	0.98	74.8	74.3	33,201	2.2	21,229	1.8	56.4
9 Alfalfa.....	Tons...	1.65	1.63	1.93	117.0	118.4	1,595,150	9.7	160,414	17.4	894.4
10 Small grains out for hay.....	Tons...	0.69	0.69	1.01	146.4	146.4	28,380	2.3	(*)		
11 Wild, salt, or prairie grasses.....	Tons...	0.74	0.74	0.79	106.8	106.8	39,338	0.1	145,667	1.3	-73.0
<b>Vegetables:</b>											
12 Potatoes.....	Bu.....	49.2	49.0	64.9	172.6	173.3	87,662	1.2	25,049	1.3	250.0
<b>Miscellaneous:</b>											
13 Sugar beets grown for sugar.....	Tons...	10.81	3.17	11.20	103.6	353.3	117,820	98.6	(*)		

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Less than one-tenth of 1 per cent.  
<sup>3</sup> Not including red clover seed.  
<sup>4</sup> Not reported in 1909 because of small acreage.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.**

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	THE STATE.	Butte. <sup>1</sup>	Custer.	Fall River.	Harding. <sup>1</sup>	Law- rence.	Meade.	Penning- ton.	Perkins. <sup>1</sup>	All other counties.	
1	Number of all farms in 1920.....	74,637	1,005	646	813	907	449	1,722	1,128	1,560	66,407
2	Number of farms irrigated in 1919.....	1,198	564	34	22	20	114	89	395	6	4
3	Per cent of all farms.....	1.6	56.1	5.3	2.7	2.2	25.4	2.3	35.0	0.4	( <sup>2</sup> )
4	Number of farms irrigated in 1909.....	500	96	89	40	28	69	45	88	9	41
5	Per cent of increase, 1909-1919.....	139.6									
<b>LAND AND FARM AREA.</b>											
6	Approximate land area.....acres..	49,195,520	1,464,960	1,006,720	1,123,840	1,716,480	510,080	2,234,240	1,786,880	1,864,960	37,487,360
7	All land in farms.....acres..	34,636,491	722,033	407,060	653,294	1,227,028	147,544	1,380,497	1,046,452	1,265,466	27,787,117
8	Improved land in farms.....acres..	18,199,250	88,367	68,416	130,564	103,467	48,213	202,562	167,639	202,081	17,202,911
9	Area irrigated in 1919.....acres..	100,682	57,856	5,537	2,801	928	6,219	9,960	16,994	222	76
10	Per cent of improved land in farms.....	0.6	65.5	10.3	2.2	0.9	12.9	4.9	10.1	0.1	( <sup>2</sup> )
11	Area irrigated in 1909.....acres..	63,248	14,378	7,820	4,633	3,315	3,355	7,949	19,463	897	1,438
12	Per cent of increase, 1909-1919.....	60.2	302.4	-29.3	-37.6	-72.0	85.4	25.4	-12.7	-75.3	-94.7
13	Area enterprises were capable of irrigating in 1920.....acres..	150,914	82,078	9,018	7,358	5,442	8,516	15,233	22,029	882	363
14	Area enterprises were capable of irrigating in 1910.....acres..	128,491	59,684	11,315	9,858	4,598	4,682	9,922	25,593	1,370	1,459
15	Per cent of increase, 1910-1920.....	17.5	37.5	-20.3	-25.4	18.4	81.9	53.5	-13.9	-35.6	-75.1
16	Area included in enterprises in 1920.....acres..	188,382	89,353	11,080	11,778	8,415	14,261	26,873	23,750	2,059	813
17	Area included in enterprises in 1910.....acres..	201,625	118,160	15,263	11,746	5,170	5,285	12,136	31,034	1,370	1,461
18	Per cent of increase, 1910-1920.....	-6.6	-24.4	-27.4	0.3	62.8	169.8	121.4	-23.5	50.3	-44.4
<b>IRRIGATION WORKS.</b>											
Independent enterprises:											
19	Number, 1920.....	292	21	61	24	42	45	43	40	10	3
20	Number, 1910.....	395	42	92	36	23	24	60	68	10	40
Main ditches:											
21	Number, 1920.....	370	30	71	32	51	53	71	44	15	3
22	Number, 1910.....	343	41	84	31	29	21	50	62	9	21
23	Length, 1920.....miles..	653	181	81	58	65	73	80	96	13	6
24	Length, 1910.....miles..	631	177	97	63	42	31	67	126	14	14
25	Capacity, 1920.....second-feet..	5,427	1,908	317	107	115	322	655	1,904	80	9
26	Capacity, 1910.....second-feet..	3,593	1,652	380	198	68	104	219	566	172	39
Laterals:											
27	Number, 1920.....	632	18	151	50	66	41	99	153	29	26
28	Number, 1910.....	832	23	80	49	11	52	56	41	20	
29	Length, 1920.....miles..	605	848	51	25	16	13	90	54	8	
30	Length, 1910.....miles..	626	482	39	11	8	14	35	28	8	
Reservoirs:											
31	Number, 1920.....	119	13	19	10	42	3	19	4	9	
32	Number, 1910.....	314	52	62	48	30	3	62	43	11	3
33	Capacity, 1920.....acre-feet..	212,264	204,386	939	189	5,107	46	264	87	1,216	
34	Capacity, 1910.....acre-feet..	216,205	202,468	843	1,472	2,302	632	7,791	569	95	35
Flowing wells:											
35	Number, 1920.....	4					4				
36	Number, 1910.....	42	2			3					37
37	Capacity, 1920.....gallons per minute..	2,750					2,750				
38	Capacity, 1910.....gallons per minute..	14,323	22			830					13,630
Pumped wells:											
39	Number, 1920.....	1							1		
40	Number, 1910.....	4			1			2	1		
41	Capacity, 1920.....gallons per minute..	800							800		
42	Capacity, 1910.....gallons per minute..	24			10			10	4		
Pumping plants:											
43	Number, 1920.....	25	3	3	2	5		2	4	4	2
44	Number, 1910.....	3			4			2	2		
45	Engine capacity, 1920.....horsepower..	498	21	28	30	187		30	64	66	72
46	Engine capacity, 1910.....horsepower..	63			49			2	12		
47	Pump capacity, 1920.....gallons per minute..	23,320	1,750	2,170	1,000	8,470		1,900	2,730	1,800	3,500
48	Pump capacity, 1910.....gallons per minute..	5,289			4,975			10	304		
49	Average lift, 1920.....feet..	21	16	14	28	27		13	18	23	24
<b>CAPITAL INVESTED.</b>											
50	Capital invested to Jan. 1, 1920.....dollars..	5,465,248	4,349,699	118,501	107,076	137,540	70,704	453,344	182,314	35,270	10,800
51	Capital invested to July 1, 1910.....dollars..	3,043,140	2,564,823	64,058	93,928	62,054	30,428	58,961	180,315	12,817	35,753
52	Per cent of increase, 1910-1920.....	79.6	70.3	85.0	14.0	121.6	132.4	668.9	89.9	175.2	-69.8
53	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	36.21	53.00	13.14	14.55	25.27	8.30	29.76	8.28	39.99	29.75
54	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	23.69	42.81	5.66	9.63	13.60	6.50	5.94	5.09	9.36	24.51
<b>ESTIMATED FINAL COST.</b>											
55	Estimated final cost of existing enterprises in 1920.....dollars..	5,500,748	4,350,849	127,951	107,376	149,540	70,704	460,894	185,264	37,470	10,800
56	Estimated final cost of existing enterprises in 1910.....dollars..	3,800,556	3,312,244	64,058	93,928	62,054	30,428	58,961	130,315	12,817	35,753
57	Per cent of increase, 1910-1920.....	44.7	31.4	99.7	14.3	141.0	132.4	631.7	42.2	192.3	-69.8
58	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	39.20	48.69	11.55	9.11	17.77	4.96	17.15	7.80	18.20	13.28
59	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	18.85	28.03	4.20	8.00	12.00	5.76	4.86	4.20	9.36	24.47

<sup>1</sup> Perkins and Harding Counties organized from parts of Butte County in 1909.  
<sup>2</sup> Less than one-tenth of 1 per cent.

# TEXAS.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Texas collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented. Statistics of number of farms irrigated

and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

In the reports of the Thirteenth Census the returns for the counties where irrigation is limited to rice growing and those for the remainder of the state were presented separately. In this report this separation is not made, except that in the last column of the county table at the end of the report totals for rice growing are given.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

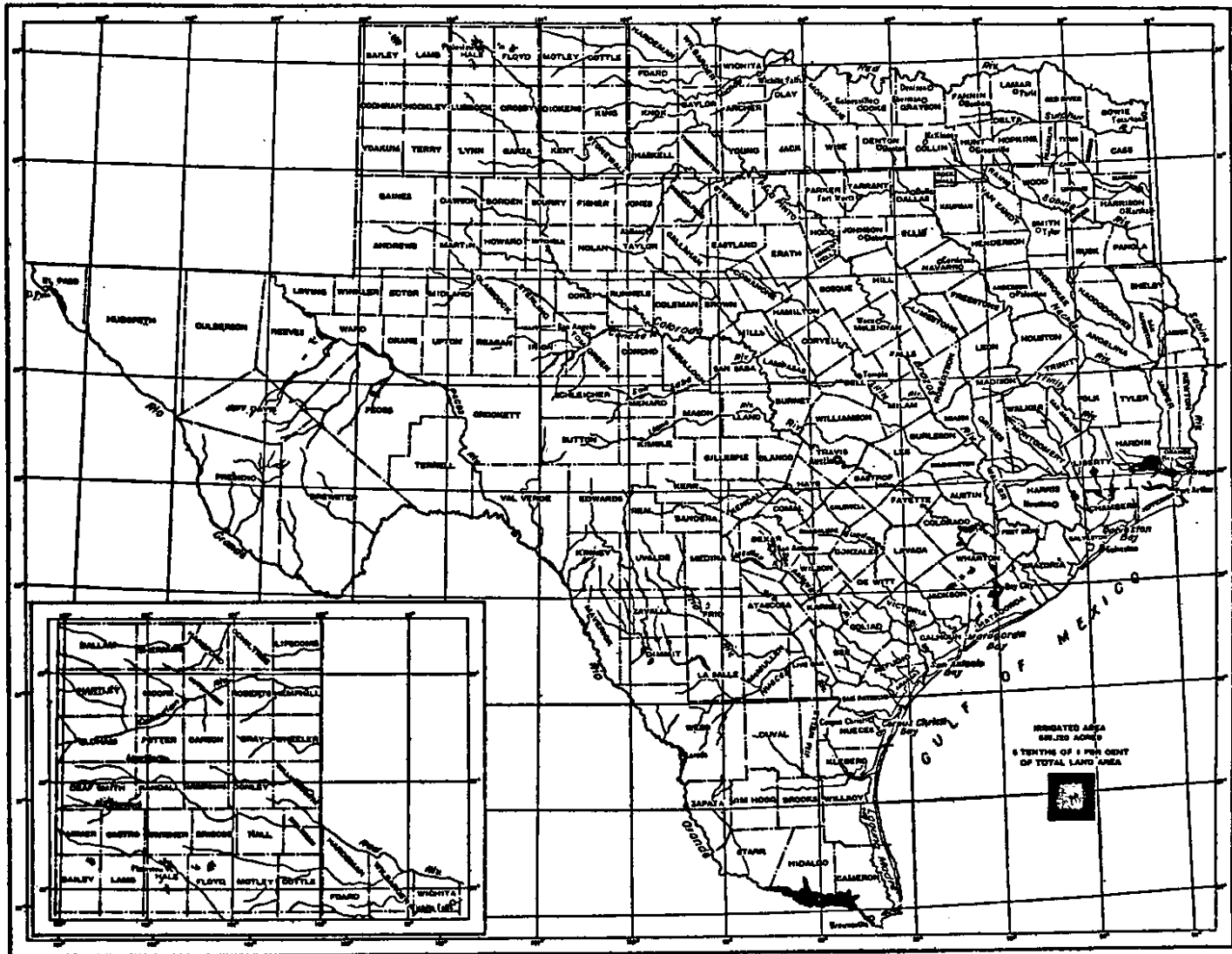
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	436, 033	417, 770	18, 263	4. 4
Approximate land area of the state.....acres..	167, 934, 720	167, 934, 720		
All land in farms.....acres..	114, 020, 621	112, 435, 067	1, 585, 554	1. 4
Improved land in farms.....acres..	31, 227, 503	27, 360, 666	3, 866, 837	14. 1
Number of farms irrigated.....	5, 974	5, 238	736	14. 1
Area irrigated.....acres..	586, 120	451, 130	134, 990	29. 9
Area enterprises were capable of irrigating.....acres..	1, 150, 542	690, 991	459, 551	66. 5
Area included in enterprises.....acres..	1, 687, 447	1, 253, 173	434, 274	34. 7
Per cent irrigated:				
Number of all farms.....	1. 4	1. 3	0. 1	
Approximate land area of the state.....	0. 3	0. 3		
Land in farms.....	0. 5	0. 4	0. 1	
Improved land in farms.....	1. 9	1. 6	0. 3	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	564, 422	239, 861	324, 561	135. 3
Excess of area included in enterprises over area irrigated.....acres..	1, 101, 327	802, 043	299, 284	37. 3
Area of irrigated land reported as available for settlement.....acres..	346, 446	( <sup>2</sup> )		
Capital invested.....	\$35, 072, 739	\$13, 487, 347	\$21, 585, 392	160. 0
Average per acre enterprises were capable of irrigating.....	\$30. 48	\$19. 52	\$10. 96	58. 1
Estimated final cost of existing enterprises.....	\$39, 860, 871	\$14, 754, 172	\$25, 106, 699	170. 2
Average per acre included in enterprises.....	\$23. 62	\$11. 77	\$11. 85	100. 7
Average cost of operation and maintenance per acre.....	\$6. 92	\$3. 25	\$3. 67	112. 9
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	1, 371	2, 772	-1, 401	-50. 5
Number of main ditches.....	820	861	-41	-4. 8
Length of main ditches.....miles..	1, 524	1, 479	45	3. 0
Capacity of main ditches.....second-feet..	23, 261	12, 818	10, 443	81. 5
Number of lateral ditches.....	2, 022	832	1, 190	143. 0
Length of lateral ditches.....miles..	2, 949	1, 224	1, 725	140. 9
Number of reservoirs.....	368	309	59	19. 1
Capacity of reservoirs.....acre-feet..	392, 999	74, 361	318, 638	428. 5
Number of flowing wells.....	135	123	12	9. 8
Capacity of flowing wells.....gallons per minute..	62, 364	37, 019	25, 345	68. 5
Number of pumped wells.....	901	1, 912	-1, 011	-52. 9
Capacity of pumped wells.....gallons per minute..	538, 565	567, 126	-28, 561	-5. 0
Number of pumping plants.....	1, 369	2, 359	-990	-41. 9
Engine capacity.....horsepower..	80, 511	69, 094	11, 417	16. 5
Pump capacity.....gallons per minute..	6, 825, 998	5, 362, 665	1, 463, 333	27. 3
Average lift.....feet..	45	( <sup>2</sup> )	45	

<sup>1</sup>A minus sign (-) denotes decrease.

<sup>2</sup>Not reported in 1910.

# TEXAS

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



**CLIMATIC CONDITIONS.**

The state of Texas has a wide range in both temperature and precipitation. Most of the precipitation is in the form of rainfall, and the normal annual amount varies quite regularly from about 50 inches at the eastern line of the state to about 10 inches at the extreme western point. The line of 20-inch annual rainfall coincides closely with the 101st meridian of longitude, and is about midway of the state, east and west. Rainfall is quite favorably distributed for irrigation, since it is heavier in the crop-growing season than in the winter.

While the rainfall is smallest in the western part of the state, the larger part of the irrigated land lies east of the line of 20-inch rainfall. Along the Gulf coast for about 150 miles west from the eastern line of the state rice is grown under irrigation, notwithstanding the normal annual rainfall is from 35 to 50 inches. The growing of rice requires that water be kept standing on the fields almost continuously, and this can be done only by irrigation. In the lower Rio Grande Valley the normal annual rainfall is between 20 and 25 inches, but in that section irrigation is practiced principally for the growing of crops in the winter, which is the season of least rainfall.

In west Texas the rainfall is light and irrigation is needed, but the water supply is so limited that only small areas can be watered.

**WATER SUPPLY FOR IRRIGATION.**

In the rice-growing districts in southeastern Texas there are many streams with large discharges, and water is pumped from these streams to the level prairie lands between the river channels. The pumping is done principally by companies that have built large canals and supply water to many farms, usually for a share of the crop. Water is pumped from wells, also, the wells as a rule being owned by individual farmers who water only their own land.

The Rio Grande forms the boundary between Texas and Mexico for more than 700 miles, but for most of this distance there is no irrigable land along the river. The Rio Grande above El Paso and for some distance below that point, in its natural condition was subject to heavy floods, for much of the time it was very low, and at times entirely dry. Under such conditions it was not of much value as a source of water for irrigation. To remedy this condition the United States Reclamation Service has built the Elephant Butte Dam in the channel of the river in New Mexico about 120 miles north of El Paso. The capacity of the reservoir created by this dam is about 2,600,000 acre-feet, which is about two

and one-half times the average annual discharge of the river at that point, making it possible to store the entire flow of the river. The water is used in New Mexico, in old Mexico, and in Texas at El Paso and immediately below. Small areas are irrigated at other points along the river, and immediately above the mouth of the river large canals have been built and considerable areas are irrigated. The supply of water in this section does not seem to depend very largely on the flow in the upper river but comes largely from tributaries below El Paso in both Texas and Mexico. There are large areas of irrigable land in both Texas and Mexico, but present irrigated lands lie almost wholly in Texas. It is not possible to irrigate much more land without storage, and the possibilities of building reservoirs are under investigation. In this section water is pumped from the river into large canals with large pumps having low lifts.

In north Texas very little stream water is available, but there has been a considerable development of water from wells, and there is opportunity for much more work of this kind.

There are many projects on the smaller streams in the interior of the state, notably the Pecos and the Medina.

**FARMS AND ACREAGE IRRIGATED.**

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1900 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	5,074	14.1	1.4	586,120	29.9	0.3	0.5	1.9
1910.....	6,238	285.3	1.3	451,130	808.6	0.3	0.4	1.6
1900.....	1,325	.....	0.4	49,652	.....	( <sup>1</sup> )	( <sup>1</sup> )	0.3

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	1,371	1,687,447	586,120	34.7	1,150,542
1860-1869.....	1	400	.....	.....	400
1870-1879.....	20	44,087	23,006	52.2	44,023
1880-1889.....	28	30,804	13,073	42.4	28,095
1890-1899.....	47	136,956	45,411	33.2	55,242
1900-1904.....	105	402,029	134,832	33.5	220,716
1905-1909.....	180	427,052	161,770	37.9	268,570
1910-1914.....	428	467,579	141,116	30.2	401,393
1915-1919.....	347	100,418	34,656	34.5	75,778
Not reported.....	215	78,110	32,256	41.3	55,325



TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	586,120	451,130	134,990	29.9	1,150,542	1,687,447
Streams, gravity.....	73,982	75,496	-1,514	-2.0	142,782	232,373
Streams, pumped.....	421,538	297,578	123,960	41.7	819,794	1,185,420
Streams, pumped and gravity.....	850	( <sup>2</sup> )	850	.....	800	1,000
Wells, pumped.....	39,483	54,052	-14,569	-27.0	70,929	106,382
Wells, flowing.....	3,266	3,730	-474	-12.7	6,291	7,906
Wells, flowing and pumped.....	1,727	( <sup>2</sup> )	1,727	.....	3,428	3,414
Lakes, pumped.....	597	458	139	30.3	7,895	8,087
Springs.....	8,686	13,068	-4,382	-33.5	11,332	11,499
Stored storm water.....	11,572	6,748	4,824	71.5	54,737	62,715
Sewage.....	260	( <sup>2</sup> )	260	.....	260	650
Streams, gravity, and pumped wells.....	454	( <sup>2</sup> )	454	.....	778	1,128
Streams, gravity, and flowing wells.....	45	( <sup>2</sup> )	45	.....	55	55
Other mixed.....	24,170	( <sup>2</sup> )	24,170	.....	31,661	61,849

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

In 1852 the state of Texas enacted a law providing for the regulation of community ditches by the commissioners' courts of the counties, according to "ancient usage and the laws of the state"; and providing also for the regulation by the same courts of all irrigation works belonging to two or more persons.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	586,120	451,130	134,990	29.9
Individual and partnership.....	110,680	49,657	61,023	122.9
Cooperative.....	108,378	130,011	-26,633	-20.5
Irrigation district.....	88,571	( <sup>2</sup> )	88,571	.....
Commercial.....	262,892	271,462	-8,570	-3.2
U. S. Reclamation Service.....	20,284	( <sup>2</sup> )	20,284	.....
State.....	65	( <sup>2</sup> )	65	.....
City.....	260	( <sup>2</sup> )	260	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	1,150,542	660,991	489,551	66.5
Individual and partnership.....	216,351	65,286	151,065	231.4
Cooperative.....	256,304	183,411	72,893	39.7
Irrigation district.....	170,548	( <sup>2</sup> )	170,548	.....
Commercial.....	481,899	442,294	39,605	9.0
U. S. Reclamation Service.....	25,070	( <sup>2</sup> )	25,070	.....
State.....	120	( <sup>2</sup> )	120	.....
City.....	260	( <sup>2</sup> )	260	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	1,687,447	1,253,178	434,274	34.7
Individual and partnership.....	328,481	104,044	224,417	215.7
Cooperative.....	294,781	279,909	14,792	5.3
Irrigation district.....	206,674	( <sup>2</sup> )	206,674	.....
Commercial.....	738,685	869,180	-130,475	-15.0
U. S. Reclamation Service.....	58,106	( <sup>2</sup> )	58,106	.....
State.....	120	( <sup>2</sup> )	120	.....
City.....	640	( <sup>2</sup> )	640	.....

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

A law enacted in 1875 granted subsidies of state land to canal companies, but this law was repealed in 1882. A law of 1887 included among the purposes for which corporations may be organized the "construction and

maintenance of canals for the purposes of irrigation, navigation, or manufacturing"; and an act of 1895 authorized the incorporation of canal companies to build irrigation works, sell water rights, and supply water for rates. In addition to passing these general laws several companies were chartered by the legislature in 1866, and at subsequent dates. All of these laws seem to contemplate the organization of commercial enterprises, as defined on page 3.

An irrigation district law was enacted in 1905, and since that time laws providing for the organization and management of "water improvement districts" have been enacted. These are, in effect, irrigation districts, and all data relating to them are included in those reported for districts in Table 5.

The United States Reclamation law has been extended to Texas, and a part of one project lies in the state.

The Federal Carey Act (act of Aug. 18, 1894) does not apply to Texas.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Texas relating to water rights are summarized in the following paragraphs:

Without any formal declaration of the right to take water from the streams of the state, the legislature of Texas in 1852 and at subsequent dates recognized this right by providing for the control of ditches by the commissioners' courts of the counties, and by chartering companies and granting rights to take water from certain streams. By an act of October 1, 1866, a company was given the right to divert three-fourths of all the water in Guadalupe River. In the same year another company was given the right to divert two-thirds of all the water in San Marcos River, and another company was given the right to divert one-fourth of all the water forming the Rio Grande.

In 1895 there was enacted the first general law making a declaration on the subject of water rights. This declaration was as follows:

"The unappropriated waters of the ordinary flow or underflow of every running or flowing river or natural stream, and the storm or rain waters of every river or natural stream, canyon, ravine, depression, or watershed within those portions of the state of Texas in which by reason of the insufficient rainfall, irrigation is beneficial for agricultural purposes, are hereby declared to be the property of the public, and may be acquired by appropriation for the uses and purposes and in the manner as hereinafter provided."

This law provided, however, that water might not be diverted from its natural course to the detriment of riparian owners without their consent, except after condemnation. All persons having previously appropriated water and those making appropriations in the future were required to file statements of their claims with the county clerks.

In 1913 a law was enacted that made the law permitting the appropriation of water applicable to the whole state, created the state board of water engineers, and gave to this board supervision over the waters of the state.

All parties claiming rights to water were required to file statements of their claims with the board, parties wishing to acquire rights were required to apply to the board for permits, and the taking of water from streams without a permit was made illegal.

The original law gave the board no authority to define rights acquired previous to the creation of the board, but this authority was given to the board in 1917. When the board has completed an adjudication it issues certificates to all parties setting forth their rights.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total. <sup>1</sup>
	Acres.	Per cent of total.	
Total.....	586,120	100.0	100.0
Appropriation and use.....	69,334	11.8	70.8
Notices filed and posted.....	105,069	17.9	5.3
Adjudicated by court.....	2,755	0.5	( <sup>2</sup> )
Permit from state.....	229,753	39.2	( <sup>2</sup> )
Certificate or license from state.....	11,898	2.0	( <sup>2</sup> )
Riparian rights.....	72,396	12.4	11.7
Underground.....	44,649	7.6	( <sup>2</sup> )
Other and mixed.....	594	0.1	( <sup>2</sup> )
Not reported.....	49,672	8.5	( <sup>2</sup> )

<sup>1</sup> Exclusive of land irrigated for rice growing.  
<sup>2</sup> This class was not included in the tabulation in 1909. All land for which the class of water rights was not reported was included in "Appropriation and use."  
<sup>3</sup> Small areas erroneously reported as in this class. State issued no permit certificate before 1913.

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	586,120	*61,768	848.9	1,687,447	1,150,542
Rio Grande River and tributaries.....	315,693	39,269	703.9	883,708	681,502
Rio Grande River direct.....	254,186	8,749	.....	705,270	555,761
Pecos River.....	67,418	22,358	156.8	172,043	120,492
Las Moras Creek.....	1,460	680	116.0	1,534	1,519
Other tributaries of Rio Grande River.....	2,620	*7,482	-65.0	4,861	3,730
Tributaries of Gulf of Mexico.....	263,464	21,833	.....	780,366	456,015
Nueces River.....	13,753	2,663	416.4	50,006	31,977
San Antonio River.....	13,179	2,955	346.0	61,789	60,177
Colorado River.....	71,278	10,402	585.2	277,268	125,656
Brazos River.....	7,535	448	.....	22,896	19,560
Trinity River.....	42,770	( <sup>2</sup> )	.....	96,320	52,720
Neches River.....	64,900	( <sup>2</sup> )	.....	149,800	82,000
Sabine River.....	12,322	( <sup>2</sup> )	.....	24,468	20,508
Other Gulf streams.....	37,227	*5,965	583.9	97,639	63,407
Canadian River.....	440	340	29.4	840	440
Red River.....	6,523	161	.....	22,513	12,585

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes 165 acres for springs and wells not reported by drainage basins.  
<sup>3</sup> Includes springs and wells.  
<sup>4</sup> Not shown separately in 1902.

The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from

springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1900 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase. <sup>1</sup>	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$35,072,739	100.0	\$30.48	50.1
1910.....	13,487,347	.....	19.52	-5.7
1900.....	1,027,608	.....	20.70	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$35,072,739	100.0	\$30.48
1860-1869.....	30,000	0.1	75.00
1870-1879.....	1,108,104	3.2	26.17
1880-1889.....	296,723	0.8	10.53
1890-1899.....	987,951	2.8	17.88
1900-1904.....	4,903,055	14.0	22.21
1905-1909.....	7,762,497	22.1	28.80
1910-1914.....	14,010,412	39.9	34.90
1915-1919.....	2,747,636	7.8	36.26
Not reported.....	3,227,361	9.2	58.33

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$35,072,739	100.0	\$30.48	558,306	\$6.92
Streams, gravity.....	5,631,241	16.1	39.44	66,906	1.98
Streams, pumped.....	19,432,010	55.4	23.70	412,118	7.55
Streams, pumped and gravity.....	60,000	0.2	100.00	350	8.57
Wells, pumped.....	2,783,280	7.9	39.24	31,749	11.07
Wells, flowing.....	340,538	1.0	54.13	1,528	4.45
Wells, flowing and pumped.....	163,057	0.5	47.57	1,253	16.69
Lakes, pumped.....	176,700	0.5	22.38	517	6.32
Springs.....	316,664	0.9	27.94	8,217	2.72
Stored storm water.....	4,785,276	13.6	87.42	11,368	5.51
Sewage.....	40,072	0.1	154.12	.....	.....
Streams, gravity, and pumped wells.....	34,680	0.1	44.58	454	16.83
Streams, gravity, and flowing wells.....	5,000	( <sup>2</sup> )	90.91	.....	.....
Other mixed.....	1,304,241	3.7	41.19	23,828	5.95

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

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TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE.	
			Amount.	Per cent. <sup>1</sup>
Total.....	\$35,072,739	\$1,570,118	\$33,493,621	.....
Rio Grande River and tributaries.....	18,925,769	1,052,480	17,873,289	.....
Rio Grande River direct.....	16,208,058	468,100	15,739,958	.....
Pecos River.....	2,219,595	451,045	1,768,550	392.1
Las Moras Creek.....	192,566	7,925	184,641	.....
Other tributaries of Rio Grande River.....	305,550	* 125,410	180,140	143.6
Tributaries of Gulf of Mexico.....	15,707,698	501,272	15,206,426	.....
Nueces River.....	1,326,555	56,808	1,269,747	.....
San Antonio River.....	5,087,542	63,765	5,023,777	.....
Colorado River.....	3,560,916	154,529	3,406,387	.....
Brazos River.....	569,543	25,443	544,100	.....
Trinity River.....	1,743,621	( <sup>4</sup> )	1,743,621	.....
Neches River.....	1,596,770	( <sup>4</sup> )	1,596,770	.....
Sabine River.....	345,935	( <sup>4</sup> )	345,935	.....
Other Gulf streams.....	1,476,816	* 200,727	1,276,089	635.7
Canadian River.....	69,472	4,500	64,972	.....
Red River.....	369,800	2,250	367,550	.....

<sup>1</sup> Per cent not shown when more than 1,000.  
<sup>2</sup> Includes \$18,616 for springs and wells not reported by drainage basins.  
<sup>3</sup> Includes springs and wells.  
<sup>4</sup> Not reported separately in 1902.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$35,072,739	100.0	558,306	\$6.92
Individual and partnership.....	8,256,568	23.5	88,008	8.10
Cooperative.....	3,821,844	10.9	102,764	6.76
Irrigation district.....	5,449,142	15.5	88,571	6.44
Commercial.....	13,825,409	39.4	258,614	7.05
U. S. Reclamation Service.....	3,673,476	10.5	20,284	2.90
State.....	6,802	( <sup>2</sup> )	65	27.69
City.....	39,498	0.1	.....	.....

<sup>1</sup> Based on area irrigated in 1919.    <sup>2</sup> Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	166
Acreage included in enterprises reporting land drained or needing drainage..	650,822
Acreage for which drains have been installed.....	272,437
Additional acreage needing drainage.....	154,532
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	41.9
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	16.1
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state....	25.3

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Meas-ured.	Not meas-ured.
Average volume of water entering canals, second-foot.....	5,835	817	5,018
Area irrigated in 1919.....acres..	171,718	45,001	126,715
Average number of acres per second-foot.....	29	55	25
Total quantity of water entering canals, acre-foot..	1,586,840	204,919	1,381,921
Area irrigated in 1919.....acres..	247,619	47,325	200,294
Average quantity per acre.....acre-foot..	6.4	4.3	6.9
Total quantity of water delivered.....acre-foot..	385,540	100,869	284,671
Area irrigated in 1919.....acres..	167,005	48,533	118,472
Average quantity per acre.....acre-foot..	2.3	2.1	2.4



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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN; 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	165	134	820	23,261	1,524	2,022	2,949	368	392,999
Rio Grande River and tributaries.....	44	33	164	12,530	641	875	1,671	74	87,169
Rio Grande River direct.....	11	19	81	9,319	365	361	1,275	46	24,999
Pecos River.....	28	9	61	2,725	257	241	313	24	62,165
Las Moras Creek.....	2	1	4	75	8	260	87		
Other tributaries of Rio Grande River.....	5	4	8	411	11	13	16	4	5
Tributaries of Gulf of Mexico.....	108	99	612	10,618	828	978	1,202	292	297,826
Nueces River.....	54	29	85	163	96	139	42	223	1,987
San Antonio River.....	4	10	50	1,782	60	80	82	24	260,346
Colorado River.....	46	53	244	3,925	324	333	639	30	8,092
Brazos River.....		2	155	287	130	270	136	3	800
Trinity River.....		1	6	1,022	77	47	102	1	25,000
Neches River.....			7	1,380	40	30	77		
Sabine River.....			9	481	42	27	33		
Other Gulf streams.....	4	4	56	1,578	59	52	91	11	1,601
Canadian River.....			4	4	2	8	2		
Red River.....	13	2	50	109	53	161	74	2	8,004

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.		Average lift (feet).
								Number.	Capacity (gallons per minute).	
Total.....	157.1	135	62,364	901	538,565	1,369	80,511	1,641	6,825,998	45
Rio Grande River and tributaries.....	41.1	15	9,110	49	23,872	151	22,560	232	2,414,876	
Rio Grande River direct.....	40.5			5	2,025	105	21,779	172	2,383,251	50
Pecos River.....	0.6	14	9,050	42	21,509	39	719	53	28,253	53
Las Moras Creek.....						1	6	1	250	20
Other tributaries of Rio Grande River.....		1	60	2	338	6	56	6	3,122	56
Tributaries of Gulf of Mexico.....	115.8	118	50,754	808	464,943	1,157	54,456	1,346	4,358,862	41
Nueces River.....	92.6	81	26,065	276	72,937	321	6,533	342	160,472	47
San Antonio River.....	10.9	25	15,465	43	12,884	77	1,438	80	31,039	39
Colorado River.....	8.5	3	5,400	57	30,667	311	12,500	359	912,048	30
Brazos River.....	2.2	3	3,500	150	136,332	166	6,276	175	153,585	63
Trinity River.....	1.5					11	7,688	20	445,100	34
Neches River.....						6	5,850	23	1,929,500	24
Sabine River.....						9	1,855	16	187,000	14
Other Gulf streams.....	1	6	324	278	212,143	256	11,316	331	540,118	42
Canadian River.....	2			3	2,000	3	115	3	2,000	30
Red River.....		2	2,600	46	47,760	58	3,390	60	50,260	31

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TABLE 18.—ACREAGE, YIELD, AND VALUE OF CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	36,736	0.8	9,088	0.2	305.1	Bu.....	1,207,132	1.1	191,474	0.3	530.4
2 Oats.....	3,494	0.2	2,496	0.6	40.0	Bu.....	53,885	0.1	60,015	0.9	-10.2
3 Winter wheat.....	6,146	0.3	1,396	0.4	343.4	Bu.....	90,535	0.2	26,631	1.1	239.3
<b>Other grains and seeds:</b>											
4 Kafir, milo, etc.....	6,310	0.4	1,154	0.2	446.8	Bu.....	200,459	0.5	29,449	0.5	580.7
5 Dry beans, navy, etc.....	694	7.6	( <sup>2</sup> )			Bu.....	6,781	10.0	( <sup>2</sup> )		
<b>Hay and forage:</b>											
6 Alfalfa.....	19,455	33.4	13,778	24.9	41.2	Tons....	55,544	40.5	43,771	44.7	26.9
7 Other tame or cultivated grasses.....	4,812	1.8	5,009	1.9	-7.9	Tons....	8,790	2.3	6,655	2.3	32.1
8 Small grains cut for hay.....	1,145	0.7	( <sup>2</sup> )			Tons....	1,244	0.6	( <sup>2</sup> )		
9 Wild, salt, or prairie grasses.....	690	0.4	593	0.3	16.4	Tons....	691	0.3	773	0.4	-10.6
10 Corn cut for forage.....	582	0.5	( <sup>2</sup> )			Tons....	631	0.9	( <sup>2</sup> )		
11 Kafir, sorghum, etc., for forage.....	11,817	0.8	( <sup>2</sup> )			Tons....	26,570	1.1	( <sup>2</sup> )		
<b>Vegetables:</b>											
12 Potatoes (Irish or white).....	553	2.0	961	2.7	-42.5	Bu.....	35,317	2.1	90,089	4.0	-60.8
13 Sweet potatoes and yams.....	603	0.9	( <sup>2</sup> )			Bu.....	59,223	1.0	( <sup>2</sup> )		
14 Cabbages.....	1,976	45.6	1,416	31.7	39.5						
15 Onions.....	942	15.1	1,842	35.6	-45.9						
16 Beans (green).....	478	34.6	( <sup>2</sup> )								
17 Tomatoes.....	614	10.4	( <sup>2</sup> )								
<b>Miscellaneous:</b>											
18 Rough rice.....	164,301	99.9	( <sup>2</sup> )			Bu.....	5,297,169	99.8	( <sup>2</sup> )		
19 Broom corn.....	12,199	30.7	( <sup>2</sup> )			Lbs....	5,144,047	36.0	( <sup>2</sup> )		
20 Cotton.....	22,006	0.2	7,474	0.1	194.4	Bales..	8,537	0.3	2,299	0.1	271.3

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	22.8	22.7	32.9	144.3	144.9	\$1,629,628	1.1	\$162,467	0.3	903.1
2 Oats.....	Bu.....	34.3	34.4	15.4	44.8	44.8	43,116	0.1	38,668	1.0	11.5
3 Winter wheat.....	Bu.....	15.1	15.1	14.7	97.4	97.4	157,407	0.2	23,408	0.8	700.6
<b>Other grains and seeds:</b>											
4 Kafir, milo, etc.....	Bu.....	24.6	24.6	31.8	129.3	129.3	230,528	0.5	19,612	0.5	
5 Dry beans, navy, etc.....	Bu.....	7.4	7.2	9.8	132.4	136.1	29,836	10.0	( <sup>2</sup> )		
<b>Hay and forage:</b>											
6 Alfalfa.....	Tons....	2.35	2.10	2.85	121.3	135.7	1,638,548	40.5	598,911	44.7	173.6
7 Other tame or cultivated grasses.....	Tons....	1.46	1.46	1.91	130.8	130.8	202,170	2.3	80,460	8.0	151.3
8 Small grains cut for hay.....	Tons....	1.15	1.15	1.09	94.8	94.8	29,856	0.6	( <sup>2</sup> )		
9 Wild, salt, or prairie grasses.....	Tons....	1.18	1.18	1.00	84.7	84.7	12,784	0.3	10,748	0.7	19.0
10 Corn cut for forage.....	Tons....	0.61	0.61	1.08	177.0	177.0	11,939	0.9	( <sup>2</sup> )		
11 Kafir, sorghum, etc., for forage.....	Tons....	1.65	1.65	2.25	136.4	136.4	604,830	1.1	( <sup>2</sup> )		
<b>Vegetables:</b>											
12 Potatoes (Irish or white).....	Bu.....	62.6	62.6	63.9	102.1	102.1	79,441	2.1	81,052	4.4	-2.0
13 Sweet potatoes and yams.....	Bu.....	85.7	85.6	98.2	114.6	114.7	106,601	1.0	( <sup>2</sup> )		
14 Cabbages.....							394,883	54.5	143,671	37.6	174.9
15 Onions.....							424,763	16.0	297,440	36.2	42.8
16 Beans (green).....							74,620	43.6	( <sup>2</sup> )		
17 Tomatoes.....							176,800	14.6	( <sup>2</sup> )		
<b>Miscellaneous:</b>											
18 Rough rice.....	Bu.....	32.3	( <sup>2</sup> )	32.2	100.0	( <sup>2</sup> )	14,832,078	99.8	( <sup>2</sup> )		
19 Broom corn.....	Lbs....	859.4	331.8	421.7	117.3	127.1	257,202	36.0	( <sup>2</sup> )		
20 Cotton.....	Bales..	0.26	0.26	0.39	150.0	150.0	1,476,901	0.3	143,157	0.9	931.7

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported in 1909.  
<sup>3</sup> Acreage too small to use as a base for a just average.

IRRIGATION—TEXAS.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	THE STATE.	Atascosa.	Bailey.	Bexar.	Brazoria.	Brewster.	Cameron. <sup>1</sup>	Chambers.	Colorado.	
1	Number of all farms in 1920.....	436,033	1,534	79	3,205	2,074	163	1,507	506	2,489
2	Number of farms irrigated in 1919.....	5,974	94	24	174	3	17	871	146	120
3	Per cent of all farms.....	1.4	6.1	30.4	5.4	0.1	10.4	57.8	28.9	4.9
4	Number of farms irrigated in 1909.....	5,238			175	9		314	99	57
5	Per cent of increase, 1909-1919.....	14.1			-0.6					
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres.....	167,934,720	869,120	659,200	808,320	857,600	3,798,400	896,640	395,520	622,080
7	All land in farms.....acres.....	114,020,621	379,296	352,142	576,218	303,037	1,772,086	299,279	179,430	457,296
8	Improved land in farms.....acres.....	31,227,503	127,520	13,553	234,287	165,150	9,511	83,121	51,321	169,846
9	Area irrigated in 1919.....acres.....	586,120	2,312	2,195	12,933	250	596	60,008	20,200	15,321
10	Per cent of improved land in farms.....	1.9	1.8	16.2	5.5	0.2	6.3	72.2	58.9	9.0
11	Area irrigated in 1909.....acres.....	451,130			4,690	1,972	17	29,439	27,375	7,503
12	Per cent of increase, 1909-1919.....	29.9			175.8	-82.3			6.7	104.2
13	Area enterprises were capable of irrigating in 1920.....acres.....	1,150,542	4,067	3,555	57,736	1,000	873	120,948	38,700	19,378
14	Area enterprises were capable of irrigating in 1910.....acres.....	690,901			7,122	2,700	17	115,363	27,950	10,435
15	Per cent of increase, 1910-1920.....	66.5			710.7	-63.0			38.5	85.7
16	Area included in enterprises in 1920.....acres.....	1,687,447	6,445	4,680	59,055	1,000	1,087	178,414	72,200	45,287
17	Area included in enterprises in 1910.....acres.....	1,253,173			9,438	5,150	32	156,349	70,450	13,501
18	Per cent of increase, 1910-1920.....	34.7			525.7	-80.6			2.6	235.4
19	Area of irrigated land reported as available for settlement.....acres.....	346,446						50,568		
<b>IRRIGATION WORKS.</b>										
<b>Independent enterprises:</b>										
20	Number, 1920.....	1,371	35	24	43	1	16	17	4	31
21	Number, 1910.....	2,772			36	8		26	8	46
<b>Main ditches:</b>										
22	Number, 1920.....	820	23	26	24	1	9	21	4	10
23	Number, 1910.....	861			10	6	3	32	5	18
24	Length, 1920.....miles.....	1,524	44	24	53	2	6	140	55	36
25	Length, 1910.....miles.....	1,479			30	7	1	158	41	22
26	Capacity, 1920.....second-feet.....	23,261	25	50	1,702	1	132	3,435	865	523
27	Capacity, 1910.....second-feet.....	12,818			1,153		2	3,099		
<b>Laterals:</b>										
28	Number, 1920.....	2,022	34	52	44			92	24	39
29	Number, 1910.....	832			7			112	28	11
30	Length, 1920.....miles.....	2,949	16	26	74			456	66	42
31	Length, 1910.....miles.....	1,224			6			241	61	13
<b>Reservoirs:</b>										
32	Number, 1920.....	368	21		11			3	1	1
33	Number, 1910.....	309			16	5		16	1	2
34	Capacity, 1920.....acre-feet.....	392,999	46		260,316			1,501	25,000	
35	Capacity, 1910.....acre-feet.....	74,361			6,364	1,565		32,964	61	
<b>Flowing wells:</b>										
36	Number, 1920.....	135	40		23			1		
37	Number, 1910.....	123			21			2		
38	Capacity, 1920.....gallons per minute.....	62,364	16,540		15,410			60		
39	Capacity, 1910.....gallons per minute.....	37,019			11,983			90		
<b>Pumped wells:</b>										
40	Number, 1920.....	901	10	27	22			15		39
41	Number, 1910.....	1,912			18	3		7	12	65
42	Capacity, 1920.....gallons per minute.....	538,565	7,700	24,150	10,820			964	25	25,850
43	Capacity, 1910.....gallons per minute.....	567,126			11,207	2,600		114	5,175	39,620
<b>Pumping plants:</b>										
44	Number, 1920.....	1,369	11	24	31	1		15	23	44
45	Number, 1910.....	2,309			24	9		7	39	60
46	Engine capacity, 1920.....horsepower.....	80,511	141	585	693	125		153	5,847	4,164
47	Engine capacity, 1910.....horsepower.....	66,094			461	530		13	3,538	2,629
48	Pump capacity, 1920.....gallons per minute.....	6,825,998	8,900	24,150	14,220	12,000		6,538	887,212	309,200
49	Pump capacity, 1910.....gallons per minute.....	5,362,665			17,710	48,800		114	607,610	296,133
50	Average lift, 1920.....feet.....	45	51	24	31	14		46	15	50
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars.....	35,072,739	142,168	73,900	4,946,566	10,010	80,955	3,108,489	1,008,802	523,925
52	Capital invested to July 1, 1910.....dollars.....	13,487,347			221,236	59,252	6,950	2,024,500	593,410	173,503
53	Per cent of increase, 1910-1920.....	160.0				-83.1			70.0	193.5
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars.....	30.48	34.96	20.79	85.68	10.01	92.73	25.70	26.07	27.04
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars.....	19.52			31.06	21.95	408.82	17.55	21.23	17.11
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars.....	89,880,871	146,218	73,900	5,446,566	10,010	90,655	4,098,489	1,008,802	523,925
57	Estimated final cost of existing enterprises in 1910.....dollars.....	14,754,172			221,236	59,252	6,950	2,518,199	593,410	173,503
58	Per cent of increase, 1910-1920.....	170.2				-83.1			70.0	193.5
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars.....	23.62	22.69	15.79	92.23	10.01	83.40	22.97	13.97	11.57
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars.....	11.77			23.44	11.51	217.19	16.11	8.43	13.23

<sup>1</sup> Part taken to form part of Willacy County in 1911.

IRRIGATION—TEXAS.

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COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Deaf Smith.	Dimmit.	El Paso. <sup>1</sup>	Floyd.	Frio.	Galveston.	Hale.	Hardeman.	Harris.	
1	Number of all farms in 1920.....	382	295	542	1,289	720	723	1,031	1,077	2,880
2	Number of farms irrigated in 1919.....	43	256	476	47	24	2	59	2	60
3	Per cent of all farms.....	11.3	86.8	87.8	3.0	3.3	0.3	5.7	0.2	2.1
4	Number of farms irrigated in 1909.....		94	446			9		2	90
5	Per cent of increase, 1909-1919.....									
<b>LAND AND FARM AREA.</b>										
6	Approximate land area..... acres..	991,360	870,400	590,720	647,040	719,360	252,800	663,040	487,040	1,058,500
7	All land in farms..... acres..	693,073	207,885	217,367	490,731	581,407	102,332	581,713	366,152	379,262
8	Improved land in farms..... acres..	83,989	23,172	30,119	242,822	112,956	27,900	235,880	166,287	216,879
9	Area irrigated in 1919..... acres..	6,483	5,397	20,259	1,497	655	203	3,335		8,000
10	Per cent of improved land in farms.....	7.7	23.3	67.3	0.6	0.6	0.7	1.4		3.7
11	Area irrigated in 1909..... acres..		3,327	23,308			2,500	5	4,040	25,795
12	Per cent of increase, 1909-1919.....		62.2				-91.9			-69.0
13	Area enterprises were capable of irrigating in 1920..... acres..	11,345	10,480	25,005	4,877	1,247	340	8,728	1,040	11,000
14	Area enterprises were capable of irrigating in 1910..... acres..		5,618	25,324			3,195	5	4,040	26,760
15	Per cent of increase, 1910-1920.....		86.5				-89.4		-74.3	-58.9
16	Area included in enterprises in 1920..... acres..	13,341	19,792	58,005	5,585	3,369	440	10,162	8,212	16,000
17	Area included in enterprises in 1910..... acres..		9,934	35,287			3,985	5	5,075	27,980
18	Per cent of increase, 1910-1920.....		99.2				-89.0		61.8	-42.8
19	Area of irrigated land reported as available for settlement..... acres..		1,250	25,000						
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	43	146	2	47	24	2	58	2	1
21	Number, 1910.....		76	63			6		2	31
Main ditches:										
22	Number, 1920.....	46	7	4	48	4		64	2	1
23	Number, 1910.....		37	21			5		2	16
24	Length, 1920..... miles..	43	3	40	43	1		52	8	5
25	Length, 1910..... miles..		34	73			8		11	21
26	Capacity, 1920..... second-feet..	94	39	774	94	10		113	12	266
27	Capacity, 1910..... second-feet..		197	2,327				60		
Laterals:										
28	Number, 1920.....	141	2		94			112	12	5
29	Number, 1910.....		5	20						11
30	Length, 1920..... miles..	70	2		47	1		56		35
31	Length, 1910..... miles..		4	44						36
Reservoirs:										
32	Number, 1920.....		153			17		1	2	
33	Number, 1910.....		63	1			1		2	3
34	Capacity, 1920..... acre-feet..		1,690			23		800	8,004	
35	Capacity, 1910..... acre-feet..		295	2			1		5	333
Flowing wells:										
36	Number, 1920.....	2	27			4				
37	Number, 1910.....		42							1
38	Capacity, 1920..... gallons per minute..	2,500	6,025			1,500				
39	Capacity, 1910..... gallons per minute..		17,368							80
Pumped wells:										
40	Number, 1920.....	44	178		48	37	3	68		
41	Number, 1910.....		48	61			2	1		36
42	Capacity, 1920..... gallons per minute..	46,250	48,450		43,250	7,695	2,216	62,797		
43	Capacity, 1910..... gallons per minute..		24,760	37,190			6,000	50		35,000
Pumping plants:										
44	Number, 1920.....	43	181		47	27	2	65		1
45	Number, 1910.....		52	65			6	1		36
46	Engine capacity, 1920..... horsepower..	2,340	3,851		1,950	306	82	3,212		2,400
47	Engine capacity, 1910..... horsepower..		692	878			695	5		3,390
48	Pump capacity, 1920..... gallons per minute..	48,750	74,900		43,250	8,045	2,216	62,985		120,000
49	Pump capacity, 1910..... gallons per minute..		30,712	46,240			27,100	50		155,350
50	Average lift, 1920..... feet..	79	39		91	63	41	76		50
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920..... dollars..	290,300	578,670	3,670,550	154,100	147,800	20,180	280,630	62,000	150,000
52	Capital invested to July 1, 1910..... dollars..		243,078	282,590			72,476	125	75,850	848,600
53	Per cent of increase, 1910-1920.....		138.1				-72.2		-18.3	-82.3
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	25.59	55.22	146.79	31.60	118.52	59.35	32.15	59.62	13.64
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..		43.27	11.16			22.68	25.00	18.77	31.71
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920..... dollars..	290,300	611,720	5,310,550	154,100	149,300	20,180	280,630	62,000	150,000
57	Estimated final cost of existing enterprises in 1910..... dollars..		243,078	282,590			72,476	125	75,850	848,600
58	Per cent of increase, 1910-1920.....		151.7				-72.2		-18.3	-82.3
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	21.76	30.91	91.55	27.59	44.32	45.86	27.62	7.55	9.38
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..		24.47	8.01			18.19	25.00	14.95	30.33

<sup>1</sup> Parts taken to form Culberson County in 1911 and Hudspeth County in 1917.



IRRIGATION—TEXAS.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Hidalgo. <sup>1</sup>	Irion.	Jackson.	Jefferson.	Jeff Davis.	Kimble.	Kinney.	La Salle.	Liberty.
1 Number of all farms in 1920.....	1,727	136	1,485	419	62	372	98	280	1,314
2 Number of farms irrigated in 1919.....	1,131	64	45	274	18	68	9	65	12
3 Per cent of all farms.....	65.5	47.1	3.0	65.4	29.0	18.3	9.2	23.2	0.9
4 Number of farms irrigated in 1909.....	278	31	74	160	.....	59	16	58	5
5 Per cent of increase, 1909-1919.....	.....	.....	.....	71.3	.....	.....	.....	.....	.....
<b>LAND AND FARM AREA.</b>									
6 Approximate land area.....acres..	1,042,560	638,720	571,520	588,800	1,448,320	832,640	839,680	999,040	742,400
7 All land in farms.....acres..	394,874	686,014	398,771	130,230	927,451	672,596	595,600	595,010	199,957
8 Improved land in farms.....acres..	99,822	7,604	126,961	93,435	1,085	26,143	13,066	40,401	73,449
9 Area irrigated in 1919.....acres..	160,532	2,133	6,074	74,002	1,210	290	1,944	2,531	13,500
10 Per cent of improved land in farms.....	160.8	28.1	4.8	79.2	111.5	1.1	14.1	5.3	18.4
11 Area irrigated in 1909.....acres..	21,048	1,511	11,197	75,963	186	2,297	3,359	2,165	1,030
12 Per cent of increase, 1909-1919.....	.....	41.2	-45.6	-2.6	550.5	-57.4	-48.1	18.9	.....
13 Area enterprises were capable of irrigating in 1920.....acres..	288,538	2,062	6,749	97,100	1,351	2,964	2,969	5,292	14,000
14 Area enterprises were capable of irrigating in 1910.....acres..	71,327	1,562	10,293	92,918	236	2,569	3,359	3,022	4,870
15 Per cent of increase, 1910-1920.....	.....	32.0	-34.4	4.5	472.5	.....	-11.6	75.1	187.5
16 Area included in enterprises in 1920.....acres..	424,538	2,417	8,584	174,000	2,034	4,783	4,034	6,574	24,000
17 Area included in enterprises in 1910.....acres..	222,569	1,662	14,995	99,822	731	9,885	3,634	15,640	5,470
18 Per cent of increase, 1910-1920.....	.....	45.4	-42.8	74.3	178.2	-51.8	11.0	-58.0	338.8
19 Area of irrigated land reported as available for settlement.....acres..	29,000	.....	.....	11,100	.....	.....	1,450	.....	500
<b>IRRIGATION WORKS.</b>									
Independent enterprises:									
20 Number, 1920.....	9	15	44	18	12	52	6	38	2
21 Number, 1910.....	12	11	78	160	.....	32	15	54	7
Main ditches:									
22 Number, 1920.....	10	24	10	19	9	37	5	2	2
23 Number, 1910.....	12	11	23	22	10	24	13	37	3
24 Length, 1920.....miles..	141	22	7	57	3	23	13	2	22
25 Length, 1910.....miles..	99	13	21	133	4	39	21	16	4
26 Capacity, 1920.....second-feet..	3,191	59	315	1,936	10	101	103	3	157
27 Capacity, 1910.....second-feet..	1,911	44	.....	.....	19	141	42	158	.....
Laterals:									
28 Number, 1920.....	134	66	18	40	.....	5	269	.....	23
29 Number, 1910.....	146	1	6	39	16	27	31	.....	.....
30 Length, 1920.....miles..	785	15	9	89	.....	1	77	.....	36
31 Length, 1910.....miles..	173	2	2	154	1	17	14	.....	.....
Reservoirs:									
32 Number, 1920.....	3	1	.....	1	8	2	.....	6	.....
33 Number, 1910.....	5	3	4	4	7	2	2	18	.....
34 Capacity, 1920.....acre-feet..	3,400	.....	.....	500	.....	5	.....	13	.....
35 Capacity, 1910.....acre-feet..	2,627	22	86	144	48	4	70	219	.....
Flowing wells:									
36 Number, 1920.....	.....	.....	.....	.....	.....	.....	.....	2	.....
37 Number, 1910.....	.....	.....	.....	.....	.....	.....	.....	2	.....
38 Capacity, 1920.....gallons per minute..	.....	.....	.....	.....	.....	.....	.....	1,000	.....
39 Capacity, 1910.....gallons per minute..	.....	.....	.....	.....	.....	.....	.....	21	.....
Pumped wells:									
40 Number, 1920.....	.....	1	48	.....	7	.....	.....	.....	.....
41 Number, 1910.....	3	.....	75	1	4	.....	2	10	5
42 Capacity, 1920.....gallons per minute..	.....	1,500	40,600	.....	3,180	.....	.....	.....	.....
43 Capacity, 1910.....gallons per minute..	81	.....	90,000	11	370	.....	30	760	45,500
Pumping plants:									
44 Number, 1920.....	10	12	44	19	11	37	2	43	3
45 Number, 1910.....	23	7	84	24	5	13	2	53	7
46 Engine capacity, 1920.....horsepower..	11,110	181	1,868	6,770	148	571	256	1,184	3,000
47 Engine capacity, 1910.....horsepower..	3,707	98	3,366	9,526	15	257	3	1,131	1,060
48 Pump capacity, 1920.....gallons per minute..	1,366,576	17,800	54,160	2,039,600	4,450	10,910	20,250	45,250	135,000
49 Pump capacity, 1910.....gallons per minute..	355,589	11,531	119,440	1,170,010	420	12,338	30	30,582	65,100
50 Average lift, 1920.....feet..	21	19	58	15	70	27	29	23	55
<b>CAPITAL INVESTED.</b>									
51 Capital invested to Jan. 1, 1920.....dollars..	8,024,550	53,400	236,189	1,785,400	59,098	88,381	383,118	155,450	732,779
52 Capital invested to July 1, 1910.....dollars..	1,961,992	17,090	265,525	1,210,787	7,050	62,790	11,676	117,559	71,500
53 Per cent of increase, 1910-1920.....	.....	212.5	-11.0	47.5	738.3	37.6	.....	32.2	924.9
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	20.65	25.90	35.00	18.39	43.74	29.14	129.04	29.37	52.34
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	27.51	10.94	25.80	13.03	29.87	24.44	3.48	38.90	14.68
<b>ESTIMATED FINAL COST.</b>									
56 Estimated final cost of existing enterprises in 1920.....dollars..	9,849,550	53,600	236,189	1,815,400	59,098	88,131	383,118	155,450	732,779
57 Estimated final cost of existing enterprises in 1910.....dollars..	2,342,318	17,000	265,525	1,210,787	7,050	62,790	11,676	117,559	71,500
58 Per cent of increase, 1910-1920.....	.....	213.6	-11.0	49.9	738.3	40.4	.....	32.2	924.9
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	22.02	23.18	27.52	10.43	29.06	18.50	94.97	23.65	30.53
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	10.52	10.28	17.71	12.13	9.64	6.35	3.21	7.52	13.07

<sup>1</sup> Parts taken to form parts of Brooks and Willacy Counties in 1911.  
<sup>2</sup> The excess of farm acreage over approximate land area is due to the fact that the entire acreage of a farm is tabulated as in the county where the operator resides, even though part of the farm may be situated in an adjoining county.

IRRIGATION—TEXAS.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Loving.	Mata-gorda.	Maver-ick.	Menard.	Orange.	Pecos.	Presidio.	Real. <sup>1</sup>	Reeves.	Run-nels.
1	Number of all farms in 1920.....	14	1,616	66	308	311	207	102	260	2,023
2	Number of farms irrigated in 1919.....	7	126	36	85	115	134	31	37	18
3	Per cent of all farms.....	50.0	7.8	54.5	27.6	37.0	64.7	30.4	14.2	0.9
4	Number of farms irrigated in 1909.....	12	212	8	52	62	2	43	63	.....
5	Per cent of increase, 1909-1919.....	.....	-40.6	.....	.....	.....	.....	.....	.....	.....
<b>LAND AND FARM AREA.</b>										
6	Approximate land area.....acres..	481,920	727,040	800,640	584,960	232,320	2,645,760	2,439,680	396,160	693,120
7	All land in farms.....acres..	172,323	406,537	131,521	512,431	64,372	2,331,822	1,212,914	359,814	1,050,716
8	Improved land in farms.....acres..	456	221,678	4,242	20,414	26,071	16,043	6,723	15,952	234,498
9	Area irrigated in 1919.....acres..	400	33,510	2,653	5,003	12,822	22,312	2,150	452	13,286
10	Per cent of improved land in farms.....	87.7	15.1	62.5	24.5	49.2	139.1	32.0	2.8	81.1
11	Area irrigated in 1909.....acres..	1,049	60,834	1,166	3,499	10,515	2,300	855	13,986	372
12	Per cent of increase, 1909-1919.....	-61.5	-44.9	127.5	43.0	21.9	870.1	151.5	-5.0	25.5
13	Area enterprises were capable of irrigating in 1920.....acres..	500	66,200	3,913	6,564	20,508	60,453	1,850	3,227	20,553
14	Area enterprises were capable of irrigating in 1910.....acres..	5,551	86,218	2,345	3,847	12,515	3,300	887	3,227	17,378
15	Per cent of increase, 1910-1920.....	-91.0	-23.2	68.9	70.6	63.9	.....	108.6	.....	18.3
16	Area included in enterprises in 1920.....acres..	3,000	164,875	6,513	7,120	24,468	68,653	2,550	3,274	26,066
17	Area included in enterprises in 1910.....acres..	30,061	130,304	2,545	5,440	26,045	35,600	897	3,274	44,858
18	Per cent of increase, 1910-1920.....	-90.0	26.5	155.9	30.9	-6.1	82.8	184.3	.....	-41.9
19	Area of irrigated land reported as available for settle-ment.....acres..	2,600	90,175	3,750	.....	3,588	28,580	300	.....	9,960
<b>IRRIGATION WORKS.</b>										
Independent enterprises:										
20	Number, 1920.....	1	15	5	55	8	16	3	19	28
21	Number, 1910.....	4	37	7	19	11	2	9	.....	16
Main ditches:										
22	Number, 1920.....	1	20	7	27	9	18	6	21	24
23	Number, 1910.....	4	29	4	17	9	2	3	.....	12
24	Length, 1920.....miles..	2	111	5	28	42	135	13	24	53
25	Length, 1910.....miles..	9	114	3	21	28	13	8	.....	62
26	Capacity, 1920.....second-feet..	9	1,772	60	254	461	1,372	23	23	399
27	Capacity, 1910.....second-feet..	557	.....	24	145	.....	37	16	.....	297
Laterals:										
28	Number, 1920.....	2	55	28	13	27	85	12	11	139
29	Number, 1910.....	4	86	3	2	21	9	6	.....	107
30	Length, 1920.....miles..	1	105	32	428	33	212	5	7	47
31	Length, 1910.....miles..	7	142	1	4	.....	11	.....	.....	75
Reservoirs:										
32	Number, 1920.....	.....	1	.....	1	.....	3	.....	.....	1
33	Number, 1910.....	.....	.....	.....	.....	.....	.....	1	.....	5
34	Capacity, 1920.....acre-feet..	.....	3	.....	100	.....	56,000	.....	.....	6,155
35	Capacity, 1910.....acre-feet..	.....	.....	.....	.....	.....	.....	1	.....	5,002
Flowing wells:										
36	Number, 1920.....	.....	2	.....	.....	.....	9	.....	.....	5
37	Number, 1910.....	.....	.....	.....	.....	.....	.....	.....	.....	2
38	Capacity, 1920.....gallons per minute..	.....	120	.....	.....	.....	7,200	.....	.....	1,850
39	Capacity, 1910.....gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....	600
Pumped wells:										
40	Number, 1920.....	.....	8	.....	3	.....	1	.....	.....	22
41	Number, 1910.....	.....	14	.....	.....	.....	.....	1	.....	7
42	Capacity, 1920.....gallons per minute..	.....	8,700	.....	1,040	.....	1,200	.....	.....	16,465
43	Capacity, 1910.....gallons per minute..	.....	10,858	.....	.....	15,000	.....	7	.....	2,166
Pumping plants:										
44	Number, 1920.....	1	20	7	50	9	1	.....	1	17
45	Number, 1910.....	2	42	4	15	11	.....	1	.....	10
46	Engine capacity, 1920.....horsepower..	40	4,676	540	967	1,855	20	.....	3	459
47	Engine capacity, 1910.....horsepower..	54	8,373	458	504	1,501	.....	1	.....	111
48	Pump capacity, 1920.....gallons per minute..	4,000	442,700	15,600	30,085	187,000	1,200	.....	250	18,065
49	Pump capacity, 1910.....gallons per minute..	8,700	915,600	18,250	27,350	208,700	.....	7	.....	5,556
50	Average lift, 1920.....feet..	15	26	50	24	14	42	.....	40	41
<b>CAPITAL INVESTED.</b>										
51	Capital invested to Jan. 1, 1920.....dollars..	5,000	1,323,342	68,078	106,273	345,935	1,180,335	10,300	13,700	581,475
52	Capital invested to July 1, 1910.....dollars..	9,785	1,408,239	24,198	61,238	171,684	60,950	.....	.....	211,910
53	Per cent of increase, 1910-1920.....	-48.9	-5.7	181.3	73.5	101.5	.....	312.0	.....	174.4
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	10.00	19.99	17.40	16.19	16.87	19.52	5.57	4.25	28.29
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	1.76	16.28	10.32	15.92	13.72	15.44	2.82	.....	12.19
<b>ESTIMATED FINAL COST.</b>										
56	Estimated final cost of existing enterprises in 1920.....dollars..	5,000	1,323,942	68,078	106,273	346,935	1,298,535	10,300	18,700	587,575
57	Estimated final cost of existing enterprises in 1910.....dollars..	190,285	1,408,239	24,198	61,238	171,684	75,950	6,000	.....	211,910
58	Per cent of increase, 1910-1920.....	-97.4	-5.7	181.3	76.8	103.2	.....	71.7	.....	177.3
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	1.67	8.03	10.45	15.21	14.26	18.91	4.04	4.18	22.54
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	6.33	10.77	9.51	11.26	6.59	2.13	6.66	.....	4.72

<sup>1</sup> Organized from parts of Bandera, Edwards, and Kerr Counties in 1913.

IRRIGATION—TEXAS.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.]

	San Saba.	Tom Green.	Uvalde.	Val Verde.	Ward.	Webb.	Whar-ton.	Zavalla.	All other counties.	Total for rice growing.	
1	Number of all farms in 1920.....	1,268	680	706	285	238	257	2,967	239	397,911	.....
2	Number of farms irrigated in 1919.....	45	107	7	101	182	87	146	228	225	5,957
3	Per cent of all farms.....	3.5	15.7	1.0	35.4	78.5	33.9	4.9	95.4	0.1	.....
4	Number of farms irrigated in 1909.....	50	102	16	59	178	76	282	32	2,013	1,059
5	Per cent of increase, 1909-1919.....	.....	4.9	.....	.....	2.2	.....	-48.2	.....	-88.9	447.5
<b>LAND AND FARM AREA.</b>											
6	Approximate land area..... acres.....	714,240	930,560	1,016,960	1,973,120	529,280	2,060,160	711,680	862,720	125,463,680	.....
7	All land in farms..... acres.....	570,216	750,663	1,222,589	1,699,287	349,476	971,850	438,068	655,104	88,049,730	.....
8	Improved land in farms..... acres.....	120,400	95,530	101,988	7,059	19,051	21,698	246,952	18,974	27,568,162	.....
9	Area irrigated in 1919..... acres.....	95	7,103	494	2,475	20,000	7,480	19,516	1,642	3,410	212,496
10	Per cent of improved land in farms.....	0.1	7.4	0.5	35.1	105.0	34.5	7.9	8.7	(1)	.....
11	Area irrigated in 1909..... acres.....	2,022	6,227	1,876	2,416	16,406	4,186	53,930	1,021	19,962	286,847
12	Per cent of increase, 1909-1919.....	-95.3	14.1	-71.1	2.4	21.9	78.7	-63.8	60.8	-82.9	-25.9
13	Area enterprises were capable of irrigating in 1920..... acres.....	2,221	10,040	2,032	8,550	37,000	13,143	40,623	4,645	11,275	315,598
14	Area enterprises were capable of irrigating in 1919..... acres.....	2,379	6,703	1,676	4,036	28,712	5,625	63,613	1,818	25,242	350,350
15	Per cent of increase, 1910-1920.....	-6.6	49.8	21.2	-12.0	28.9	133.7	-36.1	155.5	-55.3	-9.9
16	Area included in enterprises in 1920..... acres.....	2,395	14,718	2,032	4,660	71,500	31,738	75,612	5,933	18,789	606,466
17	Area included in enterprises in 1910..... acres.....	3,135	7,372	4,380	4,036	105,012	10,677	91,632	3,440	35,630	499,474
18	Per cent of increase, 1910-1920.....	-23.6	99.6	-53.6	15.5	-31.9	197.2	-17.5	72.5	-52.9	21.4
19	Area of irrigated land reported as available for settle- ment..... acres.....	.....	.....	.....	2,125	49,600	.....	31,000	.....	1,900	.....
<b>IRRIGATION WORKS.</b>											
Independent enterprises:											
20	Number, 1920.....	31	50	5	2	3	58	138	36	189	264
21	Number, 1910.....	38	30	17	5	6	62	199	19	1,620	611
Main ditches:											
22	Number, 1920.....	18	54	4	3	4	20	29	19	111	105
23	Number, 1910.....	32	20	12	9	7	57	78	11	242	225
24	Length, 1920..... miles.....	10	53	9	11	61	12	45	8	47	382
25	Length, 1910..... miles.....	19	43	11	22	65	64	125	9	120	538
26	Capacity, 1920..... second-feet.....	30	348	18	408	925	1,666	1,076	85	325	7,392
27	Capacity, 1910..... second-feet.....	280	110	67	160	1,306	165	.....	44	453	.....
Laterals:											
28	Number, 1920.....	13	92	1	13	9	51	25	86	150	256
29	Number, 1910.....	4	16	12	21	12	.....	21	.....	57	216
30	Length, 1920..... miles.....	3	25	.....	16	52	6	.....	12	40	456
31	Length, 1910..... miles.....	1	9	5	13	68	.....	57	.....	32	502
Reservoirs:											
32	Number, 1920.....	.....	11	.....	.....	.....	45	1	18	35	5
33	Number, 1910.....	4	2	.....	1	.....	9	1	9	109	21
34	Capacity, 1920..... acre-feet.....	.....	6,750	.....	.....	.....	20,248	100	65	1,834	25,603
35	Capacity, 1910..... acre-feet.....	307	1,320	.....	1	.....	196	120	90	22,325	2,310
Flowing wells:											
36	Number, 1920.....	.....	.....	.....	.....	.....	.....	1	8	11	8
37	Number, 1910.....	.....	.....	.....	.....	.....	.....	.....	11	42	1
38	Capacity, 1920..... gallons per minute.....	.....	.....	.....	.....	.....	.....	1,000	1,000	8,159	1,120
39	Capacity, 1910..... gallons per minute.....	.....	.....	.....	.....	.....	.....	3,500	3,500	3,377	80
Pumped wells:											
40	Number, 1920.....	.....	7	1	.....	.....	9	192	37	73	290
41	Number, 1910.....	1	1	4	1	7	.....	273	6	1,205	500
42	Capacity, 1920..... gallons per minute.....	.....	632	50	.....	.....	2,975	160,817	7,942	13,297	238,183
43	Capacity, 1910..... gallons per minute.....	15	45	180	60	2,714	.....	150,000	4,750	82,477	445,495
Pumping plants:											
44	Number, 1920.....	32	48	2	.....	.....	68	173	37	184	323
45	Number, 1910.....	32	23	3	1	7	.....	15	268	10	1,802
46	Engine capacity, 1920..... horsepower.....	616	1,105	20	.....	.....	3,885	6,531	809	3,114	36,143
47	Engine capacity, 1910..... horsepower.....	675	573	58	8	66	.....	2,850	12,346	249	6,240
48	Pump capacity, 1920..... gallons per minute.....	16,570	57,020	410	.....	.....	86,950	135,442	20,692	105,042	3,816,068
49	Pump capacity, 1910..... gallons per minute.....	23,908	38,199	1,700	60	2,714	87,341	625,797	11,350	252,477	3,907,380
50	Average lift, 1920..... feet.....	40	29	38	.....	.....	72	38	.....	39	40
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920..... dollars.....	117,256	401,194	28,550	275,000	370,000	1,098,640	1,543,808	160,850	635,943	7,680,370
52	Capital invested to July 1, 1910..... dollars.....	49,527	97,732	16,149	122,138	780,382	263,312	889,174	49,456	941,484	6,140,639
53	Per cent of increase, 1910-1920.....	136.8	310.5	76.8	125.2	-52.6	317.2	73.6	225.2	-32.5	25.1
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars.....	52.79	39.96	14.05	77.46	10.00	83.59	38.00	34.63	56.40	24.34
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars.....	20.82	14.58	9.64	30.26	27.18	46.81	13.98	27.20	37.30	17.53
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920..... dollars.....	117,271	402,194	28,550	315,000	370,000	1,139,702	1,574,608	160,850	645,848	7,744,770
57	Estimated final cost of existing enterprises in 1910..... dollars.....	49,527	97,732	16,149	122,138	950,382	263,312	889,174	49,456	955,194	6,140,639
58	Per cent of increase, 1910-1920.....	136.8	311.5	76.8	157.9	-61.1	332.8	77.1	225.2	-32.4	26.1
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars.....	48.96	27.33	14.05	67.60	5.17	35.91	20.82	27.11	38.47	12.77
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars.....	15.80	13.26	8.69	30.26	9.05	24.66	9.70	14.38	26.81	12.29

<sup>1</sup> Less than one-tenth of 1 per cent.

# UTAH.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Utah collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of show-

ing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

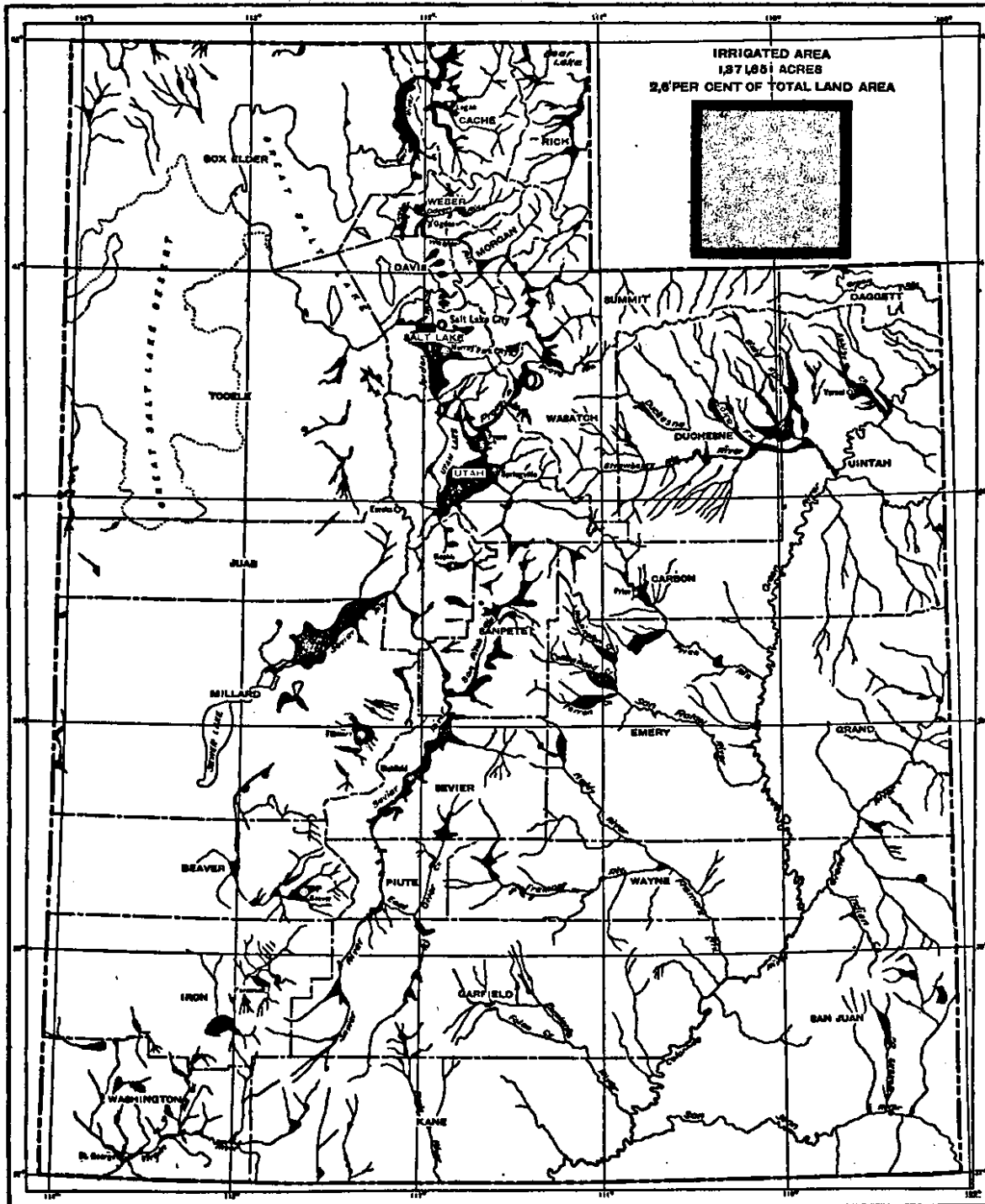
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	25,662	21,676	3,986	18.4
Approximate land area of the state.....acres..	52,597,760	52,597,760		
All land in farms.....acres..	5,050,410	3,397,699	1,652,711	48.6
Improved land in farms.....acres..	1,715,380	1,368,211	347,169	25.4
Number of farms irrigated.....	22,218	19,709	2,509	12.7
Area irrigated.....acres..	1,371,651	999,410	372,241	37.2
Area enterprises were capable of irrigating.....acres..	1,700,550	1,250,246	450,304	36.0
Area included in enterprises.....acres..	2,359,244	1,947,625	411,619	21.1
Per cent irrigated:				
Number of all farms.....	86.6	90.9	-4.3	
Approximate land area of the state.....	2.6	1.9	0.7	
Land in farms.....	27.2	29.4	-2.2	
Improved land in farms.....	80.0	73.0	7.0	
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	328,899	250,836	78,063	31.1
Excess of area included in enterprises over area irrigated.....acres..	658,694	948,215	-289,521	-30.5
Area of irrigated land reported as available for settlement.....acres..	189,563	( <sup>2</sup> )		
Capital invested.....	\$32,037,351	\$14,028,717	\$18,008,634	128.4
Average per acre enterprises were capable of irrigating.....	\$18.84	\$11.22	\$7.62	67.9
Estimated final cost of existing enterprises.....	\$33,835,641	\$17,840,775	\$15,994,866	89.7
Average per acre included in enterprises.....	\$14.34	\$9.16	\$5.18	56.6
Average cost of operation and maintenance per acre.....	\$1.08	\$0.65	\$0.43	66.2
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	2,403	2,472	-69	-2.8
Number of main ditches.....	2,381	2,495	-114	-4.6
Length of main ditches.....miles..	6,343	5,887	456	7.7
Capacity of main ditches.....second-feet..	29,447	25,081	4,366	17.4
Number of lateral ditches.....	4,068	1,357	2,711	199.8
Length of lateral ditches.....miles..	5,334	1,822	3,512	192.8
Number of reservoirs.....	476	480	-4	-0.8
Capacity of reservoirs.....acre-feet..	1,600,505	588,317	1,012,188	172.0
Number of flowing wells.....	1,256	1,138	118	10.4
Capacity of flowing wells.....gallons per minute..	96,371	42,794	53,577	125.2
Number of pumped wells.....	192	27	165	
Capacity of pumped wells.....gallons per minute..	39,059	4,827	34,232	709.2
Number of pumping plants.....	250	69	181	
Engine capacity.....horsepower..	11,392	2,143	9,249	431.6
Pump capacity.....gallons per minute..	783,588	315,057	468,531	148.7
Average lift.....feet..	25	( <sup>2</sup> )	25	

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.

<sup>2</sup> Not reported in 1910.

# UTAH

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



## CLIMATIC CONDITIONS.

The climatic conditions determining the necessity for irrigation are the amount and seasonal distribution of precipitation, especially rainfall, and, to a lesser extent, temperature and wind movement.

The surface of the central, eastern, and southern parts of the state is mountainous, with high plateaus and stream valleys interspersed between the ranges of mountains. The west central and northwestern parts of the state lie within the Great Basin, the bed of the ancient Lake Bonneville, and here the surface consists of extensive level plains, with occasional small ranges of mountains and hills or isolated peaks.

The whole state may be classed as arid, since only on the high mountains does the annual precipitation amount to 20 inches.

On the Wasatch and Uinta Mountains in the north central part of the state and on the divide between Virgin River and the Great Basin in the southwestern part of the state the annual precipitation exceeds 20 inches.

Immediately surrounding each of these sections lies a belt that receives from 15 to 20 inches of precipitation annually, and beyond that is a zone receiving from 10 to 15 inches. About one-third of the area of the state, divided about equally between the west central and the eastern parts of the state, receives less than 10 inches of precipitation annually, and in the Great Salt Lake Desert the annual precipitation is less than 5 inches.

In all of the valleys of the state the land slopes up from the central drainage channels toward the mountains, and the rainfall on the higher lands near the mountains is greater than that in the valleys, and on the higher lands crops, especially the cereals, are grown without irrigation. It is very common for farmers to have home farms on which crops are grown under irrigation and additional land above the canals on which crops are grown without irrigation.

Throughout the state the precipitation is fairly well distributed throughout the year, although it is slightly heavier in the winter than in the summer, the snowfall in the mountains being heavy and remaining well into the summer.

Precipitation in 1919 was much below the normal, and this condition was aggravated by a great deficiency in the summer months, that was offset to some extent by heavy rains in the fall. The drought was felt to some extent in May, but was much more pronounced in June and July, being accompanied by low humidities and high wind movement. Pastures, ranges, and dry-land crops suffered severely, and in many places irrigation water became scarce. On the whole, the season was unfavorable to the production of the best crops, although the fall rains helped late crops.

## WATER SUPPLY FOR IRRIGATION.

The area of the state of Utah is about equally divided between the drainage basin of Colorado River and its tributaries and the great interior basin, which has no outlet to the sea. The eastern and extreme southern parts of the state are drained by the Colorado and its tributaries, while the northern and western parts of the state are within the Great Basin.

Green and Grand Rivers unite to form Colorado River in the southeastern part of Utah. Green River rises in northwestern Wyoming, enters Utah from Wyoming, flows across the northeastern corner of Utah, makes a short loop in Colorado, and returns to Utah. It flows in a southerly direction through eastern Utah roughly parallel to the eastern boundary and receives tributaries from Colorado on the east and from the Wasatch Mountains on the west. Green River itself flows in deep canyons most of its course in Utah, and the same is true of its tributaries from the east. Its principal tributaries from the west—Duchesne and Price Rivers—flow through large valleys and are utilized to a considerable extent for irrigation.

Grand River enters Utah from Colorado about midway of the eastern boundary of the state, and Colorado River leaves the state about midway of the southern boundary of the state. Both of these streams flow in deep canyons and are not used for irrigation to any considerable extent, although they carry large volumes of water.

Virgin River, a tributary of Colorado River, provides a small supply of water for irrigation in the southwestern corner of the state.

The larger part of the irrigated land of the state lies in the Great Salt Lake drainage basin, the water supply coming principally from streams draining the Wasatch and Uinta Mountains and flowing into Utah Lake and Great Salt Lake. Of these Bear River rises in the Uinta Mountains in Utah, flows north into Wyoming, crosses and recrosses from Wyoming into Utah, makes a loop into Idaho, returns to Utah, and discharges into the northern end of Great Salt Lake. It is used for irrigation to some extent throughout its course and supplies a large area in northern Utah. Its tributaries also serve considerable areas.

From the Wasatch Mountains many short streams flow into Great Salt Lake and Utah Lake, and these water the older irrigated areas of the state.

Southwest of the Great Salt Lake drainage basin lies the drainage basin of Sevier River, and other streams that rise in the high lands of southern Utah, and flow out into the deserts and discharge into lakes or are lost.

In most of the valleys of the state artesian water is found and is used for irrigation, and in the valleys of the Great Basin there appears to be much ground water that can be obtained by pumping.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	22,218	12.7	86.6	1,371,651	37.2	2.6	27.2	80.0
1910.....	19,709	10.0	90.9	999,410	58.8	1.9	29.4	73.0
1900.....	17,924	84.3	82.5	629,293	138.8	1.2	15.3	61.0
1890.....	9,724	.....	82.5	263,473	.....	0.5	20.0	48.1

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of area in enterprises.	
Total.....	2,408	2,359,244	1,371,651	58.1	1,700,550
Before 1860.....	167	131,071	106,132	81.0	118,938
1860-1869.....	266	165,414	144,957	87.6	150,010
1870-1879.....	268	247,868	201,840	81.4	222,904
1880-1889.....	389	474,566	300,415	63.3	334,883
1890-1899.....	296	184,057	113,388	61.6	125,078
1900-1904.....	127	124,565	81,407	65.4	91,590
1905-1909.....	171	551,485	250,048	45.3	404,876
1910-1914.....	179	257,123	67,466	26.2	121,504
1915-1919.....	205	149,259	44,939	30.1	64,172
Not reported.....	355	73,836	61,061	82.7	66,595

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919		1909			
	Amount.	Per cent.	Amount.	Per cent.		
Total.....	1,371,651	999,410	372,241	37.2	1,700,550	2,359,244
Streams, gravity.....	1,105,691	954,800	150,891	15.8	1,380,171	1,917,751
Streams, pumped.....	10,389	2,559	7,830	806.0	16,575	76,187
Streams, pumped and gravity.....	50	(*)	.....	.....	200	350
Wells, pumped.....	7,808	800	7,008	12,941	19,503	19,503
Wells, flowing.....	4,908	4,100	808	19.7	5,706	10,252
Wells, flowing and pumped.....	178	(*)	.....	.....	261	331
Lakes, pumped.....	11,400	.....	.....	19,000	24,400	24,400
Lakes, gravity.....	15,218	1,671	13,547	810.7	16,185	17,285
Springs.....	41,310	35,412	5,898	16.7	45,126	60,378
Stored storm water.....	977	568	409	72.0	1,620	2,330
City water.....	25	(*)	.....	.....	25	25
Streams, gravity, and pumped wells.....	126	(*)	.....	.....	333	233
Streams, gravity, and flowing wells.....	537	(*)	.....	.....	595	793
Other mixed.....	178,495	(*)	.....	.....	201,841	220,334
Other and not reported.....	40	(*)	.....	.....	71	103

\* A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
 \* Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

Utah enacted the original irrigation district law in the United States in 1865, which did not, however, contain the provision for issuing bonds, which is the most important feature of present-day irrigation dis-

trict laws. Many districts were organized under this law, but they were short-lived. A district law providing for the issuing of bonds was enacted in 1909, but little has been done under this law. Some of the land served by the United States Reclamation Service has been organized into irrigation districts, but this land is credited to the Reclamation Service in Table 5, because the Government built the works and still controls them to a large extent. The Reclamation Service also supplies stored water to land in other enterprises under the terms of the Warren Act (act of Congress, Feb. 21, 1911) and under special agreements.

The state of Utah accepted the terms of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1897, but little has been done under this act.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE, <sup>1</sup>	
	1920	1910	Amount.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	1,371,651	999,410	372,241	37.2
Individual and partnership.....	166,887	222,448	-55,561	-25.0
Cooperative.....	1,014,649	687,260	327,389	47.6
Irrigation district.....	21,143	8,455	12,688	150.1
Carey Act.....	18,000	5,000	11,000	220.0
Commercial.....	79,911	64,727	15,184	9.6
U. S. Reclamation Service.....	* 29,285	.....	29,285	.....
U. S. Indian Service.....	25,270	11,520	13,750	119.4
City.....	24,206	(*)	24,206	.....
Other.....	3,300	(*)	3,300	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	1,700,550	1,250,246	450,304	36.0
Individual and partnership.....	195,858	257,268	-61,408	-23.9
Cooperative.....	1,225,084	780,855	434,229	54.9
Irrigation district.....	24,023	8,455	15,568	184.1
Carey Act.....	35,000	20,000	15,000	75.0
Commercial.....	91,533	87,070	4,463	5.5
U. S. Reclamation Service.....	* 50,030	.....	50,030	.....
U. S. Indian Service.....	48,870	36,600	12,270	42.4
City.....	25,552	(*)	25,552	.....
Other.....	3,300	(*)	3,300	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	2,359,244	1,947,625	411,619	21.1
Individual and partnership.....	261,720	376,502	-114,782	-30.5
Cooperative.....	1,736,863	1,259,351	477,512	37.9
Irrigation district.....	27,933	10,802	17,131	158.6
Carey Act.....	38,000	43,000	-5,000	-11.6
Commercial.....	147,933	151,970	-4,037	-2.7
U. S. Reclamation Service.....	* 60,030	.....	60,030	.....
U. S. Indian Service.....	55,870	106,000	-50,130	-47.3
City.....	27,595	(*)	27,595	.....
Other.....	3,300	(*)	3,300	.....

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Does not include about 23,000 acres to which stored water is supplied under Warren Act.  
<sup>3</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

The laws of Utah relating to water rights are summarized in the following paragraphs:

The organic act of the territory of Utah, enacted in 1851, did not mention the subject of irrigation, but the territorial legislature disposed of water rights by direct grant and also delegated this power to the county courts of the several counties. Many such grants were made both by the legislature and by the county courts in some counties.

The act of February 20, 1880, provided for the recording of vested rights to the use of water and for regulating their exercise. The county selectmen were made water commissioners for their respective counties and were empowered to hear and determine all claims to the use of water, and to issue certificates showing their findings. No suits were to be maintained in the courts until the commissioners had acted, but appeal might be taken to the courts.

The constitution of the state of Utah, adopted in 1896, declares (Art. XVII) that "all existing rights to any waters of this state for any useful or beneficial purpose are hereby recognized and confirmed."

The act of March 11, 1897, provided that any party desiring to appropriate water should post a notice at the intended point of diversion and in the nearest post office and should file a copy of the notice in the county records.

The act of March 12, 1903, provided that parties wishing to appropriate water should apply to the state engineer for permits, and for the issuing of certificates by the state engineer when works have been completed and water used in accordance with the terms of the permits.

The same act provided a special procedure for the adjudication of water rights. The state engineer was to make surveys and collect information regarding rights, and submit reports to the appropriate district courts. The courts were to determine rights on the basis of these reports and any testimony they might take. This act is still in force, but has not been utilized to any large extent. Many rights have been adjudicated in ordinary suits between claimants.

Riparian rights are not recognized in Utah.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	1,371,651	100.0	100.0
Appropriation and use.....	469,944	34.3	51.5
Notice filed and posted.....	171,955	12.5	6.2
Adjudicated by court.....	581,080	42.4	35.1
Permit from state.....	55,061	4.1	3.9
Certificate or license from state.....	66,778	4.9	3.2
Underground.....	8,631	0.6	( <sup>1</sup> )
Other and mixed.....	4,077	0.3	( <sup>1</sup> )
Not reported.....	13,125	0.9	( <sup>1</sup> )

<sup>1</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	1,371,651	713,621	92.2	2,359,244	1,700,550
Tributaries of Great Salt Lake.....	570,868	402,406	41.9	836,075	660,283
Bear River and tributaries.....	202,681	141,616	43.1	272,100	218,037
Bear River direct.....	104,731	48,560	115.7	181,323	117,523
Little Bear River.....	48,541	38,592	20.6	48,353	46,890
Malad River.....	1,189	( <sup>2</sup> )		1,935	1,189
Other tributaries of Bear River.....	50,220	* 54,464	-7.8	60,479	52,435
Weber River and tributaries.....	97,589	80,355	21.4	149,081	112,981
Weber River direct.....	44,726	41,967	6.6	83,796	49,341
Ogden River.....	21,884	22,373	-2.2	27,097	26,852
East Canyon Creek.....	6,202	4,414	40.5	6,638	6,468
Other tributaries of Weber River.....	24,777	* 11,601	113.6	31,650	30,320
Jordan River and Utah Lake and tributaries.....	270,598	180,435	50.0	414,894	329,265
Jordan River direct.....	48,652	32,401	48.3	90,495	55,720
Big Cottonwood Creek.....	10,991	8,813	24.7	13,207	12,271
Little Cottonwood Creek.....	12,144	7,973	53.3	16,698	16,601
American Fork River.....	19,145	20,446	-6.4	20,371	20,241
Provo River.....	54,732	36,939	43.3	62,703	56,072
Hobble Creek.....	5,620	18,424	-69.5	6,589	5,946
Spanish Fork River.....	61,434	23,778	158.4	96,176	83,142
Other tributaries of Jordan River and Utah Lake.....	58,429	* 31,961	82.8	108,655	78,582
Sevier River and tributaries.....	325,718	181,048	148.5	630,484	402,387
Sevier River direct.....	153,651	59,257	159.3	351,553	226,199
San Pitch River.....	77,616	42,502	82.6	105,519	78,343
Otter Creek.....	7,289	5,260	38.6	7,945	7,239
South Fork.....	18,325	3,495	424.3	32,620	19,170
Other tributaries of Sevier River.....	68,837	* 20,534	235.2	132,947	71,351
Green River and tributaries.....	280,877	53,934	420.8	510,426	335,612
Green River direct.....	2,541	1,372	85.2	3,629	3,038
Ashley River.....	26,737	15,834	69.2	44,087	44,087
Duchesne River.....	138,446	( <sup>3</sup> )		322,689	217,809
Price River.....	23,811	6,621	259.6	37,191	24,848
San Rafael River.....	77,290	21,546	258.7	85,028	80,028
Other tributaries of Green River.....	12,002	* 8,561	40.2	17,802	15,802
Grand River and tributaries.....	9,740	* 3,943	153.4	24,615	18,520
Colorado River and tributaries.....	71,950	34,845	106.5	171,054	92,850
Fremont River.....	26,513	15,701	68.9	42,005	34,005
Virgin River.....	27,106	10,741	152.4	82,450	35,586
San Juan River.....	9,554	( <sup>2</sup> )		26,646	14,158
Other tributaries of Colorado River.....	8,786	* 8,403	4.6	19,953	9,101
Independent streams.....	112,480	57,545	28.5	196,590	140,860
Beaver River.....	26,732	15,599	84.2	53,729	46,469
Coal Creek.....	27,206	2,846	856.3	60,891	33,893
Deep Creek.....	1,933	1,515	30.9	4,326	3,446
Grouse Creek.....	3,469	990	250.4	4,599	3,639
Other independent streams.....	51,099	* 66,596	-23.3	63,045	53,442

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Included in "Other tributaries" in 1902.  
<sup>3</sup> Includes springs and wells.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase. <sup>1</sup>
1920.....	\$32,037,351	122.4	\$18.84	67.9
1910.....	14,023,717	189.2	11.23	20.4
1900.....	5,865,302	111.0	9.32	-11.7
1890.....	2,780,000		10.55	

<sup>1</sup> A minus sign (-) denotes decrease.



TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$32,037,351	100.0	\$18.84
Before 1860.....	1,883,633	5.9	15.84
1860-1869.....	1,639,394	5.1	10.93
1870-1879.....	2,495,342	7.8	11.19
1880-1889.....	4,728,282	14.8	14.12
1890-1899.....	2,333,321	7.3	18.65
1900-1904.....	807,149	2.5	8.81
1905-1909.....	10,322,803	32.2	25.50
1910-1914.....	5,113,678	16.0	42.09
1915-1919.....	1,863,293	5.8	28.04
Not reported.....	850,451	2.6	12.77

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$32,037,351	100.0	\$18.84	1,122,456	\$1.08
Streams, gravity.....	26,503,462	82.7	19.20	910,594	1.01
Streams, pumped.....	733,077	2.3	44.23	7,444	5.16
Streams, pumped and gravity.....	5,100	( <sup>2</sup> )	25.50	.....	.....
Wells, pumped.....	153,091	0.5	11.83	6,212	2.08
Wells, flowing.....	167,152	0.5	29.29	756	1.79
Wells, flowing and pumped.....	18,571	0.1	71.15	27	9.48
Lakes, pumped.....	565,000	1.8	29.74	26,400	3.58
Lakes, gravity.....	75,281	0.2	4.65	13,877	0.25
Springs.....	869,214	2.7	19.26	25,858	0.75
Stored storm water.....	81,803	0.3	50.50	857	2.23
City water.....	800	( <sup>2</sup> )	32.00	.....	.....
Streams, gravity, and pumped wells.....	23,000	0.1	94.42	85	2.94
Streams, gravity, and flowing wells.....	11,822	( <sup>2</sup> )	19.87	203	0.49
Other mixed.....	2,828,242	8.8	14.01	130,126	0.94
Other and not reported.....	2,736	( <sup>2</sup> )	38.54	17	1.76

<sup>1</sup> Based on area irrigated in 1919.  
<sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$32,037,351	\$7,303,607	\$24,733,744	338.7
Tributaries of Great Salt Lake.....	14,102,398	5,017,457	9,084,936	181.1
Bear River and tributaries.....	3,430,663	2,397,638	1,033,025	43.1
Bear River direct.....	2,150,603	2,062,254	88,349	4.3
Little Bear River.....	720,363	103,170	557,193	341.5
Malad River.....	18,097	( <sup>2</sup> )	.....	.....
Other tributaries of Bear River.....	541,600	* 172,214	369,386	214.5
Weber River and tributaries.....	2,108,048	798,537	1,309,511	164.3
Weber River direct.....	1,353,323	549,432	803,891	146.3
Ogden River.....	423,756	163,406	255,349	151.6
East Canyon Creek.....	74,010	22,890	51,120	223.3
Other tributaries of Weber River.....	254,960	* 56,109	198,851	354.4
Jordan River and Utah Lake and tributaries.....	8,585,682	1,822,982	6,762,700	369.9
Jordan River direct.....	746,836	763,100	-6,264	-0.8
Big Cottonwood Creek.....	315,563	46,590	269,973	502.2
Little Cottonwood Creek.....	228,221	26,825	200,396	776.0
American Fork River.....	302,449	162,130	140,319	86.5
Provo River.....	985,979	328,691	657,288	200.0
Hobbs Creek.....	41,024	32,588	8,436	25.9
Spanish Fork River.....	4,126,999	123,930	4,003,069	.....
Other tributaries of Jordan River and Utah Lake.....	1,820,611	* 351,128	1,469,483	418.5
Sevier River and tributaries.....	9,509,836	808,872	8,700,964	.....
Sevier River direct.....	7,002,349	443,032	6,559,317	.....
San Pitch River.....	1,142,510	228,336	913,974	399.9
Otter Creek.....	151,850	18,356	133,495	727.3
South Fork.....	372,620	15,650	356,976	.....
Other tributaries of Sevier River.....	840,501	* 103,209	737,292	713.7

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Included in "Other tributaries" in 1902.  
<sup>3</sup> Includes springs and wells.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902—Continued.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Green River and tributaries.....	\$4,154,660	\$508,374	\$3,646,286	717.2
Green River direct.....	376,325	26,150	350,175	.....
Ashley Fork River.....	374,140	57,835	316,305	548.9
Duchesne River.....	2,428,174	( <sup>2</sup> )	.....	.....
Price River.....	458,725	41,719	417,006	999.6
San Rafael River.....	288,100	295,550	-7,750	-2.6
Other tributaries of Green River.....	229,196	* 86,820	142,376	104.0
Grand River and tributaries.....	219,489	13,760	205,729	.....
Colorado River and tributaries.....	2,203,203	441,845	1,761,358	398.6
Fremont River.....	567,050	189,380	377,670	199.4
Virgin River.....	1,257,981	155,515	1,102,466	708.9
San Juan River.....	206,458	( <sup>2</sup> )	.....	.....
Other tributaries of Colorado River.....	171,714	* 96,950	74,764	77.1
Independent streams.....	1,847,770	513,299	1,334,471	260.0
Beaver River.....	842,305	65,325	776,980	.....
Coal Creek.....	179,171	7,078	172,093	.....
Deep Creek.....	8,844	6,692	2,152	32.2
Grouse Creek.....	28,338	2,850	25,488	894.3
Other independent streams.....	789,112	* 431,358	357,756	82.9

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Included in "Other tributaries" in 1902.  
<sup>3</sup> Includes springs and wells.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water to enterprises controlled by agencies of most of the other classes shown in the table and a part of its expenditure is properly chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$32,037,351	100.0	1,122,456	\$1.08
Individual and partnership.....	2,736,804	8.6	64,612	2.43
Cooperative.....	20,254,212	63.2	895,509	0.87
Irrigation district.....	265,484	0.8	19,143	0.71
Carey Act.....	1,323,779	4.1	18,000	0.60
Commercial.....	2,374,991	7.4	70,431	2.71
U. S. Reclamation Service.....	3,567,057	11.1	29,255	1.30
U. S. Indian Service.....	765,354	2.4	.....	.....
City.....	729,090	2.3	24,206	1.06
Other.....	20,580	0.1	3,300	0.33

<sup>1</sup> Based on area irrigated in 1919.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

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**TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.**

Number of enterprises reporting land drained or needing drainage.....	148
Acreage included in enterprises reporting land drained or needing drainage.....	503,212
Acreage for which drains have been installed.....	85,448
Additional acreage needing drainage.....	91,976
Percent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	17.0
Percent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	3.6
Percent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	7.5

### QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing

estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

**TABLE 14.—QUANTITY OF WATER USED IN 1919.**

ITEM.	Total.	Measured.	Not measured.
Average volume entering canals.....second-feet..	48,629	15,106	33,523
Area irrigated in 1919.....acres.....	937,243	720,715	216,528
Average number of acres per second-foot.....	19	48	6
Total quantity entering canals.....acre-feet..	3,554,233	2,708,931	845,302
Area irrigated in 1919.....acres.....	982,514	770,348	212,166
Average quantity per acre.....acre-feet..	3.6	3.5	4.0
Total quantity of water delivered.....acre-feet..	1,718,769	729,360	989,409
Area irrigated in 1919.....acres.....	353,424	188,406	165,018
Average quantity per acre.....acre-feet..	4.9	3.9	6.0

### IRRIGATION WORKS.

**TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.**

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	1,479	307	2,381	29,447	6,343	4,068	5,334	476	1,600,505
Before 1860.....	168	18	204	1,723	412	678	502	22	3,638
1860-1869.....	205	9	386	3,145	711	615	539	22	30,558
1870-1879.....	245	29	317	3,556	927	708	644	35	8,059
1880-1889.....	311	127	449	6,042	1,354	827	768	71	72,113
1890-1899.....	190	26	315	2,400	736	289	286	50	47,447
1900-1904.....	34	9	114	2,047	291	138	157	34	16,080
1905-1909.....	170	31	177	6,114	812	430	1,037	48	688,990
1910-1914.....	63	16	147	2,423	459	227	1,205	71	448,384
1915-1919.....	68	38	117	1,313	250	85	109	52	288,066
Not reported.....	27	4	175	684	391	80	87	61	2,170

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	PUMPS. Number. Capacity (gallons per minute).	
Total.....	154.7	1,256	96,371	192	39,059	250	11,392	291	783,588
Before 1860.....	22.1	15	1,915	7	2,210	15	134	18	7,980
1860-1869.....	5.0	14	177	2	560	5	84	5	4,600
1870-1879.....	22.8	9	137	3	1,840	9	1,840	9	6,400
1880-1889.....	41.8	38	6,162	4	1,060	9	1,060	9	524,650
1890-1899.....	13.4	109	4,640	15	2,228	12	50	13	1,378
1900-1904.....	2.5	126	6,356	6	1,620	10	120	11	6,740
1905-1909.....	10.2	248	24,162	19	3,880	23	1,989	28	53,202
1910-1914.....	9.8	122	5,955	34	8,782	43	3,480	51	60,435
1915-1919.....	9.0	168	17,833	71	16,683	104	2,332	112	108,873
Not reported.....	15.1	407	26,034	38	2,906	32	308	35	9,330

**TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.**

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	1,479	307	2,381	29,447	6,343	4,068	5,334	476	1,600,505
Individual and partnership.....	403	48	1,422	4,627	2,077	323	956	313	46,231
Cooperative.....	1,017	241	877	21,502	3,768	3,234	3,514	143	763,299
Irrigation district.....	37	5	33	292	83	27	53	5	260,972
Carey Act.....	1	1	1	500	7	20	95	2	252,600
Commercial.....	6	2	14	1,256	236	49	78	2	27,000
U. S. Reclamation Service.....	1	2	3	820	28	35	71	1	250,000
U. S. Indian Service.....	2	—	13	3	93	201	392	—	—
City.....	7	8	17	425	60	129	175	10	508
Other and not reported.....	—	—	1	22	1	—	—	—	—

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TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920—Continued.

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	154.7	1,256	96,371	192	39,059	250	11,392	291	783,568
Individual and partnership.....	68.8	1,092	75,999	181	31,829	220	2,540	231	106,942
Cooperative.....	73.1	164	20,372	11	7,230	28	3,502	40	267,145
Commercial.....	3.6					3	4,350	12	27,000
Irrigation districts.....	1.2								
City.....	8.0					1	1,000	8	382,500

TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	1,479	307	2,331	29,447	6,343	4,068	5,334	476	1,600,505
Tributaries of Great Salt Lake.....	676	71	1,057	13,165	2,435	1,672	2,068	164	568,177
Bear River and tributaries.....	118	17	319	4,253	781	479	320	48	2,026
Bear River direct.....	8	1	40	2,204	322	17	74	2	
Little Bear River.....	47	6	104	1,074	195	395	183	4	4
Malad River.....	2	1	3	13	10			1	2
Other tributaries of Bear River.....	61	9	172	902	254	67	63	41	2,020
Weber River and tributaries.....	256	18	391	2,823	570	146	106	52	30,794
Weber River direct.....	72	1	101	1,417	181	53	46	5	22
Ogden River.....	27		73	480	109	57	29	4	4
East Canyon Creek.....	38	1	40	179	49	5	5	2	28,004
Other tributaries of Weber River.....	119	16	177	747	231	31	26	41	2,764
Jordan River and Utah Lake and tributaries.....	202	36	347	6,089	1,084	1,047	1,642	64	535,357
Jordan River direct.....	14	4	20	1,151	296	101	26	3	600
Big Cottonwood Creek.....	32	3	27	228	58	160	31	4	300
Little Cottonwood Creek.....	21	1	36	650	60	50	45	1	750
American Fork River.....	27		23	70	43	68	130	4	
Provo River.....	31	11	99	1,752	304	416	262	21	6,681
Hobbie Creek.....	1		13	31	9	10	4	1	2
Spanish Fork River.....	12	6	46	1,358	93	95	202	8	502,116
Other tributaries of Jordan River and Utah Lake.....	64	11	83	849	221	152	942	22	24,908
Sevier River and tributaries.....	95	50	321	7,762	1,391	903	1,195	63	869,406
Sevier River direct.....	23	13	44	4,693	468	330	608	14	741,900
San Pitch River.....	26	20	80	970	372	254	401	21	30,698
Otter Creek.....	2	3	12	86	42	24	9	3	3,900
South Fork.....	9		32	381	114	65	42	2	24,015
Other tributaries of Sevier River.....	35	14	153	1,632	395	230	235	23	68,892
Green River and tributaries.....	414	11	239	4,047	1,047	775	1,404	15	51,919
Green River direct.....	2		10	71	29	12			
Ashley Fork River.....	109		18	113	75	8	15		
Duchesne River.....	156	8	106	2,416	543	306	771	7	41,871
Price River.....	13	1	54	636	161	37	34	2	1,248
San Rafael River.....	11	2	30	591	170	401	570	6	8,800
Other tributaries of Green River.....	123		21	220	69	11	14		
Grand River and tributaries.....	36	5	80	286	132	44	24	6	13,152
Colorado River and tributaries.....	260	129	303	1,698	570	229	219	56	25,542
Framont River.....	148	117	43	548	121	37	65	13	4,078
Virgin River.....	85	7	164	645	263	89	86	21	19,655
San Juan River.....	10	4	38	332	75	32	47	11	1,485
Other tributaries of Colorado River.....	11	1	58	168	111	21	21	11	324
Independent streams.....	98	41	381	2,494	763	445	424	172	73,310
Beaver River.....	36	14	128	775	210	196	229	9	40,555
Coal Creek.....	22	2	58	1,158	136	97	63	63	967
Deep Creek.....	3		21	50	36			2	
Grouse Creek.....	14	3	29	35	45			1	10
Other independent streams.....	23	22	145	476	341	152	132	97	30,778

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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920—Continued.

DRAINAGE BASIN.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.				
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse- power).	Pumps.		Aver- age lift (feet).
								Number.	Capacity (gallons per minute).	
<b>Total.....</b>	<b>154.7</b>	<b>1,256</b>	<b>96,371</b>	<b>192</b>	<b>39,059</b>	<b>250</b>	<b>11,392</b>	<b>291</b>	<b>783,588</b>	<b>25</b>
<b>Tributaries of Great Salt Lake.....</b>	<b>100.3</b>	<b>395</b>	<b>34,780</b>	<b>68</b>	<b>16,067</b>	<b>137</b>	<b>9,917</b>	<b>167</b>	<b>686,245</b>	<b>35</b>
<b>Bear River and tributaries.....</b>	<b>14.7</b>	<b>114</b>	<b>5,167</b>	<b>57</b>	<b>11,597</b>	<b>97</b>	<b>2,443</b>	<b>103</b>	<b>103,370</b>	<b>42</b>
Bear River direct.....	1.2			2	902	26	1,678	29	74,845	41
Little Bear River.....	2.0	20	3,025			4	50	4	3,740	18
Malad River.....	2	2	219							
Other tributaries of Bear River.....	11.5	83	1,923	55	10,695	67	715	70	24,785	44
<b>Weber River and tributaries.....</b>	<b>8.2</b>	<b>38</b>	<b>1,358</b>	<b>6</b>	<b>1,640</b>	<b>23</b>	<b>232</b>	<b>25</b>	<b>27,145</b>	<b>16</b>
Weber River direct.....	1.3	12	338			9	106	10	6,615	14
Ogden River.....	1.8	9	320	1	230	1	7	1	230	33
Other tributaries of Weber River.....	5.1	12	650	5	1,410	13	119	14	20,300	17
<b>Jordan River and Utah Lake and tributaries.....</b>	<b>77.4</b>	<b>248</b>	<b>28,255</b>	<b>5</b>	<b>2,830</b>	<b>17</b>	<b>7,242</b>	<b>39</b>	<b>555,730</b>	<b>38</b>
Jordan River direct.....	0.3	9	130			5	4,300	20	388,500	19
Big Cottonwood Creek.....	2.0	9	92			1	1	1	500	25
American Fork River.....	2.2	27	2,665	1	900	3	23	3	1,830	21
Provo River.....	1.2	61	11,716	1	830	1	20	1	900	45
Hobble Creek.....	18	18	768	1		1	6	1		14
Spanish Fork River.....	9.5	21	1,390							
Other tributaries of Jordan River and Utah Lake.....	61.9	103	11,496	2	1,100	6	2,822	13	164,000	65
<b>Sevier River and tributaries.....</b>	<b>9.0</b>	<b>258</b>	<b>38,863</b>	<b>3</b>	<b>178</b>	<b>8</b>	<b>117</b>	<b>10</b>	<b>18,318</b>	<b>30</b>
Sevier River direct.....	1.9	184	27,127			1		2	11,250	
San Pitch River.....	3.4	16	3	1	150	1	5	1	450	4
Otter Creek.....	6	6	112							
Other tributaries of Sevier River.....	3.7	52	11,621	2	28	6	112	7	6,618	35
<b>Green River and tributaries.....</b>	<b>0.9</b>			<b>1</b>	<b>1,350</b>	<b>10</b>	<b>545</b>	<b>13</b>	<b>39,315</b>	<b>20</b>
Green River direct.....	0.3			1	1,350	8	537	10	11,580	26
Duchesne River.....	0.6					1		2	27,000	70
Price River.....	0.6							1	735	10
Other tributaries of Green River.....						1	8	1		
<b>Grand River and tributaries.....</b>	<b>0.6</b>					<b>10</b>	<b>212</b>	<b>10</b>	<b>17,812</b>	<b>19</b>
<b>Colorado River and tributaries.....</b>	<b>11.4</b>	<b>6</b>	<b>198</b>	<b>3</b>	<b>1,500</b>	<b>3</b>	<b>32</b>	<b>3</b>	<b>900</b>	<b>80</b>
Fremont River.....	1.0									
Virgin River.....	3.2	4	105	3	1,500	3	32	3	900	80
San Juan River.....	7.0	2	90							
Other tributaries of Colorado River.....	0.2									
<b>Independent streams.....</b>	<b>22.5</b>	<b>597</b>	<b>22,532</b>	<b>117</b>	<b>19,964</b>	<b>82</b>	<b>569</b>	<b>88</b>	<b>20,998</b>	<b>14</b>
Beaver River.....	1.5	1		11	3,610	9	91	9	4,010	21
Coal Creek.....	0.7	135	9,953	41	10,500	20	270	24	10,400	47
Grouse Creek.....				1	265	1	6	3	265	240
Other independent streams.....	30.3	461	12,577	64	5,589	52	202	52	6,323	9

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CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	9,028	65.2	6,752	92.9	33.7	Bu.....	193,560	72.9	155,890	91.9	24.2
2 Oats.....	52,695	85.2	74,687	92.4	-29.4	Bu.....	1,560,574	90.5	3,065,554	95.2	-49.1
3 Winter wheat.....	41,289	27.6	72,293	40.5	83.7	Bu.....	548,706	28.9	2,059,700	52.2	18.7
4 Spring wheat.....	91,533	77.0	15,938	59.6	-25.4	Bu.....	1,895,241	86.1	809,724	84.8	-54.8
5 Barley.....	11,584	74.6	1,896	26.7	178.8	Bu.....	809,724	84.8	678,249	76.1	-54.8
6 Rye.....	3,892	37.5				Bu.....	27,915	38.5	27,412	41.7	1.8
<b>Hay and forage:</b>											
7 Timothy alone.....	11,972	89.7	10,852	64.5	10.3	Tons.....	19,200	91.1	23,685	69.2	-18.9
8 Timothy and clover mixed.....	31,284	94.3	3,429	29.8	812.3	Tons.....	50,953	94.4	7,745	32.1	557.9
9 Clover alone.....	2,136	75.0	281	38.6	660.1	Tons.....	3,383	83.7	629	25.1	437.8
10 Alfalfa.....	342,635	93.8	250,210	88.0	36.9	Tons.....	738,746	98.6	724,395	91.5	2.0
11 Other tame grasses.....	22,341	88.0	15,758	80.4	41.8	Tons.....	29,999	89.6	26,384	82.8	13.7
12 Grains cut green.....	9,320	59.8				Tons.....	14,985	85.2			
13 Annual legumes cut for hay.....	1,596	87.2	1,057	68.6	932.7	Tons.....	3,601	89.0	1,851	70.5	904.1
14 Wild, salt, or prairie grasses.....	67,344	83.2	64,160	94.5	5.0	Tons.....	78,886	82.9	89,609	98.1	-12.0
15 Corn cut for forage.....	3,837	57.8	(*)			Tons.....	9,557	75.7	(*)		
16 Silage crops.....	3,377	86.8	(*)			Tons.....	27,284	86.9	(*)		
17 Root crops for forage.....	733	78.6	(*)			Tons.....	7,024	78.8	(*)		
<b>Vegetables:</b>											
18 Potatoes.....	10,758	89.3	13,264	98.3	-18.9	Bu.....	1,559,386	94.6	2,237,609	92.9	-30.8
19 Green peas.....	2,655	84.4	(*)								
20 Tomatoes.....	3,428	94.0	(*)								
<b>Fruits:</b>											
21 Grapes.....	93,344	45.5	(*)			Lbs.....	535,807	48.6	(*)		
22 Apples.....	4,594,168	81.8	(*)			Bu.....	756,624	99.6	(*)		
23 Peaches.....	4,519,350	93.7	(*)			Bu.....	854,342	96.7	(*)		
24 Pears.....	4,46,261	89.3	(*)			Bu.....	65,861	86.6	(*)		
25 Plums and prunes.....	4,56,925	83.6	(*)			Bu.....	44,112	87.0	(*)		
26 Cherries.....	4,94,612	84.0	(*)			Bu.....	107,238	86.8	(*)		
<b>Miscellaneous:</b>											
27 Sugar beets grown for sugar.....	92,439	99.0	26,032	94.8	255.1	Tons.....	921,418	99.0	393,897	95.2	133.9
28 Clover and alfalfa seed.....	9,692	72.3	8,083	60.8	19.9	Bu.....	46,125	75.5	36,366	69.7	26.8

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>3</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	19.2	14.9	21.4	111.5	143.6	\$377,442	72.9	\$125,379	93.3	201.0
2 Oats.....	Bu.....	27.9	17.9	29.6	106.1	165.4	1,872,639	90.5	1,578,417	94.5	18.6
3 Winter wheat.....	Bu.....	12.7	12.5	13.3	104.7	106.4	1,207,153	28.9	2,006,852	58.3	167.9
4 Spring wheat.....	Bu.....	18.5	11.2	20.7	111.9	184.8	4,169,530	86.1			
5 Barley.....	Bu.....	22.9	13.7	25.1	114.0	190.5	526,531	84.8	399,201	78.1	42.6
6 Rye.....	Bu.....	7.0	6.9	7.2	102.9	104.3	57,226	38.5	18,206	39.3	214.3
<b>Hay and forage:</b>											
7 Timothy alone.....	Tons.....	1.58	1.37	1.60	101.3	116.8	508,800	91.1	211,763	69.9	140.3
8 Timothy and clover mixed.....	Tons.....	1.63	1.62	1.63	100.0	100.6	1,234,778	94.4	63,165	30.9	
9 Clover alone.....	Tons.....	1.42	0.93	1.58	111.3	169.9	74,426	83.7	5,221	35.3	
10 Alfalfa.....	Tons.....	2.05	0.45	2.16	105.4	480.0	18,838,023	98.6	5,425,453	91.2	247.9
11 Other tame grasses.....	Tons.....	1.32	1.14	1.34	101.5	117.5	629,979	89.6	198,068	88.3	218.1
12 Grains cut green.....	Tons.....	1.13	0.41	1.61	142.5	392.7	299,700	85.2			
13 Annual legumes cut for hay.....	Tons.....	2.21	1.90	2.26	102.3	118.9	72,020	89.0	14,470	70.6	
14 Wild, salt, or prairie grasses.....	Tons.....	1.18	1.20	1.17	99.2	97.5	1,498,834	82.9	525,401	99.1	185.8
15 Corn cut for forage.....	Tons.....	1.90	1.09	2.49	131.1	228.4	129,020	75.7	(*)		
16 Silage crops.....	Tons.....	8.07	7.98	8.08	100.1	101.3	272,840	86.9	(*)		
17 Root crops for forage.....	Tons.....	9.55	9.45	9.58	100.3	101.4	136,968	78.8	(*)		
<b>Vegetables:</b>											
18 Potatoes.....	Bu.....	136.8	60.1	145.0	106.0	209.8	3,305,898	94.6	805,094	92.1	310.6
19 Green peas.....							133,259	84.2	(*)		
20 Tomatoes.....							483,659	93.3	(*)		
<b>Fruits:</b>											
21 Grapes.....	Lbs.....	45.4	3.1	45.7	105.6	183.9	32,148	48.6	(*)		
22 Apples.....	Bu.....	1.0	(*)	1.3	130.0		1,361,923	99.6	(*)		
23 Peaches.....	Bu.....	1.6	0.8	1.6	100.0	200.0	1,366,947	96.7	(*)		
24 Pears.....	Bu.....	1.5	1.8	1.4	93.3	77.8	135,015	86.6	(*)		
25 Plums and prunes.....	Bu.....	0.8	0.6	0.8	100.0	133.3	77,196	87.0	(*)		
26 Cherries.....	Bu.....	1.1	0.9	1.1	100.0	122.2	345,524	86.8	(*)		
<b>Miscellaneous:</b>											
27 Sugar beets grown for sugar.....	Tons.....	9.97	9.79	9.97	100.0	101.8	9,951,914	99.0	1,777,435	95.6	459.9
28 Clover and alfalfa seed.....	Bu.....	4.6	4.0	4.8	104.3	120.0	922,500	75.5	213,194	68.3	332.7

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1909.

<sup>3</sup> Number of vines of bearing age.  
<sup>4</sup> Number of trees of bearing age.  
<sup>5</sup> Not including red clover seed.

<sup>6</sup> Average yield per vine.  
<sup>7</sup> Average yield per tree.  
<sup>8</sup> Returns not sufficient to justify an average.

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COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease.]

	THE STATE.	Beaver.	Box Elder.	Cache.	Carbon.	Daggett. <sup>1</sup>	Davis.	Duchesne. <sup>2</sup>	Emery.	Garfield.	
1	Number of all farms in 1920.....	25,662	873	1,859	2,242	235	87	1,172	1,248	759	540
2	Number of farms irrigated in 1919.....	22,218	343	1,538	1,969	181	36	1,096	1,188	727	410
3	Per cent of all farms.....	86.6	92.0	82.7	87.8	77.0	97.3	93.5	95.2	95.8	75.9
4	Number of farms irrigated in 1909.....	19,709	313	1,271	1,561	169	.....	1,193	.....	664	383
5	Per cent of increase, 1909-1919.....	12.7	9.6	21.0	31.2	7.1	.....	-8.1	.....	9.5	7.0
<b>LAND AND FARM AREA.</b>											
6	Approximate land area.....acres..	52,597,760	1,702,400	3,484,160	744,960	951,680	544,000	176,000	2,090,240	2,849,920	3,349,760
7	All land in farms.....acres..	5,050,410	52,626	542,348	317,698	35,899	18,665	98,732	252,031	105,268	113,712
8	Improved land in farms.....acres..	1,716,380	23,094	219,657	183,654	12,117	5,104	52,029	96,697	43,587	33,738
9	Area irrigated in 1910.....acres..	1,371,651	28,108	86,734	94,705	21,876	6,572	10,468	90,435	91,145	27,097
10	Per cent of improved land in farms.....	80.0	84.9	39.5	51.6	178.9	128.8	37.4	93.5	209.1	80.3
11	Area irrigated in 1909.....acres..	999,410	24,430	75,928	77,330	11,620	.....	25,291	.....	46,776	26,437
12	Per cent of increase, 1909-1919.....	37.2	15.0	14.2	22.5	86.5	.....	-23.0	.....	94.9	2.5
13	Area enterprises were capable of irrigating in 1920.....acres..	1,700,550	45,829	100,633	96,619	22,458	10,599	19,536	140,100	98,933	27,353
14	Area enterprises were capable of irrigating in 1910.....acres..	1,250,246	26,630	94,133	82,503	30,862	.....	25,447	.....	50,524	33,532
15	Per cent of increase, 1910-1920.....	36.0	72.1	6.9	17.1	-27.2	.....	-23.2	.....	95.8	-18.4
16	Area included in enterprises in 1920.....acres..	2,359,244	52,180	145,465	100,507	33,381	10,600	20,375	225,959	112,943	54,998
17	Area included in enterprises in 1910.....acres..	1,947,626	31,931	129,034	119,504	40,778	.....	35,245	.....	87,303	49,322
18	Per cent of increase, 1910-1920.....	21.1	63.2	12.7	-15.8	-18.1	.....	-42.2	.....	29.4	11.5
19	Area of irrigated land reported as available for settlement.....acres..	189,563	16,874	15,590	80	10,700	3,750	.....	30,100	10,120	.....
<b>IRRIGATION WORKS.</b>											
<b>Independent enterprises:</b>											
20	Number, 1920.....	2,403	95	220	133	40	8	187	71	31	82
21	Number, 1910.....	2,472	109	218	137	45	.....	116	.....	46	107
<b>Main ditches:</b>											
22	Number, 1920.....	2,381	120	164	177	43	7	41	85	46	87
23	Number, 1910.....	2,495	125	185	139	50	.....	47	.....	51	106
24	Length, 1920.....miles..	6,343	207	401	344	141	28	72	356	227	221
25	Length, 1910.....miles..	5,837	208	354	324	123	.....	129	.....	236	202
26	Capacity, 1920.....second-feet..	29,447	759	1,411	1,820	546	153	114	1,588	1,061	464
27	Capacity, 1910.....second-feet..	26,081	611	2,107	1,393	600	.....	495	.....	1,065	671
<b>Laterals:</b>											
28	Number, 1920.....	4,068	195	67	433	81	2	81	265	447	37
29	Number, 1910.....	1,357	37	84	158	8	.....	41	.....	2	60
30	Length, 1920.....miles..	5,834	229	76	229	24	5	72	658	626	57
31	Length, 1910.....miles..	1,822	31	116	142	6	.....	59	.....	1	34
<b>Reservoirs:</b>											
32	Number, 1920.....	476	7	46	6	2	.....	72	7	9	5
33	Number, 1910.....	480	13	69	1	4	.....	28	.....	15	18
34	Capacity, 1920.....acre-feet..	1,600,506	49,451	8,597	1,509	1,248	.....	23,135	41,871	8,875	24,521
35	Capacity, 1910.....acre-feet..	583,317	12,945	260	1,566	26,748	.....	14,511	.....	18,850	43,477
<b>Flowing wells:</b>											
36	Number, 1920.....	1,256	1	82	32	.....	.....	379	.....	.....	.....
37	Number, 1910.....	1,138	.....	77	33	.....	.....	242	.....	.....	.....
38	Capacity, 1920.....gallons per minute..	96,371	.....	1,880	3,287	.....	.....	8,185	.....	.....	.....
39	Capacity, 1910.....gallons per minute..	42,794	.....	1,768	734	.....	.....	9,551	.....	.....	.....
<b>Pumped wells:</b>											
40	Number, 1920.....	192	11	61	.....	.....	.....	54	.....	.....	.....
41	Number, 1910.....	27	.....	22	.....	.....	.....	.....	.....	1	.....
42	Capacity, 1920.....gallons per minute..	39,059	3,610	12,932	.....	.....	.....	4,319	.....	.....	.....
43	Capacity, 1910.....gallons per minute..	4,527	.....	3,964	.....	.....	.....	.....	.....	480	.....
<b>Pumping plants:</b>											
44	Number, 1920.....	250	9	71	27	.....	2	50	1	2	.....
45	Number, 1910.....	69	.....	23	.....	.....	.....	.....	.....	11	.....
46	Engine capacity, 1920.....horsepower..	11,392	91	762	1,664	.....	13	179	.....	425	.....
47	Engine capacity, 1910.....horsepower..	2,143	.....	206	.....	.....	.....	.....	.....	876	.....
48	Pump capacity, 1920.....gallons per minute..	783,588	4,010	25,205	76,200	.....	965	5,258	27,000	8,000	.....
49	Pump capacity, 1910.....gallons per minute..	315,057	.....	3,987	.....	.....	.....	.....	.....	62,000	.....
50	Average lift, 1920.....feet..	25	21	46	.....	.....	11	9	70	46	.....
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920.....dollars..	32,087,351	831,344	1,806,868	1,436,207	420,075	112,698	522,313	1,432,832	781,800	430,199
52	Capital invested to July 1, 1910.....dollars..	14,028,717	91,922	1,880,966	304,285	449,291	.....	408,483	.....	509,285	262,065
53	Per cent of increase, 1910-1920.....	128.4	804.4	-3.9	372.0	-8.6	.....	27.9	.....	53.5	64.1
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	18.84	18.14	17.95	14.86	18.70	10.63	26.74	10.23	7.90	15.78
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	11.22	3.45	19.98	3.69	14.55	.....	16.05	.....	10.08	7.82
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920.....dollars..	33,835,641	859,444	2,084,063	1,472,007	420,075	112,698	545,313	1,848,675	871,800	430,199
57	Estimated final cost of existing enterprises in 1910.....dollars..	17,840,775	96,922	1,880,966	304,285	494,151	.....	408,483	.....	587,485	262,075
58	Per cent of increase, 1910-1920.....	89.7	786.7	10.8	383.8	-15.0	.....	33.5	.....	48.4	61.7
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	14.34	16.47	14.08	14.65	12.58	10.63	26.76	8.18	7.72	7.82
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	9.16	3.04	14.58	2.55	12.12	.....	11.59	.....	6.73	5.39

<sup>1</sup> Formed from part of Uintah County in 1918.

<sup>2</sup> Formed from part of Wasatch County in 1915; part of Uintah County annexed in 1917.

IRRIGATION—UTAH.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.]

	Grand.	Iron.	Juab.	Kans.	Millard.	Morgan.	Plute. <sup>1</sup>	Rich. <sup>2</sup>	Salt Lake.	San Juan.	
1	Number of all farms in 1920.....	114	646	419	229	1,038	239	246	224	2,438	406
2	Number of farms irrigated in 1919.....	89	512	305	172	941	232	324	204	1,564	203
3	Per cent of all farms.....	78.1	79.2	72.8	75.1	90.7	97.1	91.1	91.1	64.2	50.1
4	Number of farms irrigated in 1909.....	126	317	333	118	689	240	193	312	2,048	139
5	Per cent of increase, 1909-1919.....	-29.4	61.5	-8.4	45.8	36.6	-8.3	16.1	.....	-23.6	46.0
<b>LAND AND FARM AREA.</b>											
6	Approximate land area.....acres..	2,382,880	2,083,840	2,176,640	2,697,600	4,199,040	400,640	488,320	659,840	483,840	4,967,040
7	All land in farms.....acres..	42,656	278,671	105,741	71,851	185,197	117,230	35,093	236,971	317,281	167,739
8	Improved land in farms.....acres..	8,191	46,765	49,751	12,309	91,685	15,926	16,730	48,813	92,447	33,491
9	Area irrigated in 1919.....acres..	5,865	32,066	10,008	4,088	137,980	12,242	8,514	42,913	102,051	13,469
10	Per cent of improved land in farms.....	71.6	69.6	20.1	33.2	150.5	78.9	50.9	87.9	110.4	40.2
11	Area irrigated in 1909.....acres..	6,759	11,624	14,216	3,220	48,992	11,309	12,962	63,030	82,710	8,915
12	Per cent of increase, 1909-1919.....	-13.2	178.9	-29.6	27.0	181.6	8.3	-35.8	.....	23.4	51.1
13	Area enterprises were capable of irrigating in 1920.....acres..	9,664	38,858	12,372	4,469	209,694	13,506	10,258	43,503	125,194	23,283
14	Area enterprises were capable of irrigating in 1910.....acres..	8,723	12,321	16,949	3,330	91,788	11,606	15,406	68,780	100,555	9,336
15	Per cent of increase, 1910-1920.....	10.8	215.4	-27.0	34.2	128.5	16.4	-33.4	.....	24.5	149.4
16	Area included in enterprises in 1920.....acres..	11,010	98,475	14,707	7,114	373,926	13,809	10,938	50,238	176,122	40,511
17	Area included in enterprises in 1910.....acres..	22,372	19,652	21,699	6,633	241,922	12,058	51,262	89,791	121,452	21,254
18	Per cent of increase, 1910-1920.....	-50.8	401.1	-32.2	7.3	54.6	14.5	-78.7	.....	45.0	90.6
19	Area of irrigated land reported as available for settlement.....acres..	.....	.....	.....	45	29,116	.....	.....	.....	20,506	4,715
<b>IRRIGATION WORKS.</b>											
<b>Independent enterprises:</b>											
20	Number, 1920.....	37	85	27	25	66	95	23	37	135	42
21	Number, 1910.....	56	47	43	7	47	77	39	48	112	75
<b>Main ditches:</b>											
22	Number, 1920.....	51	75	30	27	77	114	36	59	129	69
23	Number, 1910.....	51	31	47	33	50	94	51	60	95	47
24	Length, 1920.....miles..	75	164	67	46	439	156	75	180	520	124
25	Length, 1910.....miles..	84	58	101	42	282	134	154	186	298	77
26	Capacity, 1920.....second-feet..	150	1,242	156	89	3,560	748	722	1,205	2,530	475
27	Capacity, 1910.....second-feet..	270	144	376	168	1,437	432	694	769	1,746	252
<b>Laterals:</b>											
28	Number, 1920.....	10	103	73	9	151	52	120	11	383	66
29	Number, 1910.....	16	8	31	4	52	35	13	39	89	2
30	Length, 1920.....miles..	8	67	58	8	384	26	35	30	926	63
31	Length, 1910.....miles..	18	9	30	6	154	18	13	66	123	1
<b>Reservoirs:</b>											
32	Number, 1920.....	3	66	3	9	21	3	3	4	14	14
33	Number, 1910.....	21	21	5	11	12	7	3	12	5	12
34	Capacity, 1920.....acre-feet..	2,752	9,968	3,100	218	672,617	104	55,000	52	3,051	11,885
35	Capacity, 1910.....acre-feet..	2,229	79	199	173,518	74	131,040	10,531	932	.....	292
<b>Flowing wells:</b>											
36	Number, 1920.....	.....	139	11	.....	178	.....	.....	.....	20	2
37	Number, 1910.....	.....	86	6	.....	.....	.....	10	.....	68	10
38	Capacity, 1920.....gallons per minute..	.....	10,061	342	.....	28,955	.....	.....	.....	222	90
39	Capacity, 1910.....gallons per minute..	.....	2,137	100	.....	.....	.....	3,600	.....	1,910	774
<b>Pumped wells:</b>											
40	Number, 1920.....	.....	41	1	.....	.....	.....	.....	.....	1	.....
41	Number, 1910.....	.....	.....	.....	.....	1	.....	.....	.....	2	1
42	Capacity, 1920.....gallons per minute..	.....	10,500	28	.....	.....	.....	.....	.....	.....	.....
43	Capacity, 1910.....gallons per minute..	.....	.....	.....	.....	116	.....	.....	.....	67	200
<b>Pumping plants:</b>											
44	Number, 1920.....	11	21	3	.....	1	.....	.....	2	9	.....
45	Number, 1910.....	19	.....	.....	.....	1	.....	.....	.....	2	1
46	Engine capacity, 1920.....horsepower..	227	272	28	.....	.....	.....	.....	46	4,323	.....
47	Engine capacity, 1910.....horsepower..	404	.....	.....	.....	2	.....	.....	.....	3	15
48	Pump capacity, 1920.....gallons per minute..	17,812	10,400	2,468	.....	11,250	.....	3,300	.....	524,900	.....
49	Pump capacity, 1910.....gallons per minute..	31,057	.....	.....	.....	116	.....	.....	.....	67	200
50	Average lift, 1920.....feet..	18	56	40	.....	.....	.....	.....	40	84	.....
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920.....dollars..	167,511	854,295	562,667	150,188	5,148,282	147,278	253,668	319,225	2,096,530	250,287
52	Capital invested to July 1, 1910.....dollars..	133,699	41,569	156,298	63,064	1,654,652	53,197	312,310	268,005	1,817,542	78,337
53	Per cent of increase, 1910-1920.....	25.3	.....	260.0	138.2	211.1	176.9	-18.8	19.1	15.3	231.0
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	17.33	21.99	45.48	33.61	24.55	10.90	24.73	7.94	16.75	11.14
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	15.33	3.37	9.22	18.94	18.03	4.58	20.27	3.90	18.08	8.29
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920.....dollars..	218,211	832,370	564,667	152,638	5,210,982	147,378	255,168	319,225	2,154,030	319,182
57	Estimated final cost of existing enterprises in 1910.....dollars..	133,699	44,468	156,298	65,397	2,068,652	53,197	450,648	268,005	1,827,542	90,337
58	Per cent of increase, 1910-1920.....	63.2	.....	261.3	133.5	149.5	177.0	-43.4	19.1	17.9	253.3
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	19.52	8.96	38.39	21.46	13.94	10.67	23.33	6.35	12.23	7.88
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	5.98	2.26	7.20	9.86	8.63	4.41	8.79	2.98	15.05	4.25

<sup>1</sup> Part of Plute County annexed to Sevier County in 1902.

<sup>2</sup> Part of Summit County annexed in 1917.

# IRRIGATION—UTAH.

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (-) denotes decrease.]

		Sanpete.	Sevier. <sup>1</sup>	Summit. <sup>2</sup>	Tooele.	Uintah. <sup>3</sup>	Utah.	Wasatch. <sup>4</sup>	Washington.	Wayne.	Weber.
1	Number of all farms in 1920.....	1,813	1,108	521	417	899	3,237	507	738	272	1,687
2	Number of farms irrigated in 1919.....	1,646	1,069	495	505	805	2,990	487	667	264	1,566
3	Per cent of all farms.....	90.8	96.5	93.1	73.1	89.5	92.4	96.1	90.4	97.1	92.8
4	Number of farms irrigated in 1909.....	1,650	1,034	396	272	586	2,717	946	668	235	1,396
5	Per cent of increase, 1909-1919.....	-0.2	3.4	.....	12.1	.....	10.0	.....	17.4	12.3	12.2
<b>LAND AND FARM AREA.</b>											
6	Approximate land area.....acres	1,034,240	1,265,920	1,196,800	4,383,360	2,748,160	1,301,760	746,880	1,577,600	1,584,000	346,240
7	All land in farms.....acres	891,007	113,005	271,778	163,375	126,151	818,133	150,536	127,899	33,551	259,566
8	Improved land in farms.....acres	138,552	66,960	35,807	49,570	54,407	135,996	25,132	29,023	14,293	66,855
9	Area irrigated in 1919.....acres	90,153	63,838	32,139	9,652	80,789	138,143	22,797	20,838	16,198	56,973
10	Per cent of improved land in farms.....	65.1	102.3	82.3	19.5	148.5	101.6	90.7	71.8	113.3	85.2
11	Area irrigated in 1909.....acres	88,959	51,622	37,245	12,318	48,469	80,858	39,031	18,686	13,842	47,505
12	Per cent of increase, 1909-1919.....	1.3	33.4	.....	-21.6	.....	53.7	.....	11.5	17.0	19.9
13	Area enterprises were capable of irrigating in 1920.....acres	91,885	69,178	32,394	11,453	127,787	173,457	22,892	29,077	18,690	70,846
14	Area enterprises were capable of irrigating in 1910.....acres	90,389	52,425	39,313	13,606	130,850	102,926	49,539	24,662	15,980	48,131
15	Per cent of increase, 1910-1920.....	1.7	32.0	.....	-15.8	.....	68.6	.....	17.9	17.0	47.2
16	Area included in enterprises in 1920.....acres	127,708	81,548	34,795	17,405	147,608	203,065	24,883	43,387	19,690	105,897
17	Area included in enterprises in 1910.....acres	133,559	68,993	46,312	18,523	186,886	127,020	106,841	67,681	34,617	56,160
18	Per cent of increase, 1910-1920.....	-4.4	18.2	.....	-6.0	.....	59.9	.....	-35.9	-43.8	88.6
19	Area of irrigated land reported as available for settlement.....acres	.....	2,556	.....	.....	1,100	27,664	.....	6,848	800	.....
<b>IRRIGATION WORKS.</b>											
Independent enterprises:											
20	Number, 1920.....	91	82	132	69	42	210	48	126	29	135
21	Number, 1910.....	106	78	173	77	66	230	162	105	89	107
Main ditches:											
22	Number, 1920.....	93	73	156	55	54	146	62	137	37	129
23	Number, 1910.....	177	69	173	70	90	226	166	138	49	75
24	Length, 1920.....miles	429	312	232	144	295	381	161	226	97	212
25	Length, 1910.....miles	394	234	277	168	371	460	395	263	141	192
26	Capacity, 1920.....second-feet	1,169	1,979	665	146	996	2,725	766	527	174	1,517
27	Capacity, 1910.....second-feet	1,630	1,390	635	239	3,136	1,730	1,305	437	866	653
Laterals:											
28	Number, 1920.....	262	288	24	29	58	449	212	79	59	73
29	Number, 1910.....	118	44	138	36	160	70	38	17	17	50
30	Length, 1920.....miles	407	274	23	40	137	624	89	80	19	60
31	Length, 1910.....miles	189	55	58	28	384	133	56	15	21	106
Reservoirs:											
32	Number, 1920.....	23	16	18	16	.....	32	16	18	10	33
33	Number, 1910.....	30	17	22	37	5	56	17	16	18	26
34	Capacity, 1920.....acre-feet	30,708	87,779	1,810	21	.....	527,715	3,581	10,654	4,003	30,250
35	Capacity, 1910.....acre-feet	33,816	11,925	458	443	484	48,612	1,484	44,242	14,274	320
Flowing wells:											
36	Number, 1920.....	33	46	.....	80	.....	220	.....	.....	.....	33
37	Number, 1910.....	156	103	.....	102	.....	195	.....	.....	.....	50
38	Capacity, 1920.....gallons per minute	505	9,395	.....	4,362	.....	27,729	.....	.....	.....	1,358
39	Capacity, 1910.....gallons per minute	4,070	5,125	.....	2,102	.....	9,316	.....	.....	.....	1,607
Pumped wells:											
40	Number, 1920.....	1	1	.....	7	1	4	.....	3	.....	6
41	Number, 1910.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	Capacity, 1920.....gallons per minute	150	.....	.....	200	1,350	2,830	.....	1,500	.....	1,640
43	Capacity, 1910.....gallons per minute	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pumping plants:											
44	Number, 1920.....	1	3	1	.....	4	8	.....	2	.....	22
45	Number, 1910.....	.....	.....	.....	.....	3	5	.....	3	.....	1
46	Engine capacity, 1920.....horsepower	5	84	6	.....	92	2,919	.....	30	.....	226
47	Engine capacity, 1910.....horsepower	.....	.....	.....	.....	54	956	.....	102	.....	25
48	Pump capacity, 1920.....gallons per minute	450	4,150	900	.....	3,350	30,830	.....	900	.....	26,245
49	Pump capacity, 1910.....gallons per minute	.....	.....	.....	.....	3,700	202,900	.....	2,330	.....	8,700
50	Average lift, 1920.....feet	4	32	12	.....	20	43	.....	20	.....	17
<b>CAPITAL INVESTED.</b>											
51	Capital invested to Jan. 1, 1920.....dollars	1,288,433	2,063,537	229,639	136,263	1,488,111	5,880,832	410,198	576,824	453,600	1,756,652
52	Capital invested to July 1, 1910.....dollars	630,936	404,561	143,499	165,573	939,427	1,868,232	442,162	372,362	113,935	463,090
53	Per cent of increase, 1910-1920.....	104.2	415.1	.....	-17.7	.....	214.8	.....	54.9	298.1	279.3
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars	14.02	30.12	7.09	11.90	11.65	33.90	17.92	19.84	24.27	24.80
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars	6.98	7.72	3.65	12.17	7.18	18.15	8.93	15.10	7.13	9.62
<b>ESTIMATED FINAL COST.</b>											
56	Estimated final cost of existing enterprises in 1920.....dollars	1,346,933	2,208,437	242,839	136,263	1,711,468	6,010,982	450,198	628,774	467,200	1,764,892
57	Estimated final cost of existing enterprises in 1910.....dollars	658,214	404,501	143,499	165,573	995,635	4,613,401	525,965	507,362	146,925	463,090
58	Per cent of increase, 1910-1920.....	104.6	446.0	.....	-17.7	.....	31.5	.....	23.9	218.0	281.0
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars	10.55	27.06	6.98	7.83	11.59	26.88	18.09	14.49	23.73	16.66
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars	4.93	5.86	3.10	8.94	5.33	36.32	4.92	7.50	4.24	8.25

<sup>1</sup> Part of Piute County annexed to Sevier County in 1902.  
<sup>2</sup> Part annexed to Rich County in 1917; part of Uintah County annexed to Summit County in 1917.  
<sup>3</sup> Parts annexed to Duchesne and Summit Counties in 1917; part taken to form Daggett County in 1918.  
<sup>4</sup> Part taken to form Duchesne County in 1915.



# WASHINGTON.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Washington collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for

the purpose of showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE I.—SUMMARY FOR THE STATE: 1920 AND 1910.

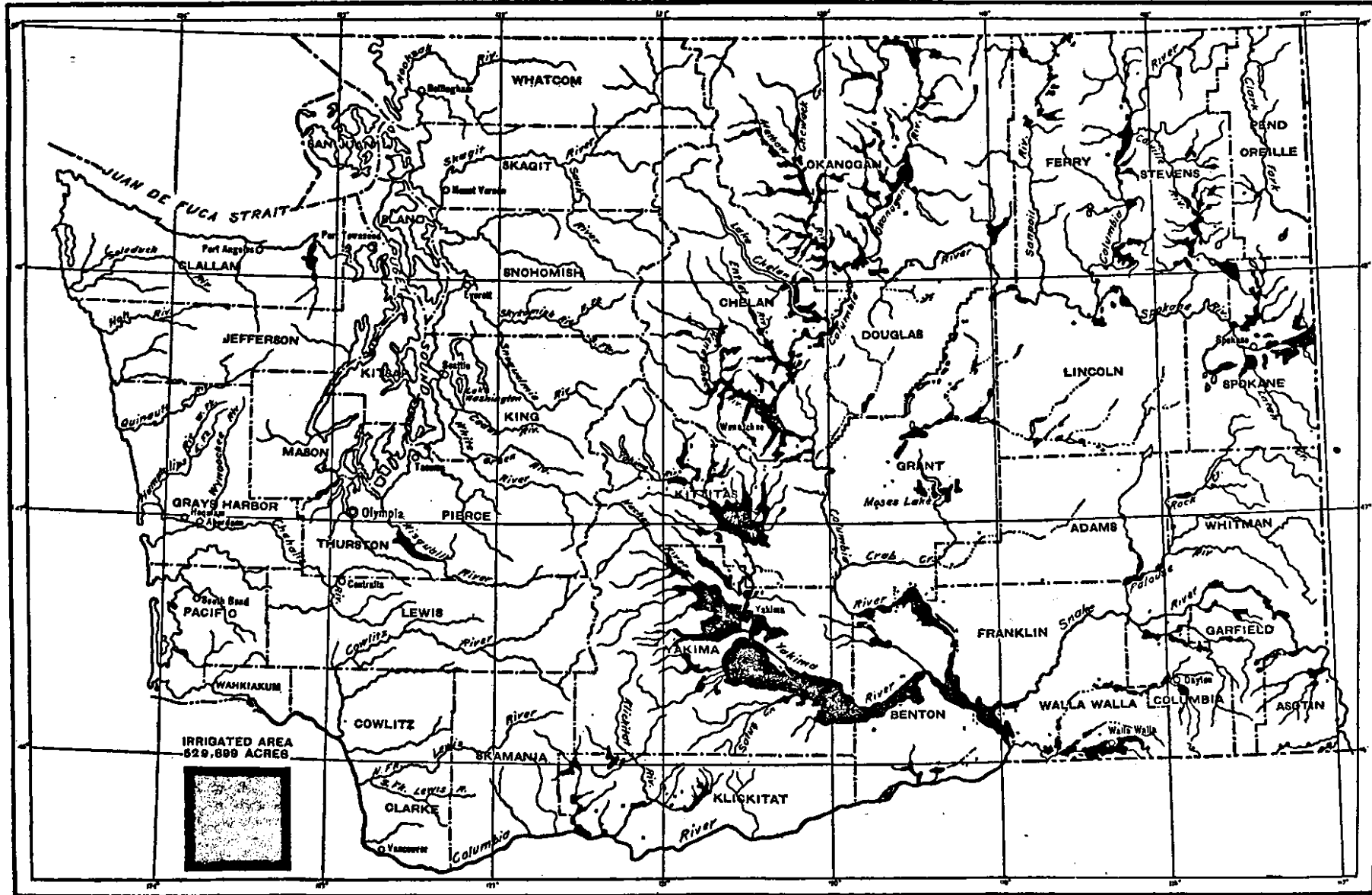
ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	66,318	56,192	10,126	18.0
Approximate land area of the state.....acres..	42,775,040	42,775,040	.....	.....
All land in farms.....acres..	13,219,053	11,712,235	1,506,818	12.9
Improved land in farms.....acres..	7,129,343	6,373,311	756,032	10.6
Number of farms irrigated.....	13,271	7,664	5,607	73.2
Area irrigated.....acres..	529,899	384,378	195,521	58.5
Area enterprises were capable of irrigating.....acres..	637,151	470,514	166,637	35.4
Area included in enterprises.....acres..	886,795	817,032	19,763	2.4
Per cent irrigated:				
Number of all farms.....	20.0	13.6	6.4	.....
Approximate land area of the state.....	1.2	0.8	0.4	.....
Land in farms.....	4.0	2.9	1.1	.....
Improved land in farms.....	7.4	5.2	2.2	.....
Excess of area enterprises were capable of irrigating over area irrigated.....acres..	107,252	136,136	-28,884	-21.2
Excess of area included in enterprises over area irrigated.....acres..	306,896	482,654	-175,758	-36.4
Area of irrigated land reported as available for settlement.....acres..	61,738	( <sup>2</sup> )	.....	.....
Capital invested.....	\$29,299,011	\$16,219,149	\$13,079,862	80.6
Average per acre enterprises were capable of irrigating.....	\$45.98	\$34.47	\$11.51	33.4
Estimated final cost of existing enterprises.....	\$37,684,591	\$22,322,856	\$15,361,735	68.8
Average per acre included in enterprises.....	\$45.03	\$27.32	\$17.71	64.8
Average cost of operation and maintenance per acre.....	\$3.45	\$3.08	\$0.37	12.0
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	2,692	1,934	758	39.2
Number of main ditches.....	1,873	1,600	273	17.1
Length of main ditches.....miles..	3,851	2,594	1,257	48.5
Capacity of main ditches.....second-feet..	16,242	13,178	3,064	23.3
Number of lateral ditches.....	3,179	1,180	1,999	169.4
Length of lateral ditches.....miles..	1,764	1,298	466	35.9
Number of reservoirs.....	205	156	49	31.4
Capacity of reservoirs.....acre-feet..	477,789	121,543	356,246	293.1
Number of flowing wells.....	60	55	5	.....
Capacity of flowing wells.....gallons per minute..	14,925	18,926	-4,001	-21.1
Number of pumped wells.....	520	128	392	306.3
Capacity of pumped wells.....gallons per minute..	227,744	60,220	167,524	278.2
Number of pumping plants.....	978	391	587	150.1
Engine capacity.....horsepower..	22,929	13,847	9,082	65.6
Pump capacity.....gallons per minute..	636,552	365,411	271,141	74.2
Average lift.....feet..	60	( <sup>2</sup> )	60	.....

<sup>1</sup> A minus sign (—) denotes decrease. Per cent not shown when base is less than 100.

<sup>2</sup> Not reported in 1910.

# WASHINGTON

APPROXIMATE LOCATION AND EXTENT OF IRRIGATED LAND.



## CLIMATIC CONDITIONS.

With reference to climatic conditions and the necessity for irrigation, the state of Washington may be divided into three fairly distinct zones—humid, arid, and semiarid.

West of the Cascade Mountains there is a heavy annual precipitation, varying from 21 to 55 inches in the valleys and from 55 inches upward in the mountains. In this section of the state there is a fairly well-defined wet season, more than 80 per cent of the precipitation occurring between October 15 and May 15, or the winter season. July and August are the driest months, the average precipitation for each of these months at many points being less than 1 inch. This creates a necessity for irrigation if crops not capable of withstanding considerable periods of drought are to be grown during the late summer months. However, only small areas are irrigated in this part of the state.

Immediately east of the Cascades and between them and Columbia River lies the arid section of the state. The rainfall at the summit of the Cascades is very heavy, but in the valleys, extending from the mountains to the Columbia, it varies from 12 to 6 inches per annum, and irrigation is necessary to the growing of crops. Most of the irrigated land in the state lies in this section.

East of the Columbia River lies the great wheat belt of Washington, where the annual rainfall varies from 13 to 25 inches. In this section most of the precipitation occurs in the fall, winter, and spring, leaving a dry summer season for the grain harvest. In this section there is little irrigation, although the desire to diversify crops has led to the consideration of many plans for irrigating large areas. These plans have not, however, advanced far enough to enter into the tabulation.

Weather conditions in 1919 were peculiarly unfavorable. The meteorologist of the United States Weather Bureau for the Washington section, in his annual summary, makes the following statement regarding the year 1919:

The most striking features of the weather in the year 1919 were the heavy rains, melting snows, and consequent freshets of January, a cold and backward spring, an unusually long and excessive drought in which the precipitation was deficient from April to November, periods of hot and desiccating winds in June and July \* \* \*.

The snowfall of the season of 1918-19 was so much lighter in the mountains than the average that the irrigation supply proved inadequate at some projects, owing largely to the unusual demands of an excessively dry and hot summer. During the growing season there was even a less supply of rain than in the preceding year, which had also a noteworthy scarcity of precipitation.

From an agricultural point of view the year was hardly a successful one, but there was an unprecedented crop of unusually fine apples.

## WATER SUPPLY FOR IRRIGATION.

West of the Cascade Mountains the streams flowing from these mountains and the Olympic Mountains to the Pacific Ocean and Puget Sound and to Columbia River furnish an ample supply of water for the small amount of irrigation required.

The streams most used for irrigation are those heading on the eastern slope of the Cascade Mountains and flowing into the Columbia. The precipitation on the Cascades is very heavy, affording a large supply of water, and there are many lakes on the headwaters of the rivers, affording opportunity for storing the flood water. The larger streams in this section, named in the order in which they enter the Columbia, from south to north, are the Klickitat, Yakima, Wenatchee, Entiat, Chelan, Methow, and Okanogan. While the building of storage reservoirs on these streams has been begun, there is opportunity for much additional storage. The streams named supply water to about 80 per cent of the total irrigated acreage of the state, Yakima River and tributaries alone supplying about 64 per cent of the total acreage.

East of Columbia River the principal streams entering the Columbia from the east, named in order from south to north, are the following: Walla Walla River, rising in the Blue Mountains in eastern Washington and Oregon; Snake River, rising in western Wyoming, flowing across the state of Idaho, and forming the eastern boundary of Oregon and Washington for nearly 200 miles; Spokane River, rising in Idaho; Colville River, rising in eastern Washington; and Clark Fork, rising in western Montana, flowing across northern Idaho and through northeastern Washington, and entering Columbia River just north of the international boundary. In this section of the state crops are grown without irrigation, and the water supply is not all utilized.

The Columbia itself enters the state from Canada near the northeast corner of the state and drains a large area in western Montana, northern Idaho, and southern Canada before entering Washington. Throughout most of its course the Columbia flows in a deep channel far below the level of the adjoining land and is not used to a large extent for irrigation.

The acreages irrigated from the various streams of the state and their tributaries are given in Table 7.

The extent of the supply of underground water has not been determined. Of the 60 flowing wells reported as being used for irrigation, two-thirds are in the vicinity of the confluence of Columbia and Snake Rivers. Pumped wells are more generally distributed, but nearly one-half of those reported are located in Benton and Grant Counties.

FARMS AND ACREAGE IRRIGATED.

TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	13,271	73.2	20.0	529,899	58.5	1.2	4.0	7.4
1910.....	7,664	118.2	13.6	334,378	146.8	0.8	2.9	5.2
1900.....	3,513	235.9	10.6	135,470	177.6	0.3	1.6	3.9
1890.....	1,046	.....	5.8	48,799	.....	0.1	1.2	2.7

TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	2,692	836,795	529,899	63.3	637,151
Before 1860.....	7	1,066	461	43.2	806
1860-1869.....	10	998	793	80.0	837
1870-1879.....	89	24,619	22,650	92.0	23,603
1880-1889.....	226	79,276	65,791	83.0	68,548
1890-1899.....	315	208,025	126,359	60.7	145,602
1900-1904.....	274	59,942	42,534	71.0	49,136
1905-1909.....	343	278,007	175,393	62.9	217,215
1910-1914.....	483	85,461	30,663	35.9	50,788
1915-1919.....	427	49,757	24,466	49.2	38,771
Not reported.....	518	48,744	40,794	83.7	41,793

TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	529,899	334,378	195,521	58.5	637,151	836,795
Streams, gravity.....	352,199	301,341	50,858	16.9	416,769	550,325
Streams, pumped.....	26,244	9,085	17,159	188.9	49,545	71,150
Streams, pumped and gravity.....	92,702	( <sup>2</sup> )	.....	.....	98,745	114,773
Wells, pumped.....	17,504	5,437	12,067	221.9	19,938	24,793
Wells, flowing.....	1,671	3,227	-1,556	-48.2	2,843	3,654
Wells, flowing and pumped.....	1,490	( <sup>2</sup> )	.....	.....	1,490	1,794
Lakes, gravity.....	3,442	4,698	-1,256	-26.7	3,979	5,562
Lakes, pumped.....	4,662	6,084	-1,422	-23.4	4,888	6,294
Springs.....	7,869	4,207	3,662	87.0	9,559	15,398
Stored storm water.....	120	209	-170	-56.9	141	151
City water.....	42	( <sup>2</sup> )	.....	.....	21	52
Streams, gravity, and pumped wells.....	2,415	( <sup>2</sup> )	.....	.....	4,069	4,674
Streams, gravity, and flowing wells.....	441	( <sup>2</sup> )	.....	.....	443	592
Other mixed.....	19,027	( <sup>2</sup> )	.....	.....	27,654	37,491
Other and not reported.....	63	( <sup>2</sup> )	.....	.....	97	127

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF ENTERPRISE.

The original irrigation district law in Washington was enacted by the first state legislature, in 1890, and it has been amended from time to time since that date. Generally, in Washington, irrigation districts have not built irrigation works, but have been or-

ganized to take over works built by other agencies. Some of the larger commercial enterprises reported in 1910 have been taken over by districts, and this accounts for the decrease in the acreage reported for commercial enterprises. Most of the land served by the United States Reclamation Service has been organized into districts, but the acreage is credited to the Reclamation Service because the Government constructed the works and still controls them to a large extent. The Reclamation Service also supplies stored water to land in other enterprises under the "Warren Act" (act of Congress, Feb. 21, 1911), and other special arrangements.

The state of Washington accepted the conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894) in 1895, but nothing has been accomplished under this law.

The small acreage credited to the state belongs to state institutions and does not represent a scheme of state construction of irrigation works.

TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
ACREAGE IRRIGATED.				
Total.....	529,899	334,378	195,521	58.5
Individual and partnership.....	142,215	95,655	46,560	48.7
Cooperative.....	93,192	81,122	12,070	14.9
Irrigation district.....	79,918	79,918	.....	.....
Commercial.....	21,705	68,911	-47,206	-67.6
U. S. Reclamation Service.....	* 122,869	55,890	67,179	120.6
U. S. Indian Service.....	69,510	35,000	34,510	98.6
State.....	200	( <sup>2</sup> )	200	.....
Other and mixed.....	290	( <sup>2</sup> )	290	.....
ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.				
Total.....	637,151	470,514	166,637	35.4
Individual and partnership.....	169,457	117,145	52,312	44.7
Cooperative.....	104,699	90,805	13,894	15.3
Irrigation district.....	118,009	.....	118,009	.....
Commercial.....	31,652	138,064	-106,412	-77.1
U. S. Reclamation Service.....	* 135,119	74,500	60,619	81.4
U. S. Indian Service.....	77,710	50,000	27,710	55.4
State.....	200	( <sup>2</sup> )	200	.....
Other and mixed.....	305	( <sup>2</sup> )	305	.....
ACREAGE INCLUDED IN ENTERPRISES.				
Total.....	836,795	817,032	19,763	2.4
Individual and partnership.....	226,671	192,310	34,361	17.9
Cooperative.....	118,539	115,410	3,129	2.7
Irrigation district.....	134,641	.....	134,641	.....
Commercial.....	75,292	266,216	-190,924	-71.7
U. S. Reclamation Service.....	* 152,947	143,096	9,851	6.9
U. S. Indian Service.....	128,200	100,000	28,200	28.2
State.....	200	( <sup>2</sup> )	200	.....
Other and mixed.....	305	( <sup>2</sup> )	305	.....

<sup>1</sup> A minus sign (-) denotes decrease. <sup>2</sup> Does not include about 100,000 acres to which stored water is supplied. <sup>3</sup> Not included in classification in 1910.

ACREAGE, BY CHARACTER OF WATER RIGHTS.

Rights to water from streams and other sources are subject to control by the states. The laws of the state of Washington relating to water rights are summarized in the following paragraphs:

The territory of Washington was organized in 1853, and the state of Washington was admitted to the Union in 1889. During the territorial period no general legislation relating to irrigation was enacted.

The constitution of the state, ratified October 1, 1889, declared that "The use of the waters of this state for irrigation, mining, and manufacturing purposes shall be deemed a public use."—(Art. XXI.)

The first state legislature enacted a law requiring each party claiming any right to water to file with the clerk of the district court before June 1, 1890, a sworn statement of his claim; and requiring also that any party wishing to take water from a stream or lake after the passage of the law should file a statement and a map setting forth his claim. This law was in effect until 1917.

The law just referred to, enacted by the first legislature, provided that after June 1, 1890, any party interested might apply to the superior court of the county to have the rights to water from any source adjudicated, and that on such application the court should proceed with the adjudication, if he should "deem it practicable." A law approved March 17, 1917, provided a new procedure for the adjudication of water rights. Water rights may also be defined in ordinary suits between rival claimants.

The law of March 17, 1917, provided that any party wishing to acquire a right to water must make application to the state hydraulic engineer for a permit. When work has been completed in accordance with a permit issued by the state hydraulic engineer, that official issues a certificate setting forth the right that has been acquired.

The irrigation law passed by the first state legislature provided that riparian owners were entitled to use any water, not otherwise appropriated, for the purpose of irrigation, "to the full extent of the soil for agricultural purposes," and that riparian rights might be condemned.

TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	529,899	100.0	100.0
Appropriation and use.....	196,700	37.1	54.5
Notice filed and posted.....	169,831	32.0	29.3
Adjudicated by court.....	56,309	10.6	7.6
Permit from state.....	39,608	7.6	(1)
Certificate or license from state.....	17,406	3.3	(1)
Riparian rights.....	17,095	3.2	(1)
Underground.....	20,859	3.9	5.2
Other and mixed.....	561	0.1	(2)
Not reported.....	11,530	2.2	(3)

<sup>1</sup> In 1910 there was no provision of law for permits or certificates from the state. Small areas were incorrectly reported in these classes.  
<sup>2</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."  
<sup>3</sup> Includes springs and wells.

ACREAGE, BY DRAINAGE BASIN.

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributary streams were included in those reported for the main streams. This area is so small, however, that the comparison of the areas reported for the tributary streams is not seriously affected.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	529,899	154,962	242.0	836,795	637,151
Columbia River and tributaries.....	621,462	163,937	238.8	816,266	621,458
Columbia River direct.....	24,471	584	.....	49,209	32,492
Clark Fork.....	306	(*)	.....	1,431	1,064
Colville River.....	6,960	310	.....	18,200	13,993
Spokane River.....	16,453	210	.....	40,391	21,676
Okanogan River and tributaries.....	20,583	2,257	812.0	42,042	30,261
Okanogan River direct.....	2,357	14	.....	3,708	2,899
Salmon Creek.....	6,729	1,095	514.5	11,478	11,238
Other tributaries of Okanogan River.....	11,497	* 1,148	901.5	26,856	16,124
Methow River.....	12,579	1,675	651.0	24,017	16,529
Entiat River.....	2,054	2,919	-29.6	2,652	2,251
Wenatchee River.....	23,734	8,285	622.5	39,288	34,568
Crab Creek.....	6,088	1,937	214.3	10,400	8,048
Yakima River and tributaries.....	337,293	121,705	177.1	436,797	353,644
Yakima River direct.....	254,282	66,371	283.1	345,373	269,163
Wilson Creek.....	11,297	6,613	70.8	12,042	11,897
Naches River.....	19,864	20,232	-1.8	21,656	20,284
Ahtanum Creek.....	9,287	3,849	141.3	9,982	9,342
Other tributaries of Yakima River.....	42,588	* 24,640	72.8	47,744	43,048
Snake River and tributaries.....	11,788	4,968	137.3	36,285	30,269
Snake River direct.....	4,047	100	.....	24,233	20,130
Grande Ronde River.....	66	(*)	.....	138	126
Asotin Creek.....	3,051	3,225	-5.4	4,051	4,051
Pataha River.....	1,480	619	139.1	2,362	2,209
Palouse River.....	1,735	508	241.5	3,645	2,020
Other tributaries of Snake River.....	1,409	* 516	173.1	1,866	1,733
Walla Walla River.....	22,270	6,328	251.9	36,157	29,965
Klickitat River.....	12,332	372	.....	19,241	13,440
White Salmon River.....	6,247	912	585.0	11,958	7,277
Other tributaries of Columbia River.....	18,304	* 6,475	182.7	48,188	25,982
Independent streams.....	8,437	1,025	723.1	20,529	15,693
Dungeness River.....	6,160	685	799.3	12,660	9,860
McDowall Creek.....	2,277	200	.....	7,869	5,833
Other independent streams.....	.....	* 140	.....	.....	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1902.  
<sup>3</sup> Includes springs and wells.

CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$29,299,011	80.6	\$45.98	33.4
1910.....	16,219,149	841.7	34.47	171.2
1900.....	1,722,369	775.8	12.71	215.4
1890.....	196,660	.....	4.03	.....

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$29,299,011	100.0	\$45.98
Before 1890.....	37,112	0.1	46.04
1890-1899.....	15,300	0.1	17.25
1870-1879.....	102,262	0.3	4.33
1880-1889.....	1,098,045	3.7	16.02
1890-1899.....	4,743,934	16.2	32.58
1900-1904.....	2,823,289	9.6	57.46
1905-1909.....	12,153,628	41.5	55.95
1910-1914.....	5,538,131	18.9	108.99
1915-1919.....	1,935,660	6.6	49.93
Not reported.....	864,650	2.9	20.45

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total .....	\$29,299,011	100.0	\$45.98	465,758	\$3.45
Streams, gravity.....	18,764,090	64.0	45.02	208,899	2.49
Streams, pumped.....	2,605,718	8.9	52.59	23,129	11.16
Streams, pumped and gravity.....	8,827,148	13.1	39.97	92,574	1.99
Wells, pumped.....	1,633,134	5.6	81.91	16,158	12.71
Wells, flowing.....	114,300	0.4	40.20	1,076	2.03
Wells, flowing and pumped.....	56,500	0.2	37.92	1,490	1.86
Lakes, pumped.....	455,631	1.6	114.51	2,976	13.05
Lakes, gravity.....	257,797	0.9	52.74	4,371	3.96
Springs.....	607,103	1.7	53.05	4,857	7.08
Stored storm water.....	5,985	(*)	42.45	66	11.85
City water.....	381	(*)	18.14	.....	.....
Streams, gravity, and pumped wells.....	237,150	0.8	58.28	2,158	20.70
Streams, gravity, and flowing wells.....	22,522	0.1	50.84	324	4.97
Other mixed.....	811,102	2.8	29.33	7,681	6.14
Not reported.....	450	(*)	6.72	.....	.....

<sup>1</sup> Based on area irrigated in 1919.  
\* Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total .....	\$29,299,011	\$2,330,758	\$26,968,253	.....
Columbia River and tributaries.....	28,990,618	2,319,513	26,671,105	.....
Columbia River direct.....	2,229,056	5,200	2,223,856	.....
Clark Fork.....	7,293	(*)	7,293	.....
Colville River.....	486,747	938	485,809	.....
Spokane River.....	1,637,743	2,994	1,634,749	.....
Okanogan River and tributaries.....	2,269,018	12,374	2,246,644	.....
Okanogan River direct.....	227,290	360	226,930	.....
Salmon Creek.....	1,060,972	5,085	1,055,887	.....
Other tributaries of Okanogan River.....	961,756	* 6,929	954,827	.....
Methow River.....	483,909	20,825	463,084	.....
Entiat River.....	73,889	17,150	56,739	330.8
Wenatchee River.....	1,868,541	95,755	1,772,786	.....
Crab Creek.....	859,050	5,415	853,635	.....
Yakima River and tributaries.....	14,849,689	1,968,555	12,881,134	654.8
Yakima River direct.....	13,912,727	1,580,185	12,332,532	780.4
Wilson Creek.....	45,875	17,925	27,950	155.9
Naches River.....	468,027	276,223	181,804	65.8
Ahtanum Creek.....	88,443	14,950	73,493	491.6
Other tributaries of Yakima River.....	344,617	* 79,262	265,355	334.8
Snake River and tributaries.....	1,398,296	109,853	1,288,443	.....
Snake River direct.....	471,772	1,080	470,692	.....
Grande Ronde River.....	5,562	(*)	5,562	.....
Asotin Creek.....	606,084	94,100	511,984	544.1
Pataha River.....	47,085	1,905	45,180	.....
Palouse River.....	175,100	2,810	172,290	.....
Other tributaries of Snake River.....	92,693	* 9,958	82,735	830.8
Walla Walla River.....	890,980	27,022	863,958	.....
Killekitat River.....	64,423	1,832	62,591	.....
White Salmon River.....	91,786	6,700	85,086	.....
Other tributaries of Columbia River.....	1,790,288	44,860	1,745,428	.....
Independent streams.....	308,393	11,245	297,148	.....
Dumfrances River.....	94,010	8,000	86,010	.....
McDowell Creek.....	2,000	.....	2,000	.....
Other independent streams.....	214,383	* 1,245	213,138	.....

<sup>1</sup> A minus sign (—) denotes decrease. Per cent not shown when more than 1,000.  
\* Not reported separately in 1902.  
\* Includes springs and wells.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that the United States Reclamation Service supplies stored water to enterprises

controlled by agencies of most of the other classes shown in the table, and a part of its expenditure is properly chargeable to those lands; but it is not possible to distribute this among the classes, because the area receiving water varies from season to season.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total .....	\$29,299,011	100.0	465,758	\$3.45
Individual and partnership.....	4,732,706	16.2	84,405	6.02
Cooperative.....	3,949,896	13.5	87,791	2.33
Irrigation district.....	6,112,628	20.9	79,618	5.73
Commercial.....	2,241,428	8.0	21,585	5.96
U. S. Reclamation Service.....	10,441,145	35.6	122,849	1.89
U. S. Indian Service.....	1,658,040	5.7	69,510	1.06
State.....	55,668	0.2	.....	.....
Other.....	7,500	(*)	.....	.....

<sup>1</sup> Based on area irrigated in 1919.  
\* Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage.....	103
Acreage included in enterprises reporting land drained or needing drainage.....	218,763
Acreage for which drains have been installed.....	79,168
Additional acreage needing drainage.....	43,461
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage.....	36.2
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state.....	9.5
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state.....	14.6

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume entering canals..... second-feet.....	8,827	4,827	4,000
Area irrigated in 1919..... acres.....	376,270	280,363	95,907
Average number of acres per second-foot.....	43	58	24
Total quantity entering canals..... acre-feet.....	2,163,818	1,513,616	655,202
Area irrigated in 1919..... acres.....	341,569	264,558	77,011
Average quantity per acre..... acre-feet.....	6.3	5.7	8.5
Total quantity of water delivered..... acre-feet.....	594,479	139,232	455,247
Area irrigated in 1919..... acres.....	174,989	77,235	97,754
Average quantity per acre..... acre-feet.....	3.4	1.8	4.6

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TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	579	115	1,873	16,242	3,851	3,179	1,764	205	477,789
Before 1860.....	1		6	11	3				
1860-1869.....	5		12	51	14	56	4		
1870-1879.....	33		92	512	130	85	4	1	10
1880-1889.....	58	7	234	2,243	429	138	63	8	1,510
1890-1899.....	122	21	321	3,993	550	1,466	325	25	4,861
1900-1904.....	78	11	241	1,814	362	1,167	37	20	4,752
1905-1909.....	95	30	332	3,999	529	729	1,172	59	65,191
1910-1914.....	53	25	234	1,235	316	348	57	55	390,416
1915-1919.....	43	11	166	1,241	256	144	79	30	10,849
Not reported.....	95	10	335	1,143	1,242	46	23	7	1,209

DATE OF BEGINNING.	Pipelines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	790.0	60	14,925	520	227,744	975	22,929	1,059	636,552
Before 1860.....	1.7			2	1,050	3	72	3	980
1860-1869.....	0.5								
1870-1879.....	1.1			2	500	3	20	3	1,000
1880-1889.....	16.0			1	470	7	116	9	5,230
1890-1899.....	63.8	7	1,150	14	2,265	31	278	33	25,105
1900-1904.....	44.1	4	1,075	21	5,888	50	757	50	18,819
1905-1909.....	373.3	3	1,000	72	63,738	148	12,411	190	302,496
1910-1914.....	143.5	17	1,980	186	83,117	316	4,705	344	131,465
1915-1919.....	109.9	8	5,480	142	36,535	266	3,332	296	106,929
Not reported.....	36.1	21	4,260	80	34,135	131	1,238	131	46,538

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-feet).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	579	115	1,873	16,242	3,851	3,179	1,764	205	477,789
Individual and partnership.....	498	87	1,694	6,611	2,578	2,307	229	171	4,647
Cooperative.....	48	8	108	2,777	522	250	272	10	12,050
Irrigation district.....	20	3	35	2,347	424	232	130	5	7,984
Commercial.....	6	8	14	1,061	118	12	50	9	9,607
U. S. Indian Service.....	3	1	9	1,720	83	26	122	1	3,500
U. S. Reclamation Service.....	3	8	11	1,716	124	350	690	7	440,000
State.....								2	
Other and not reported.....	1		2	10	2	2	1		1

CLASS.	Pipelines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.			
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps.	
								Number.	Capacity (gallons per minute).
Total.....	790.0	60	14,925	520	227,744	975	22,929	1,059	636,552
Individual and partnership.....	355.5	60	14,925	484	164,586	914	10,290	965	347,349
Cooperative.....	131.3			28	60,138	29	4,048	40	97,138
Irrigation district.....	93.5			1	1,500	14	3,935	23	31,295
Commercial.....	73.3			6	870	10	1,771	11	78,520
U. S. Indian Service.....	2.3								
U. S. Reclamation Service.....	129.4					4	2,735	14	62,200
State.....	2.8			3	650	2	85	4	18,650
Other and not reported.....	1.9					3	66	2	1,400





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CROPS.

TABLE 18.—ACREAGE, YIELD, AND VALUE OF CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.

(Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.)

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	13,283	38.1	2,494	9.5	438.3	Bu.....	487,154	54.0	87,357	15.5	457.7
2 Oats.....	7,215	2.8	6,690	2.5	7.8	Bu.....	337,056	4.2	330,587	2.5	2.0
3 Winter wheat.....	8,226	0.7	6,720	0.8	553.7	Bu.....	154,116	0.6	188,855	0.5	70.6
4 Spring wheat.....	35,694	2.7	1,738	1.0	231.5	Bu.....	923,493	5.4	49,143	0.8	293.9
5 Barley.....	5,761	6.8	( <sup>2</sup> )			Bu.....	193,568	8.6	( <sup>2</sup> )		
6 Rye.....	544	1.3	( <sup>2</sup> )			Bu.....	5,646	2.4	( <sup>2</sup> )		
<b>Hay and forage:</b>											
7 Timothy alone.....	8,142	16.1	17,326	19.6	-53.0	Tons...	15,466	19.5	33,642	23.5	-54.0
8 Timothy and clover mixed.....	8,647	6.0	7,704	6.4	12.2	Tons...	18,140	5.9	20,991	8.3	-13.6
9 Clover alone.....	2,254	12.7	794	7.3	183.9	Tons...	4,128	11.1	2,136	9.7	93.3
10 Alfalfa.....	148,409	64.9	74,496	78.5	99.2	Tons...	494,066	75.3	296,614	82.9	66.6
11 Other tame grasses.....	17,014	32.7	1,054	3.6		Tons...	35,054	38.6	1,625	3.8	
12 Small grains cut for hay.....	11,650	2.4	5,340	1.5	118.2	Tons...	15,214	2.8	9,417	1.9	61.6
13 Wild, salt, or prairie grasses.....	1,047	8.1	2,800	9.9	-62.6	Tons...	2,075	6.2	4,891	18.0	-57.6
14 Corn cut for forage.....	2,001	8.1	( <sup>2</sup> )			Tons...	6,048	14.8	( <sup>2</sup> )		
15 Silage crops.....	2,045	11.7	( <sup>2</sup> )			Tons...	23,762	15.3	( <sup>2</sup> )		
16 Root crops for forage.....	628	8.5	( <sup>2</sup> )			Tons...	2,619	3.9	( <sup>2</sup> )		
<b>Vegetables:</b>											
17 Potatoes.....	8,186	14.8	9,178	15.9	-10.8	Bu.....	1,526,353	26.0	1,532,915	20.0	-0.4
<b>Fruits:</b>											
18 Grapes.....	* 118,892	25.4	( <sup>2</sup> )			Lbs.....	1,410,072	35.6	( <sup>2</sup> )		
19 Apples.....	* 4,633,119	53.2	( <sup>2</sup> )			Bu.....	15,823,446	70.4	( <sup>2</sup> )		
20 Peaches.....	* 455,526	70.2	( <sup>2</sup> )			Bu.....	1,259,176	81.5	( <sup>2</sup> )		
21 Pears.....	* 530,834	61.2	( <sup>2</sup> )			Bu.....	1,236,330	71.5	( <sup>2</sup> )		
22 Plums and prunes.....	* 75,084	8.6	( <sup>2</sup> )			Bu.....	127,042	16.2	( <sup>2</sup> )		
<b>Miscellaneous:</b>											
23 Sugar beets grown for sugar.....	4,635	85.4	240	19.4		Tons...	40,286	86.8	244	3.7	
24 Red clover seed.....	897	77.3	( <sup>2</sup> )			Bu.....	3,925	89.2	( <sup>2</sup> )		
25 Hops.....	507	44.9	( <sup>2</sup> )			Lbs.....	870,769	53.9	( <sup>2</sup> )		

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	25.9	19.3	36.7	141.7	191.1	\$876,877	54.0	\$65,965	16.8	
2 Oats.....	Bu.....	42.1	41.9	48.7	110.9	111.4	337,056	4.2	163,948	2.8	105.6
3 Winter wheat.....	Bu.....	21.1	21.1	18.7	85.3	85.3	324,201	0.6	173,221	0.5	
4 Spring wheat.....	Bu.....	13.0	12.6	25.9	199.2	205.6	2,013,215	5.4	30,474	0.9	852.8
5 Barley.....	Bu.....	28.6	26.1	33.6	126.3	128.7	290,352	8.6	( <sup>2</sup> )		
6 Rye.....	Bu.....	5.5	5.4	10.4	189.1	192.6	11,292	2.5	( <sup>2</sup> )		
<b>Hay and forage:</b>											
7 Timothy alone.....	Tons...	1.6	1.5	1.9	118.8	126.7	463,980	19.5	536,944	24.8	-18.6
8 Timothy and clover mixed.....	Tons...	2.1	2.1	2.1	100.0	100.0	444,430	5.9	325,758	9.0	36.4
9 Clover alone.....	Tons...	2.1	2.1	1.8	85.7	85.7	99,072	11.1	25,684	8.7	285.7
10 Alfalfa.....	Tons...	2.9	2.0	3.3	113.8	143.5	11,857,584	75.3	8,156,699	86.1	275.6
11 Other tame grasses.....	Tons...	1.7	1.6	2.1	143.5	131.2	735,378	38.1	22,325	3.7	
12 Small grains cut for hay.....	Tons...	1.1	1.1	1.3	118.2	118.2	418,385	2.8	123,354	2.0	239.2
13 Wild, salt, or prairie grasses.....	Tons...	1.1	1.1	2.0	181.8	181.8	39,425	6.3	65,124	21.9	-39.5
14 Corn cut for forage.....	Tons...	1.6	1.5	3.0	187.5	200.0	78,598	14.8	( <sup>2</sup> )		
15 Silage crops.....	Tons...	6.9	6.0	9.0	130.4	136.4	261,382	15.3	( <sup>2</sup> )		
16 Root crops for forage.....	Tons...	9.0	9.5	4.2	44.7	44.2	55,104	3.9	( <sup>2</sup> )		
<b>Vegetables:</b>											
17 Potatoes.....	Bu.....	106.4	92.5	186.5	175.2	201.7	3,205,341	26.0	505,887	16.9	533.6
<b>Fruits:</b>											
18 Grapes.....	Lbs.....	* 8.5	* 7.3	* 11.9	140.0	163.0	112,806	35.6	( <sup>2</sup> )		
19 Apples.....	Bu.....	* 2.8	* 1.7	* 3.4	121.4	170.0	18,697,378	48.9	( <sup>2</sup> )		
20 Peaches.....	Bu.....	* 2.4	* 1.5	* 2.8	116.7	186.7	2,707,228	81.6	( <sup>2</sup> )		
21 Pears.....	Bu.....	* 2.0	* 1.5	* 2.3	115.0	153.3	680,118	19.2	( <sup>2</sup> )		
22 Plums and prunes.....	Bu.....	* 0.9	* 0.8	* 1.7	183.9	212.5	247,732	16.2	( <sup>2</sup> )		
<b>Miscellaneous:</b>											
23 Sugar beets grown for sugar.....	Tons...	8.6	8.4	8.7	101.2	103.6	435,089	86.8	1,755	4.6	
24 Red clover seed.....	Bu.....	3.8	1.8	4.4	115.8	244.4	117,750	89.2	( <sup>2</sup> )		
25 Hops.....	Lbs.....	1,431.1	1,197.7	1,717.5	120.0	143.4	391,846	53.9	( <sup>2</sup> )		

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Not reported separately in 1909.

\* Number of vines of bearing age. \* Yield per vine.  
 \* Number of trees of bearing age. \* Yield per tree.

IRRIGATION—WASHINGTON.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.]

	THE STATE.	Adams.	Asotin.	Benton.	Chelan.	Clallam.	Colum- bia.	
1	Number of all farms in 1920.....	66,288	1,084	578	1,519	2,005	607	622
2	Number of farms irrigated in 1919.....	13,271	8	279	1,294	1,704	125	93
3	Per cent of all farms.....	20.0	0.7	48.3	85.2	81.3	20.6	15.0
4	Number of farms irrigated in 1909.....	7,664	20	238	768	1,189	77	56
5	Per cent of increase, 1909-1919.....	73.2	.....	17.2	68.5	43.3	.....	.....
<b>LAND AND FARM AREA.</b>								
6	Approximate land area.....acres..	42,775,040	1,223,680	387,840	1,069,440	1,856,000	1,104,640	549,120
7	All land in farms.....acres..	13,244,720	938,395	259,233	371,811	235,621	55,043	326,330
8	Improved land in farms.....acres..	7,129,343	727,876	96,404	201,678	65,810	20,132	192,613
9	Area irrigated in 1919.....acres..	529,899	943	3,474	39,272	38,894	6,160	2,168
10	Per cent of improved land in farms.....	7.4	0.1	3.6	19.5	59.1	30.6	1.1
11	Area irrigated in 1909.....acres..	334,378	1,523	3,179	23,437	23,620	4,265	2,174
12	Per cent of increase, 1909-1919.....	58.5	-38.1	9.3	67.6	64.7	44.4	-0.3
13	Area enterprises were capable of irrigating in 1920.....acres..	637,151	1,342	4,559	48,851	50,502	6,880	3,063
14	Area included in enterprises in 1910.....acres..	470,514	1,655	5,373	50,653	27,979	4,405	2,797
15	Per cent of increase, 1910-1920.....	35.4	-18.9	-15.1	-3.6	30.5	123.8	9.5
16	Area included in enterprises in 1920.....acres..	836,795	1,737	4,684	72,015	65,324	12,660	3,532
17	Area included in enterprises in 1910.....acres..	817,032	5,123	9,844	87,384	53,497	9,975	3,922
18	Per cent of increase, 1910-1920.....	2.4	-66.1	-52.4	-17.6	22.1	26.9	-9.9
19	Area of irrigated land reported as available for settlement.....acres..	61,738	.....	.....	15,756	3,750	2,500	.....
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20	Number, 1920.....	2,692	26	21	146	379	7	52
21	Number, 1910.....	1,934	19	22	74	260	7	42
Main ditches:								
22	Number, 1920.....	1,873	27	17	30	207	7	43
23	Number, 1910.....	1,600	12	18	50	227	7	43
24	Length, 1920.....miles..	3,851	19	16	151	394	36	36
25	Length, 1910.....miles..	2,594	24	40	130	357	17	36
26	Capacity, 1920.....second-feet..	16,242	203	39	932	1,100	570	697
27	Capacity, 1910.....second-feet..	13,178	185	76	1,099	1,219	281	211
Laterals:								
28	Number, 1920.....	3,179	27	1	111	99	75	44
29	Number, 1910.....	1,180	8	10	70	132	19	30
30	Length, 1920.....miles..	1,764	8	.....	185	30	32	15
31	Length, 1910.....miles..	1,298	7	64	119	122	19	4
Reservoirs:								
32	Number, 1920.....	205	4	1	.....	36	.....	1
33	Number, 1910.....	156	1	3	2	.....	.....	.....
34	Capacity, 1920.....acre-feet..	477,789	4	100	.....	11,451	.....	1
35	Capacity, 1910.....acre-feet..	121,543	10,000	1,160	.....	12,748	.....	.....
Flowing wells:								
36	Number, 1920.....	60	6	.....	7	1	.....	.....
37	Number, 1910.....	55	.....	.....	4	.....	.....	.....
38	Capacity, 1920.....gallons per minute..	14,925	160	.....	6,200	10	.....	.....
39	Capacity, 1910.....gallons per minute..	18,926	.....	.....	1,290	.....	.....	.....
Pumped wells:								
40	Number, 1920.....	520	7	.....	101	13	.....	4
41	Number, 1910.....	128	5	.....	31	8	.....	1
42	Capacity, 1920.....gallons per minute..	227,744	5,160	.....	38,807	1,775	.....	130
43	Capacity, 1910.....gallons per minute..	60,220	1,873	.....	10,158	564	.....	1,500
Pumping plants:								
44	Number, 1920.....	975	12	1	144	138	.....	7
45	Number, 1910.....	391	8	1	84	54	.....	3
46	Engine capacity, 1920.....horsepower..	22,929	143	5	4,555	1,415	.....	23
47	Engine capacity, 1910.....horsepower..	13,847	133	2	5,894	2,624	.....	58
48	Pump capacity, 1920.....gallons per minute..	636,552	10,042	200	163,628	45,853	.....	355
49	Pump capacity, 1910.....gallons per minute..	365,411	3,223	42	147,059	14,777	.....	1,620
50	Average lift, 1920.....feet..	60	28	8	37	88	.....	18
<b>CAPITAL INVESTED.</b>								
51	Capital invested to Jan. 1, 1920.....dollars..	29,299,011	77,350	627,165	2,387,113	3,503,670	94,010	61,447
52	Capital invested to July 1, 1910.....dollars..	16,219,149	171,946	1,662,958	3,211,493	889,152	18,900	16,027
53	Per cent of increase, 1910-1920.....	80.6	-55.0	-62.3	-25.7	294.0	397.4	283.4
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	45.98	57.64	137.57	48.88	69.38	9.53	20.06
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	34.47	103.89	309.50	63.40	31.78	4.29	5.73
<b>ESTIMATED FINAL COST.</b>								
56	Estimated final cost of existing enterprises in 1920.....dollars..	37,684,591	87,750	627,165	3,040,470	4,080,090	97,010	64,947
57	Estimated final cost of existing enterprises in 1910.....dollars..	22,322,856	171,946	1,662,958	3,565,377	1,340,835	18,900	16,027
58	Per cent of increase, 1910-1920.....	68.8	-49.0	-62.3	-14.7	204.3	413.3	306.2
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	45.03	50.52	133.90	42.22	62.46	7.66	13.39
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	27.32	33.56	168.93	40.81	25.06	1.89	4.09

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**COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.**

[A minus sign (-) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

		Douglas.	Ferry.	Franklin.	Garfield.	Grant.	Kittitas.	Klickitat.	Lincoln.
1	Number of all farms in 1920.....	1,629	730	414	413	1,110	928	1,177	1,860
2	Number of farms irrigated in 1919.....	314	61	78	28	185	787	164	83
3	Per cent of all farms.....	19.3	8.4	18.8	6.0	16.7	79.4	13.9	4.5
4	Number of farms irrigated in 1909.....	146	20	21	54	49	639	169	77
5	Per cent of increase, 1909-1919.....	115.1					15.8	-3.0	
<b>LAND AND FARM AREA.</b>									
6	Approximate land area..... acres..	1,143,689	1,420,800	771,840	444,160	1,740,800	1,490,560	1,168,000	1,473,280
7	All land in farms..... acres..	892,223	1,62,888	456,056	314,182	743,618	215,918	562,331	1,329,405
8	Improved land in farms..... acres..	567,685	36,618	255,636	169,252	418,758	95,984	190,616	832,678
9	Area irrigated in 1919..... acres..	4,822	791	2,253	883	7,545	81,967	18,978	2,221
10	Per cent of improved land in farms.....	0.8	2.2	0.9	0.6	1.8	85.4	10.0	0.3
11	Area irrigated in 1909..... acres..	3,317	397	830	1,316	8,230	68,992	4,681	2,217
12	Per cent of increase, 1909-1919.....	45.4	99.3	171.4	-52.9	133.6	19.0	305.4	6.2
13	Area enterprises were capable of irrigating in 1920..... acres..	4,938	2,253	10,014	1,552	9,302	83,552	21,360	2,838
14	Area enterprises were capable of irrigating in 1910..... acres..	8,365	4,258	1,276	1,728	8,501	72,348	7,461	2,404
15	Per cent of increase, 1910-1920.....	-41.0	-47.1	684.8	-10.2	9.4	15.6	186.3	18.1
16	Area included in enterprises in 1920..... acres..	3,755	7,421	14,268	1,698	12,806	87,775	32,315	3,291
17	Area included in enterprises in 1910..... acres..	12,626	5,271	2,113	2,283	14,456	92,940	18,590	2,935
18	Per cent of increase, 1910-1920.....	-31.7	40.8	575.2	-25.6	-11.4	-5.6	73.8	12.1
19	Area of irrigated land reported as available for settlement..... acres..	1,603		10,500				500	
<b>IRRIGATION WORKS.</b>									
Independent enterprises:									
20	Number, 1920.....	86	45	48	36	172	223	93	54
21	Number, 1910.....	45	20	21	47	43	257	115	48
Main ditches:									
22	Number, 1920.....	14	39	4	26	79	212	67	37
23	Number, 1910.....	33	20	8	42	22	206	87	41
24	Length, 1920..... miles..	15	31	8	17	37	389	173	24
25	Length, 1910..... miles..	31	24	7	41	41	387	108	31
26	Capacity, 1920..... second-feet..	48	119	121	97	113	1,788	842	63
27	Capacity, 1910..... second-feet..	49	129	44	120	87	1,530	596	92
Laterals:									
28	Number, 1920.....	20	6	25	2	29	25	38	62
29	Number, 1910.....	26	4		5	22	143	65	24
30	Length, 1920..... miles..	11	1	2	1	8	41	19	7
31	Length, 1910..... miles..	8	1		1	17	56	23	3
Reservoirs:									
32	Number, 1920.....	8	2	2	1	18	7	18	1
33	Number, 1910.....	4	1		2	10	3	11	3
34	Capacity, 1920..... acre-feet..		151	2		4,519	384,310	415	
35	Capacity, 1910..... acre-feet..	39	700		1	84	35,000	12	
Flowing wells:									
36	Number, 1920.....	2	1						
37	Number, 1910.....	2				2		1	
38	Capacity, 1920..... gallons per minute..	190	1,000						
39	Capacity, 1910..... gallons per minute..	25				7		14	
Pumped wells:									
40	Number, 1920.....	22	3	31	1	132	1	2	9
41	Number, 1910.....	1	1	5		14		12	5
42	Capacity, 1920..... gallons per minute..	6,865	1,000	13,080	250	39,779	200	24	3,785
43	Capacity, 1910..... gallons per minute..	850	13	1,845		2,606		278	450
Pumping plants:									
44	Number, 1920.....	55	8	50	7	164	9	12	20
45	Number, 1910.....	18	2	22	5	26	3	19	8
46	Engine capacity, 1920..... horsepower..	1,452	9	1,100	242	3,084	193	104	361
47	Engine capacity, 1910..... horsepower..	406	12	298	90	417	207	45	184
48	Pump capacity, 1920..... gallons per minute..	38,760	153	36,478	7,750	76,924	12,575	6,100	11,805
49	Pump capacity, 1910..... gallons per minute..	12,713	278	12,335	2,660	28,785	11,700	919	3,170
50	Average lift, 1920..... feet..	95	12	48	76	79	24	45	63
<b>CAPITAL INVESTED.</b>									
51	Capital invested to Jan. 1, 1920..... dollars..	382,390	66,050	362,390	32,700	1,192,739	4,678,707	198,501	87,431
52	Capital invested to July 1, 1910..... dollars..	488,941	37,406	26,561	23,503	166,510	681,168	73,434	28,434
53	Per cent of increase, 1910-1920.....	-21.8	76.6	891.2	39.1	616.8	586.9	170.3	207.5
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	77.44	29.32	35.19	21.07	128.22	56.00	9.29	30.81
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	58.45	8.78	28.65	13.60	19.59	9.42	9.84	11.83
<b>ESTIMATED FINAL COST.</b>									
56	Estimated final cost of existing enterprises in 1920..... dollars..	402,008	66,950	637,390	36,000	1,301,729	5,908,707	206,851	88,431
57	Estimated final cost of existing enterprises in 1910..... dollars..	483,941	37,406	36,561	23,503	191,510	681,168	89,434	28,434
58	Per cent of increase, 1910-1920.....	-17.8	79.0		53.2	579.7	767.4	131.3	211.0
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	45.91	9.02	44.67	21.20	101.65	67.32	6.40	26.67
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	38.12	7.10	17.30	10.29	13.25	7.33	4.81	9.69

## IRRIGATION—WASHINGTON.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (—) denotes decrease. Per cent not shown when base is less than 100 or when per cent is more than 1,000.]

	Okanogan.	Spokane.	Stevens. <sup>1</sup>	Walla Walla.	Whitman.	Yakima.	Other counties. <sup>2</sup>
1 Number of all farms in 1920.....	2,856	4,830	2,727	1,502	2,957	5,755	30,901
2 Number of farms irrigated in 1919.....	1,103	775	18	654	14	5,354	203
3 Per cent of all farms.....	38.6	16.0	0.7	43.5	0.5	93.0	0.6
4 Number of farms irrigated in 1909.....	397	287	126	273	46	2,951	61
5 Per cent of increase, 1909-1919.....	177.8	170.0	.....	139.6	.....	81.4	.....
<b>LAND AND FARM AREA.</b>							
6 Approximate land area.....acres..	3,341,440	1,123,840	1,603,200	809,600	1,349,120	3,237,760	15,466,240
7 All land in farms.....acres..	689,796	811,206	472,490	703,251	1,252,485	479,629	1,969,909
8 Improved land in farms.....acres..	212,497	449,537	139,391	474,161	1,033,670	261,866	701,922
9 Area irrigated in 1919.....acres..	35,899	16,154	8,990	23,575	2,099	230,033	2,778
10 Per cent of improved land in farms.....	16.9	3.6	6.4	3.0	0.2	87.8	.....
11 Area irrigated in 1909.....acres..	15,238	12,143	3,510	10,008	1,377	148,630	394
12 Per cent of increase, 1909-1919.....	135.6	33.0	.....	135.6	52.4	54.8	.....
13 Area enterprises were capable of irrigating in 1920.....acres..	52,315	20,995	18,238	39,040	2,536	242,726	7,315
14 Area enterprises were capable of irrigating in 1910.....acres..	31,670	17,140	13,235	20,954	1,705	186,050	557
15 Per cent of increase, 1910-1920.....	65.2	22.5	.....	86.3	48.7	30.5	.....
16 Area included in enterprises in 1920.....acres..	71,760	39,458	28,605	45,303	4,138	309,235	10,014
17 Area included in enterprises in 1910.....acres..	53,012	52,330	15,510	39,622	3,057	331,455	887
18 Per cent of increase, 1910-1920.....	35.4	-24.6	.....	14.3	35.4	-6.7	.....
19 Area of irrigated land reported as available for settlement.....acres..	7,995	3,638	575	9,587	.....	3,334	2,000
<b>IRRIGATION WORKS.</b>							
Independent enterprises:							
20 Number, 1920.....	383	107	199	280	29	252	54
21 Number, 1910.....	255	55	91	136	36	280	61
Main ditches:							
22 Number, 1920.....	306	49	179	237	20	238	35
23 Number, 1910.....	238	50	91	100	36	242	26
24 Length, 1920.....miles..	421	94	240	1,069	27	624	30
25 Length, 1910.....miles..	321	124	133	140	30	564	8
26 Capacity, 1920.....second-feet..	1,851	782	477	959	48	5,152	191
27 Capacity, 1910.....second-feet..	1,845	625	374	913	68	3,615	14
Laterals:							
28 Number, 1920.....	149	84	181	1,813	19	360	19
29 Number, 1910.....	171	44	78	68	14	247	.....
30 Length, 1920.....miles..	186	136	29	79	4	956	20
31 Length, 1910.....miles..	96	93	10	105	4	546	.....
Reservoirs:							
32 Number, 1920.....	49	32	7	5	.....	3	10
33 Number, 1910.....	38	18	3	10	2	2	7
34 Capacity, 1920.....acre-feet..	30,789	5,663	800	.....	.....	39,000	54
35 Capacity, 1910.....acre-feet..	25,727	1,536	20	4	11	34,500	1
Flowing wells:							
36 Number, 1920.....	1	.....	.....	33	5	3	1
37 Number, 1910.....	.....	5	.....	13	.....	27	1
38 Capacity, 1920.....gallons per minute..	.....	.....	.....	6,080	1,000	285	.....
39 Capacity, 1910.....gallons per minute..	.....	1	.....	12,502	.....	5,069	18
Pumped wells:							
40 Number, 1920.....	52	49	2	45	.....	43	3
41 Number, 1910.....	2	30	.....	1	.....	9	3
42 Capacity, 1920.....gallons per minute..	18,613	58,646	45	36,240	.....	8,225	120
43 Capacity, 1910.....gallons per minute..	188	33,929	.....	4,500	.....	1,382	84
Pumping plants:							
44 Number, 1920.....	131	75	9	65	11	51	11
45 Number, 1910.....	25	32	2	36	6	18	19
46 Engine capacity, 1920.....horsepower..	1,885	3,316	41	2,775	340	1,735	151
47 Engine capacity, 1910.....horsepower..	299	1,633	23	1,152	63	270	37
48 Pump capacity, 1920.....gallons per minute..	54,461	79,688	9,156	25,885	8,434	47,002	1,303
49 Pump capacity, 1910.....gallons per minute..	9,983	42,646	275	62,987	2,179	11,812	1,248
50 Average lift, 1920.....feet..	43	83	48	24	66	38	.....
<b>CAPITAL INVESTED.</b>							
51 Capital invested to Jan. 1, 1920.....dollars..	2,874,338	1,668,838	641,580	990,667	225,933	8,897,058	248,934
52 Capital invested to July 1, 1910.....dollars..	1,119,447	946,307	244,466	1,166,120	53,720	5,169,024	23,632
53 Per cent of increase, 1910-1920.....	156.8	76.4	.....	-15.0	320.6	72.4	.....
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	54.94	79.49	35.18	25.38	89.09	36.65	34.03
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	35.35	55.21	18.47	55.65	31.51	27.73	42.48
<b>ESTIMATED FINAL COST.</b>							
56 Estimated final cost of existing enterprises in 1920.....dollars..	4,797,308	2,699,388	1,002,330	1,340,767	237,533	10,670,024	291,734
57 Estimated final cost of existing enterprises in 1910.....dollars..	1,229,118	946,307	244,466	1,393,370	53,720	10,078,743	23,632
58 Per cent of increase, 1910-1920.....	290.3	185.2	.....	-3.8	342.2	5.9	.....
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	68.85	68.41	35.04	29.60	57.40	34.50	29.13
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	23.19	18.08	15.76	35.17	17.57	30.41	26.64

<sup>1</sup> Part taken to form Pend Oreille County in 1911.<sup>2</sup> Includes Clarke, Jefferson, King, Kitsap, Lewis, Pend Oreille, Pierce, Skagit, Skamania, Thurston, and Whatcom Counties. No irrigation is reported for the other counties of the state.

# WYOMING.

## INTRODUCTION.

The following pages present the statistics of irrigation for the state of Wyoming collected at the census of 1920. Statistics of acreage irrigated, of acreage, yield, and value of crops grown on irrigated land, and of cost of operation and maintenance relate to the year 1919; other items relate to the year 1920. Throughout the report figures for the census of 1910 are given for purposes of comparison; and, for the purpose of

showing the historical development of irrigation, items which have been reported in censuses previous to 1910 are presented.

Statistics of number of farms irrigated and of acreage, yield, and value of crops grown on irrigated land were collected in the general census of agriculture. All other statistics were obtained in a special canvass of irrigation enterprises.

TABLE 1.—SUMMARY FOR THE STATE: 1920 AND 1910.

ITEM.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Amount.	Per cent.
Number of all farms.....	15,748	10,987	4,761	43.3
Approximate land area of the state..... acres..	62,430,720	62,460,160	<sup>2</sup> -29,440	( <sup>3</sup> )
All land in farms..... acres..	11,809,351	8,543,010	3,266,341	38.2
Improved land in farms..... acres..	2,102,005	1,256,160	845,845	67.3
Number of farms irrigated.....	6,449	6,297	152	2.4
Area irrigated..... acres..	1,207,982	1,133,302	74,680	6.6
Area enterprises were capable of irrigating..... acres..	1,831,039	1,639,510	191,529	11.7
Area included in enterprises..... acres..	2,564,668	2,224,298	340,370	15.3
Per cent irrigated:				
Number of all farms.....	41.0	57.3	-16.3	.....
Approximate land area of the state.....	1.9	1.8	0.1	.....
Land in farms.....	10.2	13.3	-3.1	.....
Improved land in farms.....	57.5	90.2	-32.7	.....
Excess of area enterprises were capable of irrigating over area irrigated..... acres..	623,057	506,208	116,849	23.1
Excess of area included in enterprises over area irrigated..... acres..	1,356,686	1,090,996	265,690	24.4
Area of irrigated land reported as available for settlement..... acres..	197,326	( <sup>4</sup> )		
Capital invested.....	\$34,326,328	\$17,700,980	\$16,625,348	93.9
Average per acre enterprises were capable of irrigating.....	\$18.75	\$10.80	\$7.95	73.6
Estimated final cost of existing enterprises.....	\$51,500,288	\$20,425,890	\$31,074,398	152.1
Average per acre included in enterprises.....	\$20.08	\$9.18	\$10.90	118.7
Average cost of operation and maintenance per acre.....	\$1.04	\$0.86	\$0.18	20.9
<b>IRRIGATION WORKS.</b>				
Number of enterprises.....	3,564	5,577	-2,013	-36.1
Number of main ditches.....	5,007	5,593	-586	-10.5
Length of main ditches..... miles..	9,517	10,933	-1,416	-13.0
Capacity of main ditches..... second-feet..	39,009	42,630	-3,621	-8.5
Number of lateral ditches.....	2,777	2,340	437	18.7
Length of lateral ditches..... miles..	2,534	2,298	236	10.3
Number of reservoirs.....	374	414	-40	-9.7
Capacity of reservoirs..... acre-feet..	2,911,748	2,550,937	360,811	14.1
Number of flowing wells.....	7	2	5	.....
Capacity of flowing wells..... gallons per minute..	46	250	-204	-81.6
Number of pumped wells.....	16	3	13	.....
Capacity of pumped wells..... gallons per minute..	8,020	835	7,185	860.5
Number of pumping plants.....	57	34	23	.....
Engine capacity..... horsepower..	1,304	705	599	85.0
Pump capacity..... gallons per minute..	39,725	142,529	-102,804	-72.1
Average lift..... feet..	31	( <sup>4</sup> )	31	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.  
<sup>2</sup> Decrease due to building of Pathfinder and Shoshone Reservoirs.

<sup>3</sup> Less than one-tenth of 1 per cent decrease.  
<sup>4</sup> Not reported in 1910.



**CLIMATIC CONDITIONS.**

The surface of Wyoming consists of high, rolling prairies broken by mountain ranges. The main ranges of the Rocky Mountains pass through the state forming the Continental Divide, while many broken ranges occur, cutting the state into many more or less isolated valleys. The broken topography produces a variety in climatic conditions.

Except for small areas in the high mountains, no part of the state receives more than 20 inches of precipitation in normal years. Along the eastern border of the state the normal annual precipitation is from 15 to 20 inches and crops are grown without irrigation. Immediately west of this, and occupying nearly one-half the area of the state, is a wide zone in which the normal precipitation is from 10 to 15 inches. In this section there is little agriculture except in the stream valleys where irrigation is practiced. The grazing of cattle and sheep on the natural grasses forms the principal industry.

In the southwest part of the state is a large section—the Red Desert—where the precipitation is less than 10 inches and the same condition prevails in the Big Horn Basin in the northern part of the state.

In the valleys of the extreme western part of the state the normal annual precipitation varies from about 10 inches in the Green River Valley to about 18 inches in Jackson's Hole, near Yellowstone Park.

The year 1919 was the driest on record, except 1902. During the first eight months of the year, which includes the growing season for crops, the precipitation was only about one-half the normal. In many places dry-farm crops were a total failure, and in many sections irrigated crops suffered because of shortage of water.

**WATER SUPPLY FOR IRRIGATION.**

Since Wyoming lies along the Continental Divide, the rivers rising in its mountains flow into adjoining states on all four sides. Crossing the eastern border to South Dakota and Nebraska are Belle Fourche, Cheyenne, and North Platte Rivers, and Lodgepole Creek. Flowing to the south are only small streams except Green River; while from the south the state receives the North Platte and the Laramie. Bear River and Snake River flow to the west into Idaho; and to the north into Montana flow Yellowstone, Clark Fork of the Yellowstone, Big Horn, Tongue, Powder, and Little Missouri Rivers and many smaller streams.

The streams flowing to the east, except the North Platte, do not carry large volumes of water except in flood periods, and they flow through a country where crops can be grown with some success without irrigation. Storage is necessary if these streams are to be used extensively for irrigation.

The North Platte rises in north central Colorado, flows in a northerly direction about half way across

Wyoming, turns abruptly to the east, and flows in a southeasterly direction to the Wyoming-Nebraska line. Throughout most of its course in Wyoming the North Platte flows through a rough mountainous country where there is little opportunity to use its water for irrigation. Its principal tributaries in Wyoming are the Medicine Bow, coming from the east; the Sweetwater, coming from the west, and the Laramie, coming from the south. Just below the mouth of the Sweetwater the United States Reclamation Service has built the Pathfinder Reservoir, having a capacity of about 1,000,000 acre-feet, which is about two-thirds of the average total annual discharge of the river at that point. Since a large part of the annual discharge is used as it comes, this reservoir has sufficient capacity to control the flow of the stream except in years of abnormal flood discharge. Water is diverted from both sides of the North Platte about 30 miles west of the Wyoming-Nebraska line, for use on lands in both states. The canal on the south side is under construction, and much additional land will be irrigated from the North Platte in that section. Stored water from Pathfinder Reservoir is supplied to a large area under private canals, mainly in Nebraska.

Laramie River, a tributary of the North Platte, like the main stream, rises in the mountains of northern Colorado and flows into Wyoming. Some of its waters are diverted from its drainage basin into the tributaries of the South Platte in Colorado, and there are large projects on the stream in Wyoming. Litigation between the parties taking water from the stream in Colorado and in Wyoming is pending in the United States Supreme Court.

Very little land is irrigated from the streams along the southern border of the state. The country is largely rough and undeveloped, and far from transportation. Green River rises in high mountains that receive a very heavy snowfall, and carries a large volume of unused water, but the valleys through which it flows are undeveloped and lack transportation facilities. Green River is one of the principal tributaries of Colorado River, and possible storage and use of its water is being studied in connection with the whole Colorado River System.

Bear River, which rises in Utah, flows into Wyoming and crosses and recrosses into Utah and Idaho, and finally discharges into Great Salt Lake, flows principally through high mountain valleys in Wyoming. It is not susceptible of much larger use in Wyoming.

Snake River rises in the southern part of Yellowstone National Park, and some of its headwater tributaries rise in very close proximity to those of Green River. There is not much opportunity to use this river in Wyoming as its course is through high mountain valleys. Jackson Lake lies along the course of Snake River, and is used as a reservoir to store flood water for use along the course of the river in Idaho.

Yellowstone River rises in the mountains to the southeast of Yellowstone National Park, flows into Yellowstone Lake within the park, and thence into Montana. There is practically no opportunity to use this stream for irrigation in Wyoming.

Big Horn River and its tributaries drain the whole north central part of Wyoming. Their headwaters rise in the mountains southeast of Yellowstone National Park, near those of Green, Snake, and Yellowstone Rivers. The larger of the tributaries are Wind, Greybull, and Shoshone Rivers. All of these streams are used for irrigation, but only on the Shoshone has provision been made for storing the flood waters on a large scale. On that stream the United States Reclamation Service has built the Shoshone Reservoir, which has a capacity of 456,600 acre-feet. This is less than one-half of the average annual run-off of the river at this point, and there is opportunity for additional storage.

The other streams flowing north into Montana flow through the high plains, where there is little irrigation and where some crops can be grown in most years without irrigation.

The supply of water in streams has met the demands for irrigation so far and there has been little attempt to develop ground water.

**FARMS AND ACREAGE IRRIGATED.**

**TABLE 2.—NUMBER OF FARMS AND ACREAGE IRRIGATED: 1890 TO 1920.**

CENSUS YEAR.	FARMS IRRIGATED.			AREA IRRIGATED.				
	Number.	Per cent of increase.	Per cent of all farms.	Acres.	Per cent of increase.	Per cent of total land area.	Per cent of land in farms.	Per cent of improved land in farms.
1920.....	6,449	2.4	41.0	1,207,982	6.6	1.9	10.2	57.5
1910.....	6,297	69.2	57.3	1,133,302	87.1	1.8	13.3	90.2
1900.....	3,721	94.1	61.1	605,878	163.8	1.0	7.5	76.5
1890.....	1,917	.....	61.3	229,676	.....	0.4	12.5	48.2

**TABLE 3.—ACREAGE, CLASSIFIED BY DATE OF BEGINNING OF ENTERPRISES SUPPLYING WATER FOR IRRIGATION.**

DATE OF BEGINNING.	Number of enterprises.	Area included in enterprises, 1920 (acres).	AREA IRRIGATED IN 1919.		Area enterprises were capable of irrigating in 1920 (acres).
			Acres.	Per cent of acreage in enterprises.	
Total.....	3,564	2,564,668	1,207,982	47.1	1,831,039
Before 1860.....	2	640	320	50.0	320
1860-1869.....	14	10,005	9,288	92.8	9,880
1870-1879.....	152	141,117	77,228	54.7	104,503
1880-1889.....	931	702,056	406,196	57.9	518,857
1890-1899.....	613	365,655	239,300	60.5	337,220
1900-1904.....	806	330,746	163,643	49.4	208,831
1905-1909.....	442	519,421	169,976	32.7	327,299
1910-1914.....	368	140,116	55,288	39.5	97,482
1915-1919.....	252	219,585	18,642	8.6	53,627
Not reported.....	226	108,327	68,201	63.0	83,020

**TABLE 4.—ACREAGE, CLASSIFIED BY SOURCE OF WATER SUPPLY: 1919 AND 1909.**

CLASS.	AREA IRRIGATED (ACRES).				Area enterprises were capable of irrigating in 1920 (acres).	Area included in enterprises, 1920 (acres).
	1919	1909	Increase. <sup>1</sup>			
			Amount.	Per cent.		
Total.....	1,207,982	1,133,302	74,680	6.6	1,831,039	2,564,668
Streams, gravity.....	1,155,598	1,112,234	43,362	3.9	1,707,269	2,417,882
Streams, pumped.....	1,525	1,540	-15	-1.0	3,448	4,700
Wells, pumped.....	147	75	72	.....	148	148
Wells, flowing.....	19	64	-45	.....	40	65
Lakes, gravity.....	355	120	235	195.8	381	545
Springs.....	5,985	5,003	977	19.5	10,268	12,627
Stored storm water.....	10,852	14,261	-3,409	-23.9	46,728	51,822
Streams, gravity, and pumped wells.....	400	( <sup>2</sup> )	400	.....	634	854
Other mixed.....	33,043	( <sup>2</sup> )	33,043	.....	62,063	76,066
Other and not reported.....	60	( <sup>2</sup> )	60	.....	60	60

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when base is less than 100.  
<sup>2</sup> Not included in classification in 1910.

**ACREAGE, BY CHARACTER OF ENTERPRISE.**

Wyoming accepted the conditions of the Federal Carey Act (act of Congress, Aug. 18, 1894), in 1895. The original act granted to each of the states containing arid land 1,000,000 acres, and an amendment granted to Wyoming an additional area of 1,000,000 acres.

**TABLE 5.—ACREAGE, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920 AND 1910.**

ITEM AND CLASS.	CENSUS OF—		INCREASE. <sup>1</sup>	
	1920	1910	Acres.	Per cent.
<b>ACREAGE IRRIGATED.</b>				
Total.....	1,207,982	1,133,302	74,680	6.6
Individual and partnership.....	724,620	613,823	-89,203	-11.0
Cooperative.....	286,702	116,317	170,385	146.5
Irrigation district.....	22,935	11,800	11,135	94.4
Carey Act.....	36,230	86,252	-50,022	-58.0
Commercial.....	57,300	87,935	-30,135	-34.3
U. S. Reclamation Service.....	53,555	12,905	40,650	315.0
U. S. Indian Service.....	22,000	4,270	17,730	415.2
State.....	2,120	( <sup>2</sup> )	2,120	.....
City.....	2,020	( <sup>2</sup> )	2,020	.....
<b>ACREAGE ENTERPRISES WERE CAPABLE OF IRRIGATING.</b>				
Total.....	1,831,039	1,639,510	191,529	11.7
Individual and partnership.....	1,008,379	1,024,137	-15,758	-1.5
Cooperative.....	432,958	165,478	267,480	161.6
Irrigation district.....	54,017	27,050	26,967	99.7
Carey Act.....	72,215	205,974	-133,759	-64.9
Commercial.....	121,310	133,305	-11,995	-9.0
U. S. Reclamation Service.....	98,022	34,869	63,153	166.8
U. S. Indian Service.....	45,000	48,699	-3,699	-7.6
State.....	2,120	( <sup>2</sup> )	2,120	.....
City.....	2,020	( <sup>2</sup> )	2,020	.....
<b>ACREAGE INCLUDED IN ENTERPRISES.</b>				
Total.....	2,564,668	2,234,298	340,370	15.3
Individual and partnership.....	1,339,116	1,153,378	185,738	16.1
Cooperative.....	532,206	189,894	342,312	180.5
Irrigation district.....	55,617	27,050	28,567	109.3
Carey Act.....	98,190	426,472	-328,282	-77.0
Commercial.....	146,478	193,967	-49,489	-25.3
U. S. Reclamation Service.....	299,799	167,530	131,909	78.6
U. S. Indian Service.....	87,940	63,657	24,283	38.1
State.....	2,155	( <sup>2</sup> )	2,155	.....
City.....	2,177	( <sup>2</sup> )	2,177	.....

<sup>1</sup> A minus sign (-) denotes decrease.  
<sup>2</sup> Not included in classification in 1910.



An irrigation district law was enacted in 1907. This law has been utilized both for the financing of new enterprises and for buying in enterprises originally organized in some other form.

The areas reported under United States Reclamation Service in Table 5 include land watered by a Carey Act enterprise supplied under contract.

**ACREAGE, BY CHARACTER OF WATER RIGHTS.**

The laws of Wyoming relating to water rights are summarized in the following paragraphs:

Wyoming was organized as a territory in 1868 and the first territorial legislature adopted the common law of England so far as it was "not inapplicable." The supreme court of the state has held that this enactment did not establish in Wyoming the common law of riparian rights, since it is "unsuited to our requirements and necessities" (Moyer v. Preston, 6 Wyo. 308).

In 1875 the territory enacted a law providing that persons holding land along any stream were entitled to use the water for irrigation and to the right of way for canals over the land of others.

In 1886 there was enacted a law to regulate the use of water for irrigation and other purposes. It divided the territory into districts, gave the district courts jurisdiction over water rights, required all parties claiming rights to water to file statements of their claims with the clerks of the proper courts, required all parties wishing to acquire rights to file statements before beginning construction of works, and provided that whenever any party interested in any ditch, canal, or reservoir desired a determination of the priority of rights to water from the source from which water was obtained, he might apply to the proper district court for an adjudication.

The law of 1886 declared "The water of every natural stream not heretofore appropriated within this territory is hereby declared to be the property of the public, and the same is dedicated to the use of the people, subject to appropriation as herein provided."

Wyoming was admitted to the Union as a state in 1890, and the constitution of the state contained the following general declarations regarding water:

"The water of all natural streams, springs, lakes, or other collections of still water within the boundaries of the state are hereby declared to be the property of the state." (Art. 8, sec. 1.)

"Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests." (Art. 8, sec. 3.)

The constitution provided also for the office of state engineer, and a board of control of which the engineer is president, to which was assigned "supervision of the waters of the state and of their appropriation, distribution, and diversion."

The first state legislature enacted the laws necessary to the carrying out of the constitutional provisions referred to, and the system adopted at that time is still in effect.

Persons wishing to acquire rights are required to make application to the state engineer for permits and are to submit proof of the completion of irrigation works in accordance with the permits, and the board of control is to issue certificates defining the rights acquired.

Rights previously acquired are adjudicated by the board of control, and certificates defining rights in accordance with the decisions of the board are issued.

Many suits attacking the law of 1890 have been decided by the state supreme court, and the law has been upheld by the court.

**TABLE 6.—ACREAGE IRRIGATED, CLASSIFIED BY CHARACTER OF RIGHTS UNDER WHICH WATER IS RECEIVED: 1919 AND 1909.**

CLASS.	1919		1909, per cent of total.
	Acres.	Per cent of total.	
Total.....	1,207,932	100.0	100.0
Appropriation and use.....	25,662	2.1	8.7
Notice filed and posted.....	60,792	5.0	0.5
Adjudicated by court.....	152,186	13.4	4.3
Permit from state.....	466,026	38.6	28.3
Certificate or license from state.....	457,038	37.8	57.9
Underground.....	276	( <sup>1</sup> )	( <sup>2</sup> )
Other and mixed.....	657	0.1	( <sup>2</sup> )
Not reported.....	35,345	2.9	( <sup>2</sup> )

<sup>1</sup> Less than one-tenth of 1 per cent.  
<sup>2</sup> All land for which the class of water rights was not reported was included in "Appropriation and use."

**ACREAGE, BY DRAINAGE BASIN.**

The report of a special census taken in 1902 presented all data by drainage basins rather than by counties. The results of the census of 1920 have been tabulated on the same basis, and the data for 1902 are presented for purposes of comparison. For no other census have the results been tabulated in this form. The acreage reported for each drainage basin in 1919 comprises all the irrigated land in that drainage basin, including that watered from springs and wells. In the 1902 results the acreages irrigated from springs and wells were not reported for the smaller tributary streams, but the acreages for the tributaries were included in those reported for the main streams.

**TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902.**

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Total.....	1,207,932	773,111	58.2	2,564,668	1,831,039
Missouri River drainage.....	860,845	580,631	49.8	1,806,348	1,308,438
Clark Fork (of Yellowstone) and tributaries.....	8,897	4,557	94.8	15,640	14,121
Clark Fork direct.....	3,686	2,850	28.9	5,369	5,312
Tributaries of Clark Fork.....	5,211	* 1,707	206.3	10,271	8,809
Big Horn River and tributaries.....	307,846	113,875	170.3	750,261	468,198
Big Horn River direct.....	42,799	2,502	.....	70,236	56,945
Popo Azie River.....	22,073	14,340	53.9	34,723	34,375
Wind River.....	43,620	3,787	.....	228,338	77,122
Poison Creek.....	5	2,690	-98.8	10	10
Owl Creek.....	11,610	6,558	77.0	14,546	12,951
No Wood Creek.....	18,416	10,989	82.4	26,193	22,080
Greybull River.....	49,231	35,552	38.5	93,543	79,134
Shell Creek.....	11,955	4,319	176.8	24,006	22,406
Shoshone River.....	95,091	26,311	261.4	217,998	134,431
Little Horn River.....	1,408	4,781	-70.4	11,363	4,340
Other tributaries of Big Horn River.....	11,638	* 2,966	293.7	29,257	24,404
Tongue River and tributaries.....	43,025	35,623	20.8	69,167	59,290
Tongue River direct.....	9,806	7,285	34.6	11,670	10,771
Goose Creek.....	27,627	20,653	33.8	43,817	37,749
Other tributaries of Tongue River.....	5,593	* 7,685	-27.2	13,671	10,770
Powder River and tributaries.....	88,903	64,357	38.1	132,985	112,340
Powder River direct.....	2,466	.....	.....	4,975	4,962
Red Fork Creek.....	3,341	2,610	28.0	4,271	3,385
Crazy Woman Creek.....	21,965	6,950	216.0	29,694	24,151
Clear Creek.....	50,648	47,801	6.0	71,580	63,735
Other tributaries of Powder River.....	10,484	* 6,998	49.9	22,495	18,107
Little Missouri River.....	60	* 186	-63.6	60	60
Tributaries of Cheyenne River.....	7,872	14,291	-44.9	16,818	11,531
Belle Fourche River.....	1,966	6,173	-68.2	5,954	3,621
South Fork.....	5,906	7,908	-25.3	11,784	7,910
Other tributaries of Cheyenne River.....	.....	212	-100.0	.....	.....

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

TABLE 7.—ACREAGE IRRIGATED, CLASSIFIED BY DRAINAGE BASIN: 1919 AND 1902—Continued.

DRAINAGE BASIN.	AREA IRRIGATED (ACRES).			Area included in enterprises, 1920 (acres).	Area enterprises were capable of irrigating in 1920 (acres).
	1919	1902	Per cent of increase. <sup>1</sup>		
Missouri River drainage—Con.					
Niobrara River.....	445	975	-54.4	445	445
North Platte River and tributaries.....	402,993	336,840	19.8	888,419	628,233
North Platte River direct.....	56,794	39,570	43.5	120,195	76,956
Beaver Creek.....	2,621	7,370	-64.4	3,666	3,186
Grand Encampment Creek.....	7,053	6,622	6.5	10,173	7,293
Spring Creek.....	13,123	7,679	70.9	18,702	18,177
Sage Creek.....	375	1,634	-77.1	570	570
Pass Creek.....	8,557	8,390	2.0	12,500	11,373
Medicine Bow River.....	54,500	40,661	34.0	139,599	67,103
Sweetwater River.....	5,448	11,403	-52.2	14,166	10,523
Muddy Creek.....	657	1,525	-56.9	1,112	677
Box Elder Creek.....	4,648	4,740	-1.9	7,916	7,696
La Poudre Creek.....	9,103	4,524	101.2	21,697	15,690
Labonte Creek.....	4,378	3,639	20.3	6,625	5,768
Laramie River and tributaries.....	149,999	138,176	8.6	369,928	291,993
Laramie River direct.....	72,406	57,335	26.3	171,554	122,956
Little Laramie River.....	30,860	53,105	-41.9	42,852	35,144
Sybilie Creek.....	6,183	7,234	-14.5	9,519	8,044
North Laramie River.....	6,858	5,721	19.9	20,144	11,749
Chugwater Creek.....	5,914	3,907	51.4	9,853	9,258
Other tributaries of Laramie River.....	27,784	10,874	155.5	113,006	106,842
Rawhide Creek.....	2,045	4,187	-51.2	3,651	2,481
Horse Creek.....	28,369	15,524	82.7	71,188	39,702
Other tributaries of North Platte River.....	55,325	41,106	34.3	89,831	68,977
Tributaries of South Platte River.....	9,804	9,898	-0.8	21,553	14,220
Lodgepole Creek.....	1,775	3,694	-51.9	10,184	3,694
Crow Creek.....	2,530	8,643	-29.2	5,590	4,887
Lone Tree Creek.....	1,960	1,444	35.7	2,040	1,955
Cache la Poudre River.....	3,489	1,077	224.0	3,739	3,694
Other tributaries of South Platte River.....		30	-100.0		
Other tributaries of Missouri River.....		50	-100.0		
Colorado River drainage.....	211,507	118,566	78.4	473,116	353,731
Green River and tributaries.....	211,507	118,566	78.4	473,116	353,731
Green River direct.....	20,285	11,351	78.7	32,492	28,034
New Fork.....	27,743	10,975	152.8	53,918	43,614
Horse Creek.....	15,520	6,569	136.3	21,670	19,453
Cottonwood Creek.....	17,437	4,673	272.7	32,317	29,283
South Piney Creek.....	11,928	16,179	-26.3	30,924	28,397
La Barge Creek.....	5,459	5,055	8.0	11,700	7,725
Fontenelle Creek.....	4,428	3,241	36.6	5,858	5,033
Bitter Creek.....	2,395	1,405	70.6	12,495	11,447
Blacks Creek.....	65,980	28,139	134.5	175,970	104,305
Henry's Fork.....	8,298	6,813	21.8	25,940	23,694
Little Snake River.....	13,463	17,363	-22.5	18,038	16,358
Other tributaries of Green River.....	18,571	6,803	173.0	51,794	38,388
Great Salt Lake drainage.....	63,665	32,764	94.3	91,842	82,470
Bear River and tributaries.....	63,665	32,764	94.3	91,842	82,470
Bear River direct.....	37,306	25,180	48.3	49,027	45,412
Tributaries of Bear River.....	26,359	7,604	246.6	42,815	37,058
Columbia River drainage.....	62,965	41,150	53.0	104,362	86,400
Snake River and tributaries.....	62,965	41,150	53.0	104,362	86,400
Snake River direct.....	912	1,050	-13.1	2,202	1,879
Gros Ventre River.....	6,718	3,523	90.7	9,866	7,493
Little Gros Ventre River.....	6,243	3,599	73.5	9,157	6,997
Salt River.....	34,338	22,570	52.1	57,288	46,234
Tributaries of Pierre River.....		5,372	-100.0		
Other tributaries of Snake River.....	14,754	5,036	193.0	25,849	23,797

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

**CAPITAL INVESTED AND COST OF OPERATION AND MAINTENANCE.**

TABLE 8.—CAPITAL INVESTED IN IRRIGATION ENTERPRISES: 1890 TO 1920.

CENSUS YEAR.	Amount.	Per cent of increase.	AVERAGE PER ACRE.	
			Amount.	Per cent of increase.
1920.....	\$34,326,328	93.9	\$19.06	76.6
1910.....	17,700,980	845.5	10.80	64.6
1900.....	3,973,165	377.9	6.56	81.2
1890.....	831,427		3.62	

TABLE 9.—CAPITAL INVESTED, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Amount.	Per cent of total.	Average per acre.
Total.....	\$34,326,328	100.0	\$18.75
Before 1860.....	1,250	( <sup>1</sup> )	3.91
1860-1869.....	45,731	0.1	4.63
1870-1879.....	978,368	2.9	9.36
1880-1889.....	5,459,654	15.9	10.52
1890-1899.....	3,109,641	9.1	9.22
1900-1904.....	4,844,972	14.1	16.21
1905-1909.....	14,962,407	43.6	45.71
1910-1914.....	1,621,916	4.7	16.64
1915-1919.....	2,337,484	6.8	43.59
Not reported.....	964,905	2.8	11.62

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 10.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY SOURCE OF WATER SUPPLY.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.			OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Average per acre.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total.....	\$34,326,328	100.0	\$18.75	869,581	\$1.04
Streams, gravity.....	33,025,460	96.2	19.34	826,086	1.03
Streams, pumped.....	99,914	0.3	28.98	985	9.91
Wells, pumped.....	10,460	( <sup>2</sup> )	70.88	122	7.79
Wells, flowing.....	4,630	( <sup>2</sup> )	115.75	12	9.58
Lakes, gravity.....	4,935	( <sup>2</sup> )	12.95	60	0.83
Springs.....	66,299	0.2	6.45	2,983	0.60
Stored storm water.....	407,055	1.2	8.71	10,055	0.73
Streams, gravity, and pumped wells.....	16,770	( <sup>2</sup> )	26.45	125	1.20
Other mixed.....	690,705	2.0	11.13	29,153	1.25
Other and not reported.....	100	( <sup>2</sup> )	1.67		

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Total.....	\$34,326,328	\$4,701,049	\$29,625,279	630.2
Missouri River drainage.....	29,818,236	3,901,748	25,916,488	664.2
Clark Fork (of Yellowstone) and tributaries.....	117,292	40,475	76,817	189.8
Clark Fork direct.....	58,402	26,150	29,252	111.9
Tributaries of Clark Fork.....	61,890	14,325	47,565	332.0
Big Horn River and tributaries.....	14,330,800	919,433	13,411,367	.....
Big Horn River direct.....	1,295,576	22,000	1,273,576	.....
Pope Agle River.....	349,546	72,264	277,282	383.7
Wind River.....	2,101,819	17,904	2,083,915	.....
Polson Creek.....	1,000	18,700	-17,700	-94.7
Owl Creek.....	52,915	40,154	12,761	31.5
No Wood Creek.....	161,588	81,978	79,610	97.1
Greybull River.....	503,184	204,604	298,580	145.9
Shell Creek.....	380,420	32,730	347,690	.....
Shoshone River.....	8,702,480	878,278	8,824,202	.....
Little Horn River.....	35,000	31,695	3,305	10.4
Other tributaries of Big Horn River.....	747,272	19,126	728,146	.....
Tongue River and tributaries.....	811,125	218,405	592,720	271.4
Tongue River direct.....	125,555	50,750	74,805	147.4
Goose Creek.....	563,618	127,100	436,418	343.4
Other tributaries of Tongue River.....	122,952	40,555	81,497	201.0
Powder River and tributaries.....	1,159,996	285,084	874,912	306.9
Powder River direct.....	152,100		152,100	.....
Red Fork Creek.....	78,500	12,800	65,700	513.3
Crazy Woman Creek.....	127,791	22,275	105,516	473.7
Clear Creek.....	553,465	189,375	364,090	192.3
Other tributaries of Powder River.....	248,140	60,634	187,506	309.2
Little Missouri River.....	728	950	-224	-23.6
Tributaries of Cheyenne River.....	242,836	102,877	140,009	136.1
Belle Fourche River.....	78,086	50,165	28,001	51.6
South Fork.....	166,820	49,272	117,548	238.6
Other tributaries of Cheyenne River.....		3,440	-3,440	-100.0
Niobrara River.....	10,365	4,200	6,365	151.5

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

TABLE 11.—CAPITAL INVESTED, CLASSIFIED BY DRAINAGE BASIN: 1920 AND 1902—Continued.

DRAINAGE BASIN.	1920	1902	INCREASE. <sup>1</sup>	
			Amount.	Per cent.
Missouri River drainage—Con.				
North Platte River and tributaries	12,931,901	2,227,217	10,704,684	480.6
North Platte River direct	5,920,923	306,084	5,614,839	—
Beaver Creek	37,497	51,168	-13,671	-26.7
Grand Encampment Creek	72,692	50,828	21,864	43.0
Spring Creek	184,290	38,498	145,794	378.7
Sage Creek	4,206	13,790	-9,584	-69.5
Pass Creek	50,051	41,877	8,174	19.5
Medicine Bow River	346,664	244,287	102,377	41.9
Sweetwater River	87,322	54,701	32,621	59.8
Muddy Creek	7,770	6,546	1,224	18.7
Box Elder Creek	104,676	37,655	67,021	178.0
La Prele Creek	327,411	37,500	289,911	773.1
Labonte Creek	71,526	22,040	49,486	120.1
Laramie River and tributaries	4,334,596	888,096	3,446,500	383.1
Laramie River direct	923,041	661,296	261,835	39.6
Little Laramie River	48,753	119,122	-70,369	-59.1
Sybilie Creek	65,041	32,200	32,841	102.0
North Laramie River	396,708	13,886	382,822	—
Chugwater Creek	83,155	30,945	52,210	168.7
Other tributaries of Laramie River	2,818,198	* 30,737	2,787,461	—
Rawhide Creek	27,330	49,445	-22,115	-44.7
Horse Creek	530,476	132,847	403,628	303.8
Other tributaries of North Platte River	817,872	* 241,257	576,615	230.0
Tributaries of South Platte River	212,945	102,907	110,038	106.9
Lodgepole Creek	89,037	39,500	49,537	125.4
Crow Creek	48,919	43,925	4,994	11.4
Lone Tree Creek	36,173	17,380	18,793	108.1
Cache la Poudre River	38,816	1,907	36,919	—
Other tributaries of South Platte River		* 105	-105	-100.0
Other tributaries of Missouri River		* 200	-200	-100.0
Colorado River drainage	3,064,797	579,190	2,485,607	429.2
Green River and tributaries	3,064,797	579,190	2,485,607	429.2
Green River direct	170,841	31,750	139,091	438.1
New Fork	293,043	27,253	265,790	975.3
Horse Creek	51,163	13,350	37,813	283.2
Cottonwood Creek	456,827	11,000	445,827	—
South Piney Creek	85,728	38,761	46,967	121.2
La Barge Creek	39,150	20,365	18,785	92.2
Fontanelle Creek	33,000	9,777	23,223	237.5
Bitter Creek	93,158	4,500	88,658	—
Blacks Creek	508,776	98,298	408,480	729.9
Henry's Fork	77,320	11,291	66,029	534.8
Little Snake River	274,302	325,107	-50,805	-15.6
Other tributaries of Green River	923,489	* 17,740	905,749	—
Great Salt Lake drainage	679,405	118,340	561,065	474.1
Bear River and tributaries	679,405	118,340	561,065	474.1
Bear River direct	294,588	87,355	207,233	237.2
Tributaries of Bear River	384,817	* 30,985	353,832	—
Columbia River drainage	763,890	101,771	662,119	650.6
Snake River and tributaries	763,890	101,771	662,119	650.6
Snake River direct	500,202	8,570	491,632	111.0
Gros Ventre River	31,225	14,802	16,423	40.6
Little Gros Ventre River	18,746	13,330	5,416	28.8
Salt River	149,207	41,724	107,483	257.6
Tributaries of Pierre River		12,595	-12,595	-100.0
Other tributaries of Snake River	64,510	* 10,750	53,760	500.1

<sup>1</sup> A minus sign (-) denotes decrease. Per cent not shown when more than 1,000.  
<sup>2</sup> Includes springs and wells.

In classifying capital invested by type of enterprise (Table 12) the average capital invested per acre is not presented, for the reason that it is not possible to compute this correctly. The United States Reclamation Service supplies stored water from reservoirs in Wyoming to enterprises controlled by agencies of most of the other classes shown in the table, in Nebraska and Idaho, as well as in Wyoming, and a part of its expenditure is properly chargeable to those lands; but it is not possible to tell how much should be so charged or how it should be distributed among the various classes.

TABLE 12.—CAPITAL INVESTED, 1920, AND COST OF OPERATION AND MAINTENANCE, 1919, CLASSIFIED BY CHARACTER OF ENTERPRISE.

[When water is pumped, cost of operation and maintenance includes cost of fuel and attendance.]

CLASS.	CAPITAL INVESTED, 1920.		OPERATION AND MAINTENANCE, 1919.	
	Amount.	Per cent of total.	Area for which cost is reported (acres).	Average cost per acre. <sup>1</sup>
Total	\$34,326,328	100.0	869,581	\$1.04
Individual and partnership	8,738,886	25.5	439,726	1.04
Cooperative	6,701,990	19.5	244,642	0.95
Irrigation district	1,441,312	4.2	21,417	0.77
Carey Act	2,434,791	7.1	33,705	1.34
Commercial	780,562	2.3	56,300	0.55
U. S. Reclamation Service	12,863,870	37.5	50,631	1.87
U. S. Indian Service	1,339,887	3.9	22,000	1.19
State	15,050	( <sup>2</sup> )	1,140	0.61
City	9,980	( <sup>2</sup> )	20	142.50

<sup>1</sup> Based on area irrigated in 1919. <sup>2</sup> Less than one-tenth of 1 per cent.

DRAINAGE OF IRRIGATED LAND.

The acreages reported in Table 13 relate to lands within the boundaries of irrigation projects, and do not include lands within the vicinity of these projects. "Additional acreage needing drainage" includes all lands so reported by the owners of the enterprises, and includes lands producing partial crops as well as those wholly unproductive.

TABLE 13.—ACREAGE WITHIN IRRIGATION ENTERPRISES FOR WHICH DRAINS HAVE BEEN INSTALLED AND ADDITIONAL ACREAGE IN NEED OF DRAINAGE: 1920.

Number of enterprises reporting land drained or needing drainage	144
Acreage included in enterprises reporting land drained or needing drainage	513,347
Acreage for which drains have been installed	68,086
Additional acreage needing drainage	75,183
Per cent that acreage for which drains have been installed is of total acreage included in enterprises reporting drainage	13.3
Per cent that acreage for which drains have been installed is of total acreage included in irrigation enterprises in the state	2.7
Per cent that acreage for which drains have been installed plus that needing drainage is of total acreage included in irrigation enterprises in the state	5.6

QUANTITY OF WATER USED.

The quantity of water used in 1919 was reported on only part of the irrigation schedules, and the figures given vary greatly. In order that proper values may be assigned to the figures given, those representing measurements and those representing estimates are reported separately in Table 14. While the data are incomplete, the reports represent sufficient acreages to serve as bases for reliable averages.

TABLE 14.—QUANTITY OF WATER USED IN 1919.

ITEM.	Total.	Measured.	Not measured.
Average volume of water entering canals, second-foot	9,890	3,706	6,184
Area irrigated in 1919	454,615	228,539	226,076
Average number of acres per second-foot	46	62	37
Total quantity of water entering canals	1,310,560	491,047	819,513
Area irrigated in 1919	545,265	230,729	314,536
Average quantity per acre	2.4	2.1	2.6
Total quantity of water delivered	393,985	274,200	119,785
Area irrigated in 1919	186,328	128,021	58,307
Average quantity per acre	2.1	2.1	2.1

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IRRIGATION WORKS.

TABLE 15.—IRRIGATION WORKS, CLASSIFIED BY DATE OF BEGINNING.

DATE OF BEGINNING.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2,066	301	5,007	39,009	9,517	2,777	2,534	374	2,911,748
Before 1860.....	1		2	2	2				
1860-1869.....	16		24	135	55	1	10		
1870-1879.....	95	10	327	1,617	538	24	24	16	11,952
1880-1889.....	679	46	1,557	9,540	2,720	815	682	55	156,152
1890-1899.....	383	32	910	7,189	1,753	695	537	31	7,507
1900-1904.....	311	46	718	6,111	1,474	224	176	62	983,034
1905-1909.....	219	62	526	8,422	1,290	673	856	102	1,718,235
1910-1914.....	163	49	408	2,947	791	152	99	61	26,052
1915-1919.....	103	41	290	2,131	525	123	82	34	8,075
Not reported.....	95	15	245	915	369	70	68	13	741

DATE OF BEGINNING.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.		
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps. Number. Capacity (gallons per minute).
Total.....	17.9	7	46	16	8,020	57	1,304	70 39,725
Before 1860.....								
1860-1869.....								
1870-1879.....	1.0	2		1		1	8	1
1880-1889.....	1.1	1		4	3,000	5	185	5 8,200
1890-1899.....	3.6					2	40	2 2,470
1900-1904.....	2.9			3	2,500	8	324	9 3,720
1905-1909.....	4.2					4	81	4 6,050
1910-1914.....	0.8			2	1,435	17	488	17 11,652
1915-1919.....	0.2	2	40	3	185	11	91	14 4,776
Not reported.....	4.1	2	6	3	900	9	92	18 1,857

TABLE 16.—IRRIGATION WORKS, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CLASS.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2,066	301	5,007	39,009	9,517	2,777	2,534	374	2,911,748
Individual and partnership.....	1,942	267	4,782	24,387	7,908	2,050	1,073	333	70,733
Cooperative.....	95	17	180	8,702	1,181	287	534	13	86,803
Irrigation district.....	2	1	7	708	100	20	70	2	43,947
Carey Act.....	7	6	14	1,298	133	40	149	10	67,466
Commercial.....	11	3	13	1,543	187	68	221	8	266,002
U. S. Reclamation Service.....	2	5	4	2,345	93	281	473	6	2,376,385
U. S. Indian Service.....									
State.....	7	1	6	26	7	31	14	1	411
City.....		1	1	6	8			1	1

CLASS.	Pipe lines, length (miles).	FLOWING WELLS.		PUMPED WELLS.		PUMPING PLANTS.		
		Number.	Capacity (gallons per minute).	Number.	Capacity (gallons per minute).	Number.	Engine capacity (horse-power).	Pumps. Number. Capacity (gallons per minute).
Total.....	17.9	7	46	16	8,020	57	1,304	70 39,725
Individual and partnership.....	11.7	7	46	16	8,020	55	1,239	57 39,725
Cooperative.....	2.6					1	15	11
Irrigation district.....	0.5							
Carey Act.....								
Commercial.....	0.1							
U. S. Reclamation Service.....	1.9							
U. S. Indian Service.....								
State.....	0.8							
City.....	0.8					1	50	2

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TABLE 17.—IRRIGATION WORKS, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	Number of diverting dams.	Number of storage dams.	MAIN DITCHES.			LATERAL DITCHES.		RESERVOIRS.	
			Number.	Capacity (second-foot).	Length (miles).	Number.	Length (miles).	Number.	Capacity (acre-feet).
Total.....	2,066	301	5,007	39,009	9,517	2,777	2,534	374	2,911,748
Missouri River drainage.....	1,546	252	3,429	27,977	6,671	1,750	1,932	321	2,039,572
Clark Fork (of Yellowstone) and tributaries.....	4		58	214	90	6	7	4	2,704
Clark Fork direct.....			4	38	12	2	6		
Tributaries of Clark Fork.....	4		54	176	78	4	1	4	2,704
Big Horn River and tributaries.....	266	30	732	8,202	2,029	494	696	70	466,867
Big Horn River direct.....	10	1	27	712	143	36	47	1	2
Popo Agie River.....	87		122	605	270	20	34	1	112
Wind River.....	7	1	88	1,006	233	12	13	2	2,050
Poison Creek.....			1					1	3
Owl Creek.....	6		12	279	89	12	16	6	275
No Wood Creek.....	21	5	94	388	206	8	5	4	60
Greybull River.....	46		100	1,276	327	20	71	4	181
Shell Creek.....	31	5	53	433	145	10	20	5	1,637
Shoshone River.....	38	9	64	3,079	327	294	448	17	460,806
Little Horn River.....	2		7	46	42	15	1	1	25
Other tributaries of Big Horn River.....	68	8	164	379	247	67	41	28	1,716
Tongue River and tributaries.....	160	25	201	1,534	452	113	98	27	11,227
Tongue River direct.....	20		23	359	101	48	7		
Goose Creek.....	91	21	99	874	229	30	58	16	10,579
Other tributaries of Tongue River.....	49	4	79	301	122	35	33	11	648
Powder River and tributaries.....	135	19	224	2,509	656	73	122	15	4,062
Powder River direct.....	1		1	72	17	1	3		
Red Fork Creek.....	19		25	60	50	1	1		
Crazy Woman Creek.....	17	2	49	525	113	18	10	4	37
Clear Creek.....	46	9	83	1,468	312	40	94	8	3,389
Other tributaries of Powder River.....	52	8	66	384	164	13	14	8	636
Little Missouri River.....		1	1		1				
Tributaries of Cheyenne River.....	71	40	118	1,203	166	245	98	39	6,479
Belle Fourche River.....	24	25	49	397	76	108	19	26	2,433
South Fork.....	47	15	69	806	91	137	79	13	4,046
Niobrara River.....	3	2	7	8	4				
North Platte River and tributaries.....	865	113	1,933	13,878	3,082	783	898	141	1,544,370
North Platte River direct.....	24	4	28	3,134	260	197	197	2	1,070,005
Beaver Creek.....	12	2	70	50	62	1	1	3	673
Grand Encampment Creek.....	13	1	31	106	52	7	7	1	150
Spring Creek.....	3	2	48	343	79	63	45	3	3,596
Sage Creek.....	2		4	3	4				
Pass Creek.....	3		54	293	84	18	9	1	2,000
Medicine Bow River.....	112	13	283	927	414	68	58	9	7,459
Sweetwater River.....	42	1	85	174	141	37	20	9	2,474
Muddy Creek.....	1		5	12	7				
Box Elder Creek.....	13	3	33	44	68	5	16	3	38
La Prele Creek.....	11	3	47	326	81	13	62	2	20,012
Lebonte Creek.....	40		42	54	76	24	24		
Laramie River and tributaries.....	358	40	624	5,933	909	150	334	48	396,031
Laramie River direct.....	40	7	69	1,718	287	93	228	7	263,350
Little Laramie River.....	42		98	141	119	26	15		
Sybilis Creek.....	98	11	122	297	119	4	9	10	260
North Laramie River.....	101	6	128	462	86	9	15	6	8,019
Chugwater Creek.....	37	10	100	152	107	10		6	384
Other tributaries of Laramie River.....	40	6	107	2,869	169	8	73	17	124,008
Rawhide Creek.....	13	2	13	42	13	33	9	2	46
Horse Creek.....	48	26	121	774	169	32	41	26	27,335
Other tributaries of North Platte River.....	172	16	445	1,663	663	135	76	32	14,553
Tributaries of South Platte River.....	42	22	155	429	191	36	13	26	3,863
Lodgepole Creek.....	9	11	33	256	47	26	13	7	2,633
Crow Creek.....	8	4	33	115	47	8		7	473
Lone Tree Creek.....	16	4	34	55	12			6	710
Cocche la Poudre River.....	9	3	35	8	85			5	47
Colorado River drainage.....	361	40	1,019	7,495	1,908	823	503	40	24,772
Green River and tributaries.....	361	40	1,019	7,495	1,908	823	503	40	24,772
Green River direct.....	23	1	55	1,403	171	14	9	2	114
New Fork.....	9	2	78	1,011	241	133	86	1	
Horse Creek.....	6		41	403	82				
Cottonwood Creek.....	19		83	485	131	125	75		
South Piney Creek.....	26	1	110	221	163	333	116		
La Barge Creek.....	22		19	131	44	6	2		
Fontanella Creek.....	20		24	73	35	8	6		
Bitter Creek.....	3	1	21	25	28	1	4	16	1,105
Blacks Creek.....	156	9	326	1,867	532	54	114	11	3,333
Henry's Fork.....	45	22	110	301	143	74	42	3	23
Little Snake River.....	8		58	289	127	4	1	2	458
Other tributaries of Green River.....	24	4	94	1,286	211	71	46	5	19,739
Great Salt Lake drainage.....	54	7	219	1,306	390	59	40	11	324
Bear River and tributaries.....	54	7	219	1,306	390	59	40	11	324
Bear River direct.....	11		86	703	170	13	7		
Tributaries of Bear River.....	43	7	133	603	210	46	33	11	324
Columbia River drainage.....	105	2	340	2,231	558	145	59	2	847,080
Snake River and tributaries.....	105	2	340	2,231	558	145	59	2	847,080
Snake River direct.....	1		9	42	12	10		1	847,000
Groes Ventre River.....	20		39	118	64	1	1		
Little Gros Ventre River.....	14		32	103	50				
Salt River.....	50	2	169	1,355	297	116	54	1	89
Other tributaries of Snake River.....	20		101	613	135	18	4		



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## CROPS.

**TABLE 18.—ACREAGE, YIELD, AND VALUE OF PRINCIPAL CROPS GROWN ON IRRIGATED LAND, AND COMPARISONS WITH TOTALS FOR THE STATE: 1919 AND 1909.**

[Totals for the state, used in making comparisons, are shown in state bulletin on agriculture.]

CROP.	AREA HARVESTED.					QUANTITY HARVESTED.					
	1919		1909		Per cent of increase. <sup>1</sup>	Unit.	1919		1909		Per cent of increase. <sup>1</sup>
	Acres.	Per cent of total for state.	Acres.	Per cent of total for state.			Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	2,738	7.1	1,176	12.7	132.8	Bu.....	51,830	13.3	25,297	14.3	104.9
2 Oats.....	23,684	40.4	76,302	61.5	-69.0	Bu.....	512,262	50.9	2,175,203	64.7	-76.4
3 Winter wheat.....	2,466	7.2	26,326	62.7	63.1	Bu.....	35,513	17.4	490,400	66.4	35.7
4 Spring wheat.....	40,470	27.5	4,982	58.2	-37.8	Bu.....	630,098	50.8	112,699	59.6	-47.9
5 Barley.....	3,099	38.9	375	24.7	44.3	Bu.....	58,741	50.8	6,121	29.9	-27.9
6 Rye.....	541	1.3	(*)			Bu.....	4,415	2.3	(*)		
7 <b>Other grains and seeds:</b>											
Clover and alfalfa seed <sup>2</sup> .....	2,356	53.1	(*)			Bu.....	7,584	47.9	(*)		
<b>Hay and forage:</b>											
8 Timothy alone.....	18,645	61.3	18,265	62.1	2.1	Tons...	18,824	63.9	28,136	63.0	-33.1
9 Timothy and clover mixed.....	25,601	75.9	4,098	50.7	526.6	Tons...	32,359	77.3	8,149	49.9	297.1
10 Clover alone.....	1,638	42.6	242	67.2	576.9	Tons...	1,811	45.0	586	72.5	209.0
11 Alfalfa.....	176,295	53.4	162,447	95.3	8.5	Tons...	284,423	55.3	379,933	95.5	-25.1
12 Other tame grasses.....	50,923	78.1	83,456	75.0	-39.0	Tons...	47,484	79.7	97,849	71.9	-51.5
13 Annual legumes cut for hay.....	778	33.7	4,930	25.2	100.0	Tons...	1,011	54.9	5,835	24.5	40.0
14 Small grains cut for hay.....	9,081	9.0				Tons...	7,160	14.4			
15 Wild, salt, or prairie grasses.....	142,750	62.9	189,271	78.0	-24.6	Tons...	116,168	67.1	182,033	79.8	-36.8
16 Silage crops.....	653	54.5	(*)			Tons...	3,787	58.7	(*)		
17 Corn cut for forage.....	951	2.8	(*)			Tons...	2,317	9.4	(*)		
<b>Vegetables:</b>											
18 Potatoes.....	4,532	38.4	4,768	57.2	-4.9	Bu.....	532,511	62.6	620,667	66.6	-14.2
<b>Miscellaneous:</b>											
19 Sugar beets grown for sugar.....	2,714	27.3	1,100	93.1	146.7	Tons...	23,067	23.8	11,198	84.6	106.0

CROP.	AVERAGE YIELD PER ACRE, 1919.						VALUE.				
	Unit.	For state.	On non-irrigated land.	On irrigated land.			1919		1909		Per cent of increase. <sup>1</sup>
				Average.	Per cent of average for state.	Per cent of average on non-irrigated land.	Amount.	Per cent of total for state.	Amount.	Per cent of total for state.	
<b>Cereals:</b>											
1 Corn.....	Bu.....	10.1	9.4	18.9	187.1	201.1	\$95,534	18.3	\$15,118	14.9	465.8
2 Oats.....	Bu.....	17.2	14.1	21.6	125.6	153.2	563,488	50.9	1,302,033	71.2	-56.7
3 Winter wheat.....	Bu.....	5.9	5.3	14.4	244.1	271.7	76,708	17.4	440,491	68.4	226.4
4 Spring wheat.....	Bu.....	8.4	5.7	15.6	185.7	273.7	1,361,012	50.8	89,215	68.4	2.1
5 Barley.....	Bu.....	14.5	11.7	19.0	131.0	162.4	91,049	50.8	4,999	33.8	54.6
6 Rye.....	Bu.....	4.6	4.6	8.2	178.3	178.3	7,726	2.3	(*)		
7 <b>Other grains and seeds:</b>											
Clover and alfalfa seed <sup>2</sup> .....	Bu.....	2.5	3.9	3.2	91.4	82.1	144,096	47.9	(*)		
<b>Hay and forage:</b>											
8 Timothy alone.....	Tons...	0.97	0.90	1.01	104.1	112.2	439,424	63.9	208,307	61.0	135.0
9 Timothy and clover mixed.....	Tons...	1.24	1.17	1.26	101.6	107.7	776,616	77.3	71,810	54.1	981.5
10 Clover alone.....	Tons...	1.04	1.00	1.11	106.7	111.0	36,220	45.0	2,996	54.8	
11 Alfalfa.....	Tons...	1.56	1.49	1.61	103.2	108.1	6,541,729	55.3	2,526,657	96.1	158.9
12 Other tame grasses.....	Tons...	0.89	0.75	0.83	104.5	124.0	1,044,648	79.7	606,658	64.6	71.6
13 Annual legumes cut for hay.....	Tons...	0.80	0.54	1.30	162.5	240.7	19,209	54.9	53,741	26.8	221.5
14 Small grains cut for hay.....	Tons...	0.49	0.46	0.79	161.2	171.7	150,360	14.4	1,384,269	77.7	97.2
15 Wild, salt, or prairie grasses.....	Tons...	0.76	0.68	0.81	106.6	119.1	2,729,948	67.1	(*)		
16 Silage crops.....	Tons...	5.38	4.88	5.80	107.8	118.9	37,870	58.7	(*)		
17 Corn cut for forage.....	Tons...	0.73	0.68	2.44	334.2	358.8	34,755	9.4	(*)		
<b>Vegetables:</b>											
18 Potatoes.....	Bu.....	72.2	48.9	117.5	162.7	267.7	1,251,401	62.6	350,072	66.7	257.5
<b>Miscellaneous:</b>											
19 Sugar beets grown for sugar.....	Tons...	9.76	10.24	8.60	87.1	83.0	242,204	23.8	51,779	85.8	867.8

<sup>1</sup> A minus sign (-) denotes decrease.

<sup>2</sup> Not including red clover seed.

<sup>3</sup> Not reported separately in 1909.

## IRRIGATION—WYOMING.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910.

[A minus sign (—) denotes decrease.]

	THE STATE.	Albany.	Big Horn. <sup>1</sup>	Campbell. <sup>2</sup>	Carbon.	Converse. <sup>3</sup>	Crook. <sup>4</sup>	
1	Number of all farms in 1920.....	15,748	441	998	1,072	413	804	1,098
2	Number of farms irrigated in 1919.....	6,449	280	952	8	313	157	21
3	Per cent of all farms.....	41.0	63.5	95.4	0.7	75.8	18.2	1.9
4	Number of farms irrigated in 1909.....	0,297	339	1,018	.....	442	219	80
5	Per cent of increase, 1909-1919.....	2.4	-17.4	.....	.....	-28.2	.....	.....
<b>LAND AND FARM AREA.</b>								
6	Approximate land area.....acres..	62,430,720	2,815,360	1,990,400	3,047,040	5,124,480	2,045,120	1,834,240
7	All land in farms.....acres..	11,809,351	847,732	190,445	860,748	843,520	770,484	949,975
8	Improved land in farms.....acres..	2,102,005	119,815	93,661	98,289	102,113	71,885	126,607
9	Area irrigated in 1919.....acres..	1,207,982	114,248	108,754	1,066	121,293	30,821	951
10	Per cent of improved land in farms.....	57.5	95.4	118.1	1.1	118.8	42.9	0.8
11	Area irrigated in 1909.....acres..	1,133,302	151,826	93,779	.....	131,749	40,607	6,712
12	Per cent of increase, 1909-1919.....	6.6	-24.8	.....	.....	-7.9	.....	.....
13	Area enterprises were capable of irrigating in 1920.....acres..	1,831,039	218,270	161,341	2,220	150,485	43,818	1,689
14	Area enterprises were capable of irrigating in 1910.....acres..	1,639,510	221,225	195,094	.....	163,394	52,159	8,017
15	Per cent of increase, 1910-1920.....	11.7	-1.3	.....	.....	-7.9	.....	.....
16	Area included in enterprises in 1920.....acres..	2,584,668	332,455	213,937	3,278	193,632	53,592	1,925
17	Area included in enterprises in 1910.....acres..	2,224,298	355,033	237,003	.....	191,486	85,713	11,038
18	Per cent of increase, 1910-1920.....	15.3	-6.4	.....	.....	1.1	.....	.....
19	Area of irrigated land reported as available for settlement.....acres..	197,326	1,000	19,900	.....	4,500	.....	.....
<b>IRRIGATION WORKS.</b>								
Independent enterprises:								
20	Number, 1920.....	3,564	303	198	19	380	118	29
21	Number, 1910.....	5,577	436	430	.....	629	336	94
Main ditches:								
22	Number, 1920.....	5,007	587	178	20	642	174	30
23	Number, 1910.....	5,593	487	418	.....	640	336	80
24	Length, 1920.....miles..	9,517	781	594	29	1,065	366	36
25	Length, 1910.....miles..	10,933	1,037	1,388	.....	1,005	495	91
26	Capacity, 1920.....second-feet..	39,009	4,669	2,904	100	3,057	2,259	350
27	Capacity, 1910.....second-feet..	42,630	6,831	5,124	.....	3,801	1,364	257
Laterals:								
28	Number, 1920.....	2,777	103	114	8	156	53	41
29	Number, 1910.....	2,340	290	190	.....	173	87	73
30	Length, 1920.....miles..	2,534	142	206	5	121	115	7
31	Length, 1910.....miles..	2,298	588	140	.....	142	62	28
Reservoirs:								
32	Number, 1920.....	374	30	12	14	25	10	13
33	Number, 1910.....	414	33	15	.....	28	28	52
34	Capacity, 1920.....acre-feet..	2,911,748	132,114	2,293	2,438	* 10,336	20,798	55
35	Capacity, 1910.....acre-feet..	2,560,937	372,888	1,060	.....	38,973	37,353	1,910
Flowing wells:								
36	Number, 1920.....	7	.....	.....	.....	1	1	.....
37	Number, 1910.....	2	.....	.....	.....	.....	.....	.....
38	Capacity, 1920.....gallons per minute..	46	.....	.....	.....	.....	40	.....
39	Capacity, 1910.....gallons per minute..	250	.....	.....	.....	100	.....	.....
Pumped wells:								
40	Number, 1920.....	16	.....	1	2	5	1	.....
41	Number, 1910.....	3	.....	.....	.....	.....	.....	.....
42	Capacity, 1920.....gallons per minute..	8,020	.....	900	2,005	.....	180	.....
43	Capacity, 1910.....gallons per minute..	835	.....	.....	.....	.....	.....	.....
Pumping plants:								
44	Number, 1920.....	57	.....	6	2	6	3	3
45	Number, 1910.....	34	.....	9	.....	2	2	1
46	Engine capacity, 1920.....horsepower..	1,304	.....	202	82	40	51	23
47	Engine capacity, 1910.....horsepower..	705	.....	143	.....	21	312	1
48	Pump capacity, 1920.....gallons per minute..	39,725	.....	2,250	2,005	1,287	1,782	1,391
49	Pump capacity, 1910.....gallons per minute..	142,529	.....	6,690	.....	1,500	123,560	7
50	Average lift, 1920.....feet..	31	.....	14	70	17	35	13
<b>CAPITAL INVESTED.</b>								
51	Capital invested to Jan. 1, 1920.....dollars..	34,326,328	3,975,710	4,495,690	85,100	* 1,193,535	862,217	20,912
52	Capital invested to July 1, 1910.....dollars..	17,700,990	2,682,679	2,310,660	.....	737,851	1,729,146	86,578
53	Per cent of increase, 1910-1920.....	93.9	48.2	.....	.....	61.8	.....	.....
54	Average cost per acre based on area enterprises were capable of supplying with water in 1920.....dollars..	18.75	18.21	27.86	38.33	7.93	19.68	12.38
55	Average cost per acre based on area enterprises were capable of supplying with water in 1910.....dollars..	10.80	12.13	11.84	.....	4.52	33.15	10.80
<b>ESTIMATED FINAL COST.</b>								
56	Estimated final cost of existing enterprises in 1920.....dollars..	51,500,288	3,998,180	6,104,440	88,100	* 1,253,535	914,897	20,912
57	Estimated final cost of existing enterprises in 1910.....dollars..	20,425,890	4,114,507	2,370,693	.....	738,778	2,264,508	86,578
58	Per cent of increase, 1910-1920.....	152.1	-2.8	.....	.....	69.7	.....	.....
59	Average cost per acre based on estimated final cost and area included in enterprises in 1920.....dollars..	20.06	12.03	28.53	26.88	6.48	17.07	10.86
60	Average cost per acre based on estimated final cost and area included in enterprises in 1910.....dollars..	9.18	11.59	10.00	.....	3.86	26.42	7.84

<sup>1</sup> Part taken to form Park County in 1911; parts taken to form parts of Hot Springs and Washakie Counties in 1913.

<sup>2</sup> Campbell County formed from parts of Crook and Weston Counties in 1913.

<sup>3</sup> Part taken to form Niobrara County in 1913.

<sup>4</sup> Includes 1,836,720 acres in Yellowstone National Park.

\* Entire capacity and cost of Pathfinder Reservoir reported in Natrona County although reservoir lies in Carbon and Natrona Counties. Incorrectly reported in Laramie County in 1910.



IRRIGATION—WYOMING.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1920; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease.]

	Fremont. <sup>1</sup>	Goshen. <sup>2</sup>	Hot Springs. <sup>3</sup>	Johnson.	Laramie. <sup>4</sup>	Lincoln. <sup>5</sup>	Natrona.
1 Number of all farms in 1920.....	969	1,511	197	624	1,178	923	183
2 Number of farms irrigated in 1919.....	827	324	127	227	64	749	52
3 Per cent of all farms.....	85.3	21.4	64.5	36.4	5.4	81.1	28.4
4 Number of farms irrigated in 1920.....	610			247	577		183
5 Per cent of increase, 1919-1920.....				-8.1			-71.6
<b>LAND AND FARM AREA.</b>							
6 Approximate land area..... acres..	7,847,040	1,399,040	1,298,000	2,664,960	1,713,920	5,724,800	3,406,080
7 All land in farms..... acres..	449,331	890,778	117,309	472,611	1,008,343	441,212	220,062
8 Improved land in farms..... acres..	120,291	205,765	24,044	71,232	250,630	182,091	14,285
9 Area irrigated in 1919..... acres..	115,067	55,481	16,443	63,383	24,165	168,428	10,385
10 Per cent of improved land in farms.....	95.7	27.0	66.7	89.0	9.6	92.5	72.7
11 Area irrigated in 1920..... acres..	78,783			54,838	122,021		22,498
12 Per cent of increase, 1919-1920.....				15.6			-53.8
13 Area enterprises were capable of irrigating in 1920..... acres..	197,406	85,142	21,125	82,933	29,990	245,723	14,920
14 Area enterprises were capable of irrigating in 1910..... acres..	170,946			76,501	166,909		28,255
15 Per cent of increase, 1910-1920.....				10.1			-40.0
16 Area included in enterprises in 1920..... acres..	370,472	138,452	23,333	97,830	50,690	288,057	21,918
17 Area included in enterprises in 1910..... acres..	211,834			104,492	177,252		36,837
18 Per cent of increase, 1910-1920.....				-6.4			-40.5
19 Area of irrigated land reported as available for settlement..... acres..	72,440	27,453				1,213	
<b>IRRIGATION WORKS.</b>							
<b>Independent enterprises:</b>							
20 Number, 1920.....	385	69	72	150	90	586	61
21 Number, 1910.....	396			221	462		273
<b>Main ditches:</b>							
22 Number, 1920.....	494	103	52	174	212	820	84
23 Number, 1910.....	384			224	459		277
24 Length, 1920..... miles..	1,148	236	160	513	260	1,410	142
25 Length, 1910..... miles..	892			529	827		334
26 Capacity, 1920..... second-feet..	4,323	1,803	431	1,724	618	5,299	238
27 Capacity, 1910..... second-feet..	3,449			2,050	5,852		1,049
<b>Laterals:</b>							
28 Number, 1920.....	342	130	15	68	47	693	6
29 Number, 1910.....	135			39	200		230
30 Length, 1920..... miles..	228	195	19	113	18	308	14
31 Length, 1910..... miles..	250			31	270		114
<b>Reservoirs:</b>							
32 Number, 1920.....	31	30	9	8	28	14	17
33 Number, 1910.....	10			6	60		52
34 Capacity, 1920..... acre-feet..	6,314	27,728	488	3,871	*3,932	847,718	*1,081,264
35 Capacity, 1910..... acre-feet..	2,168			5,125	1,196,215		6,119
<b>Flowing wells:</b>							
36 Number, 1920.....	1						
37 Number, 1910.....							
38 Capacity, 1920..... gallons per minute..							
39 Capacity, 1910..... gallons per minute..							
<b>Pumped wells:</b>							
40 Number, 1920.....					2		
41 Number, 1910.....	1						
42 Capacity, 1920..... gallons per minute..			50		735		3,000
43 Capacity, 1910..... gallons per minute..	120						
<b>Pumping plants:</b>							
44 Number, 1920.....	5		6	3	2		4
45 Number, 1910.....	2			3	3		5
46 Engine capacity, 1920..... horsepower..	82		58	49	20		166
47 Engine capacity, 1910..... horsepower..	13			31	66		76
48 Pump capacity, 1920..... gallons per minute..	2,480		4,020	1,100	735		8,850
49 Pump capacity, 1910..... gallons per minute..	340			1,455	3,278		3,211
50 Average lift, 1920..... feet..	90		26	33	12		19
<b>CAPITAL INVESTED.</b>							
51 Capital invested to Jan. 1, 1920..... dollars..	3,784,769	3,680,421	141,450	861,860	*287,853	1,694,382	*2,207,139
52 Capital invested to July 1, 1910..... dollars..	1,099,026			552,515	2,467,260		201,416
53 Per cent of increase, 1910-1920.....				56.0			*965.8
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	19.17	43.23	6.70	10.39	8.93	( <sup>7</sup> )	( <sup>7</sup> )
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..	6.43			7.34	14.78		6.88
<b>ESTIMATED FINAL COST.</b>							
56 Estimated final cost of existing enterprises in 1920..... dollars..	11,646,044	6,596,902	146,450	878,536	*268,853	1,741,382	*2,206,139
57 Estimated final cost of existing enterprises in 1910..... dollars..	1,122,481			552,515	3,139,090		201,416
58 Per cent of increase, 1910-1920.....				59.0			*966.3
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	31.44	47.65	6.28	8.96	5.31	( <sup>7</sup> )	( <sup>7</sup> )
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..	5.30			5.29	17.71		5.47

<sup>1</sup> Part taken to form part of Hot Springs County in 1913.  
<sup>2</sup> Formed from part of Laramie County in 1913.  
<sup>3</sup> Formed from parts of Big Horn, Fremont, and Park Counties in 1913.  
<sup>4</sup> Parts taken to form Goshen and Platte Counties in 1913.  
<sup>5</sup> Formed from part of Uinta County in 1913.  
<sup>6</sup> Entire capacity and cost of Pathfinder Reservoir reported in Natrona County although reservoir lies in Carbon and Natrona Counties. Incorrectly reported in Laramie County in 1910.  
<sup>7</sup> Average not shown because most of land served by storage works lies in another state.

IRRIGATION—WYOMING.

COUNTY TABLE.—ACREAGE IRRIGATED, 1919 AND 1909; AND ACREAGE IN ENTERPRISES, IRRIGATION WORKS, AND CAPITAL INVESTED IN IRRIGATION ENTERPRISES, 1920 AND 1910—Continued.

[A minus sign (-) denotes decrease.]

	Niobrara. <sup>1</sup>	Park. <sup>2</sup>	Platte. <sup>3</sup>	Sheridan.	Sweetwater.	Uinta. <sup>4</sup>	Washakie. <sup>5</sup>	Weston. <sup>6</sup>
1 Number of all farms in 1920.....	739	839	1,146	972	139	408	318	721
2 Number of farms irrigated in 1919.....	2	756	404	420	90	359	275	42
3 Per cent of all farms.....	0.3	90.1	35.3	43.2	64.7	88.0	86.5	5.8
4 Number of farms irrigated in 1909.....		602		679	135	1,123		43
5 Per cent of increase, 1909-1919.....				-38.1	-33.3			
<b>LAND AND FARM AREA.</b>								
6 Approximate land area..... acres..	1,686,560	3,332,480	1,860,000	1,647,360	6,716,800	1,340,180	1,434,240	1,537,920
7 All land in farms..... acres..	633,708	286,193	974,429	625,798	61,245	324,475	93,379	747,578
8 Improved land in farms..... acres..	60,614	89,683	180,303	113,385	13,938	58,551	37,607	68,616
9 Area irrigated in 1919..... acres..	769	77,527	66,753	68,311	14,010	102,695	41,179	6,263
10 Per cent of improved land in farms.....	1.3	86.4	37.0	60.2	100.5	151.6	109.5	9.1
11 Area irrigated in 1909..... acres..		58,853		94,141	10,798	260,020		6,577
12 Per cent of increase, 1909-1919.....				-27.4	29.7			
13 Area enterprises were capable of irrigating in 1920..... acres..	1,102	121,465	108,639	90,198	46,805	148,553	50,597	8,618
14 Area enterprises were capable of irrigating in 1910..... acres..		108,478		114,285	22,687	303,704		8,076
15 Per cent of increase, 1910-1920.....				-21.1	106.5			
16 Area included in enterprises in 1920..... acres..	1,427	180,716	131,362	108,667	57,591	222,643	60,349	12,542
17 Area included in enterprises in 1910..... acres..		265,255		117,563	90,614	330,103		10,075
18 Per cent of increase, 1910-1920.....				-7.6	-36.4			
19 Area of irrigated land reported as available for settlement..... acres..			46,000		20,480	1,140	3,200	
<b>IRRIGATION WORKS.</b>								
<b>Independent enterprises:</b>								
20 Number, 1920.....	7	202	178	203	82	308	70	54
21 Number, 1910.....		313		526	107	1,308		48
<b>Main ditches:</b>								
22 Number, 1920.....	15	175	289	239	127	437	84	71
23 Number, 1910.....		302		537	102	1,296		51
24 Length, 1920..... miles..	17	501	451	606	212	701	189	100
25 Length, 1910..... miles..		813		939	151	2,369		73
26 Capacity, 1920..... second-feet..	161	2,688	1,869	2,189	606	2,474	559	699
27 Capacity, 1910..... second-feet..		3,870		2,111	1,269	5,381		222
<b>Laterals:</b>								
28 Number, 1920.....		228	298	131	76	53	22	198
29 Number, 1910.....		77		252	15	634		34
30 Length, 1920..... miles..		348	289	106	61	116	35	88
31 Length, 1910..... miles..		103		240	5	316		9
<b>Reservoirs:</b>								
32 Number, 1920.....	4	24	24	28	26	9	2	16
33 Number, 1910.....		12		78	13	7		17
34 Capacity, 1920..... acre-feet..	457	463,641	270,995	11,252	19,505	2,884	60	3,724
35 Capacity, 1910..... acre-feet..		461,020		2,361	24,716	400,099		924
<b>Flowing wells:</b>								
36 Number, 1920.....				2	2			
37 Number, 1910.....						1		
38 Capacity, 1920..... gallons per minute..				6				
39 Capacity, 1910..... gallons per minute..						150		
<b>Pumped wells:</b>								
40 Number, 1920.....			3	2				
41 Number, 1910.....				1	1			
42 Capacity, 1920..... gallons per minute..			1,150					
43 Capacity, 1910..... gallons per minute..				660	55			
<b>Pumping plants:</b>								
44 Number, 1920.....			8	4	3		1	1
45 Number, 1910.....		1		2	2	1		1
46 Engine capacity, 1920..... horsepower..			72	373	44		26	16
47 Engine capacity, 1910..... horsepower..		1		18	16	1		6
48 Pump capacity, 1920..... gallons per minute..			5,120	4,900	1,505		1,200	1,100
49 Pump capacity, 1910..... gallons per minute..		6		1,360	855	17		250
50 Average lift, 1920..... feet.....			21	42	39		58	10
<b>CAPITAL INVESTED.</b>								
51 Capital invested to Jan. 1, 1920..... dollars..	23,195	5,640,280	1,642,905	1,098,497	892,577	729,264	859,652	170,920
52 Capital invested to July 1, 1910..... dollars..		4,233,566		550,599	129,949	367,634		62,101
53 Per cent of increase, 1910-1920.....				99.1	586.9			
54 Average cost per acre based on area enterprises were capable of supplying with water in 1920..... dollars..	21.05	46.44	15.12	12.16	19.07	4.91	16.99	19.83
55 Average cost per acre based on area enterprises were capable of supplying with water in 1910..... dollars..		39.03		4.82	5.78	2.86		6.45
<b>ESTIMATED FINAL COST.</b>								
56 Estimated final cost of existing enterprises in 1920..... dollars..	27,170	9,862,433	1,907,605	1,040,157	910,727	744,344	921,952	219,560
57 Estimated final cost of existing enterprises in 1910..... dollars..		4,233,566		550,599	129,949	367,634		62,101
58 Per cent of increase, 1910-1920.....				88.9	600.8			
59 Average cost per acre based on estimated final cost and area included in enterprises in 1920..... dollars..	19.04	54.57	14.52	9.57	15.81	3.34	15.28	17.51
60 Average cost per acre based on estimated final cost and area included in enterprises in 1910..... dollars..		15.96		4.68	1.43	2.63		5.17

<sup>1</sup> Formed from part of Converse County in 1913.

<sup>2</sup> Formed from part of Big Horn County in 1911; part taken to form part of Hot Springs County in 1913.

<sup>3</sup> Formed from part of Laramie County in 1913.

<sup>4</sup> Part taken to form Lincoln County in 1913.

<sup>5</sup> Formed from part of Big Horn County in 1913.

<sup>6</sup> Part taken to form Campbell County in 1913.

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# DRAINAGE

ROGER D. MARSDEN  
SPECIAL AGENT FOR DRAINAGE

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Condition of land in enterprises.....	559	571	585	593	605	617	625	641	649	657	665	675	683	691	703	708
Size of enterprises.....	559	571	585	593	605	617	625	641	649	657	665	675	683	691	703	708
Character of enterprises.....	560	572	585	594	606	618	626	641	649	658	666	675	684	691	704	708
Drainage works.....	561	574	586	595	607	618	627	642	650	658	666	676	685	693	704	711
Maintenance of works.....	562	574	587	596	607	619	628	643	651	659	667	677	686	693	705	711
Date of organization.....	562	575	587	596	607	619	628	643	651	659	667	677	686	694	705	711
Crops.....	563	575	587	597	608	619	629	644	651	659	668	677	686	694	705	712
<b>COUNTY TABLES.</b>																
I.—Drainage on farms: 1920.....	563	576	588	597	608	620	629	644	652	660	669	678	687	695	706	713
II.—Operating drainage enterprises: 1920.....	565	578	589	599	611	621	632	645	653	661	671	679	688	697	706	728

<sup>1</sup> Statistics for drainage on farms are given for all other states, while statistics for drainage enterprises are given for only Arizona, Nevada, New Mexico, Oklahoma, and Oregon.





Operating drainage enterprises shown in red

ENGRAVED BY U.S.G.S.

Scale 1:1875,000.

100 0 100 200 300 400 500 600 Miles



# DRAINAGE.

## INTRODUCTION.

### THE FIRST CENSUS OF DRAINAGE.

The act of Congress providing for the Fourteenth Census, in the paragraph defining the scope of the census of agriculture, provides: "Inquiries shall be made as to the quantity of land reclaimed by \* \* \* drainage and the crops produced; also as to the location and character of \* \* \* drainage enterprises, and the capital invested in such enterprises." No provision for inquiries regarding drainage had been contained in any previous census act, and nothing comparable to a census of drainage has been taken heretofore.

In gathering these statistics, some difficulties have been encountered incident to a new investigation, and some due to the nature of an improvement that is partly hidden beneath the ground surface and that usually operates more or less effectively for a few years, at least, without expense or attention. These difficulties will be indicated more specifically in the paragraphs regarding method of canvass and accuracy of the statistics. It is believed, however, that the information obtained gives a reasonably accurate idea of the amount of farm land provided with artificial drainage; also of the extent and condition of land in enterprises organized for securing drainage in units of considerable size, which are larger than individuals could undertake and which affect many landowners; of the utilization of that land for agriculture; of the nature and extent of the drainage improvement works of those enterprises; and of the capital invested in them.

### SCOPE OF THE DRAINAGE CENSUS.

The scope of the census of drainage is as defined in general terms by the act making provision for the Fourteenth Census. The number of farms having land provided with artificial drainage and the area of that land were determined, also the number of farms having land that needed drainage in order to be suitable for crops and the acreage of such land in farms. The area embraced in enterprises organized by a number of individuals to drain land that is used for agricultural purposes, or will be so used, also was determined, together with the condition of that land on the census date and before the drainage was undertaken. The figures for capital invested in enterprises to December 31, 1919, were obtained, with the estimated amounts required to complete construction of the improvement works authorized. The kind and amount of those works installed by the enterprises were learned.

The information concerning the character of the enterprises required that a study be made of the drainage statutes of the various states. The names of the principal crops raised on the drained land were obtained, but not the acreage devoted to each crop. In planning the census, it was deemed quite impracticable to attempt to segregate for each farm the crops produced upon land artificially drained.

The statistics for farms and farm acreage provided with artificial drainage include all the states; those for drainage enterprises omit Alabama, Virginia, and West Virginia, where no organized drainage enterprises of a public nature had begun actual construction of the improvements, and all states north of Potomac River.

Drainage census reports.—For each of the 29 states in which drainage of land for agriculture is most important, a separate drainage bulletin has been issued. These bulletins show by counties the number of farms and the land in farms reported as provided with artificial drainage, and likewise the number of farms and the additional farm acreage reported as needing such drainage. The part of this land that needs clearing also, to be suitable for growing crops, is given by counties. Acreage and capital invested for all organized enterprises, and the estimated additional investment required to complete the enterprises, are classified according to the progress of construction of the drainage works; according to the drainage basin; according to condition of the land as regards improvement, timber, and drainage condition; and according to character of the enterprises. For those undertakings that had completed or had begun actual construction by January 1, 1920, the classification is made also according to kind of drainage works, maintenance provided for those works, and date of organization of the enterprises. For the same enterprises the statistics are given by counties regarding area and condition of the land, kind and length of drains, area drained by pumping, cost of drainage per acre, increase in improved land since drainage was begun, and the principal crops grown upon the drained land.

A summary bulletin for the United States has been issued, of the same form and subject matter as the state bulletins, but giving the more detailed statistics by states instead of by counties.

This volume presents all the published statistics for drainage collected at the Fourteenth Census. Following the general discussion of results, the tabular and other matter in the United States summary and

the state bulletins are printed, together with similar information for the states for which no separate bulletins were issued.

**Schedules and method of canvass.**—The information regarding number of farms and farm acreage provided with artificial drainage or needing drainage, and the number of farms in drainage and levee districts, was obtained from the farm operators as a part of the general agricultural information by the enumerators who visited every farm.

The statistics relating to organized enterprises were secured on a special drainage schedule by special agents, except that enumerators were instructed to secure those schedules in the more remote sections where it was expected that few or no drainage enterprises would be found. The information relating to the enterprises was obtained from a present or former official of each enterprise, or from some landowner having personal knowledge of the undertaking, wherever practicable. Where a county board or some county official serves as the executive authority for all or a large number of drainage enterprises in the county, as is provided by the laws of several states, it was necessary that the statistics be compiled by the special agents from county records and other available sources. This information was verified as far as possible by consultation with county officials and with other persons having knowledge of drainage in the locality.

The appendix to this volume contains a copy of the drainage questions from the agricultural schedule and of the instructions to enumerators regarding those questions; it contains also a copy of the special drainage schedule, and of the instructions to special agents regarding the inquiries on that schedule.

#### DEFINITIONS AND EXPLANATION OF TERMS.

**Drainage of agricultural land.**—For determining the scope of the drainage census, the drainage of agricultural land was defined as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground for the purpose of improving the condition of the soil and crops. In this connection the area drained does not include land from which water flows without artificial aid into natural water courses; nor does it include land protected from overflow by levees, dikes, or embankments, nor areas guarded by trenches from the run-off from higher land, unless some form of drainage works has been constructed on the protected land.

The statistics for drainage naturally divide into two parts, one relating to the work which each farm owner may do independently and for himself only, the other relating to the work that is done by cooperation among a few or many landowners associated in some form of organization recognized by law. In

the census publications, the former has been designated as "drainage on farms," and the latter as "drainage enterprises;" terms used not uncommonly to distinguish these parts are "farm drainage" and "district drainage."

**Drainage on farms.**—Drainage on farms may be either inside or outside of drainage enterprises; that which is inside usually is connected with and supplemental to the work done by the enterprises.

The area provided with drainage, however, does not distinguish between land benefited by works of individual owners and that benefited by works of organized enterprises, but includes all the acreage of which the soil actually has been made of more value for agricultural purposes by drainage. Such temporary work as bedding the fields or laying out dead furrows to cause the surface water to flow away quickly is not considered as drainage, and the land thus treated has not been included in the statistics unless other more permanent drains also have been provided. Information was not obtained to show the amount of drainage on farms that is located within drainage enterprises.

The land needing drainage, in farms, is the area additional to that reported as provided with drainage, which could be made suitable for crops by drainage only, or by drainage and clearing. The acreage needing clearing was defined as that which was covered with trees, stumps, or perennial woody shrubs; the acreage covered with only grass, weeds, or other annual growth was considered not to need clearing.

**Drainage enterprises.**—Drainage enterprises comprise public and private corporations and local improvement districts organized to secure the drainage of land to be used for agricultural purposes; also government projects and other organizations engaged in extensive land drainage work. Schedules were obtained also for drainage undertakings, each to benefit 500 acres or more, by individual farm owners, and the figures are included in the statistics for enterprises. By the definition of drainage of agricultural land, mere flood-protection is not drainage, so statistics are not included for levee or diking districts that have not undertaken the construction of open ditches or tile drains.

Each drainage enterprise comprises that area organized into a separate drainage district, or assessed for the same public drain, or drained by works operated or constructed as a separate undertaking. In order to present the statistics by counties, an organized enterprise embracing land situated in more than one county was divided and a separate schedule was prepared for the part in each county; thus the number of enterprises given for each state represents the number of schedules, and exceeds the number of separate organizations if any enterprise in the state extends across a county boundary.



**Operating and nonoperating enterprises.**—The term "operating" has been applied by the census to those enterprises that had completed or had begun actual construction of the drainage improvement works, and the term "nonoperating" to those that had not begun construction, on or before January 1, 1920. This was deemed the most practicable way of dividing the actual from the prospective enterprises, though the completion of certain of those classed as nonoperating may be as little in doubt as the completion of many that were under construction on the census date.

**Land in enterprises and assessed acreage.**—The land in drainage enterprises is the acreage that has been or is to be benefited by drainage works constructed by the enterprises and, except in a few instances noted, is the land assessed to pay the cost of the enterprises. The exceptions are irrigation projects installing drains to benefit land damaged by seepage or by alkali as a result of the irrigation, and assessing the cost against the entire irrigation enterprise instead of against only the area needing drainage or protection. Under such circumstances the area thus assessed but not needing drainage has been omitted from the tabulations.

As some drainage enterprises are located wholly or partly within other enterprises, addition of the separate acreages would show more than the actual amount of land in the enterprises in some states and counties; therefore, in order to eliminate duplications, from the area in each enterprise was deducted the area situated in enterprises organized previously. The summation of the areas in the enterprises was tabulated and is shown as "assessed acreage," for comparison with the actual land in enterprises.

The condition of the land in enterprises, without respect to the amount of drainage needed or supplied, has been shown by dividing all the land into three classes—improved, timber and cut-over, and other unimproved land. The question on the drainage schedules asked for the percentage cultivated, but it is believed that all improved land in farms was so reported, and perhaps any other improved land in the enterprises. Timber and cut-over land is shown to indicate the amount of land that must be cleared as well as drained, to be fitted for agriculture, rather than the value of the land for lumbering operations.

To show the drainage condition, the acreage swampy, subject to overflow, or too wet for cultivation is stated, including the area damaged by seepage water and by alkali in those regions where irrigation is generally practiced. The condition of this part as to timber or improvement is not indicated. It is to be assumed that all land in drainage enterprises was in need of drainage before the improvement works were constructed. Nearly all the drainage laws imply, and many of them state, that no land shall be included in drainage districts or be assessed for drainage improvements unless it will be benefited by the works of the

enterprises. The area suffering a loss of crops shows the acreage which the owners or tenants planted to crops that suffered damage, either partial or complete, due to defective drainage. As the schedules were returned by special agents, effort was made to ascertain whether these figures included any land that merely would have been cultivated if it had been drained and protected against overflow, and to eliminate such acreages.

**Capital invested.**—The capital invested in drainage enterprises is the total cost of those enterprises. It includes the attorneys' fees, court costs, and other expenses for organizing the enterprises; the cost for engineering investigations and surveys, and for plans and specifications for the improvement works to be constructed; the purchase of land to be used as right of way for the ditches, and of land and buildings for other purposes necessary for the enterprise; the payment of awards to landowners claiming damages; expenditures for machinery and tools for constructing and maintaining the works; payments for labor, and payments to contractors for construction and installation of the improvements; expenses for supervision and administration; and any other items properly chargeable to drainage and paid by the enterprise. It does not include the cost of land or other property that is to be sold or used for any other purpose than the operation and maintenance of the drainage works, neither does it include the cost of operation for drainage pumping plants.

**Drainage works.**—The drainage works of an enterprise were defined to include all kinds of drains and all accessory structures for protecting the land in the enterprise against overflow or seepage and other waters that are constructed by or for the enterprise. Supplementary works constructed by private individuals or corporations were not included. The drains include both open ditches or canals, and covered or underground conduits of clay, concrete, wood, or other material. Ditches, as the term is used in the drainage census, include all open trenches artificially constructed or enlarged to drain away surface or soil waters; tile include all varieties of pipes, of whatever shape or material, placed beneath the surface of the ground in such manner as to permit the excess water to flow away. The dimensions of the ditches are expressed by the depth and the width of the ditch bottom; the size of tile, if circular, by the inside diameter in inches.

The accessory structures include all levees, dikes, dams, weirs, gates, sluices, pumping machinery, and other devices for draining away or controlling surface and soil waters. These are not considered drainage works in the strict sense of that term, but the cost of such accessory works as have been constructed by the drainage enterprises is included in the cost of those enterprises, and the other information is given in the statistics herein published.

Enterprises are called pumping districts if a part or all of the water from the drains is collected at some low point and must be raised by some form of machinery in order to be removed from the area. The type of drainage is the classification as to whether the drainage water is removed by pumping or by gravity. All kinds of machinery or devices for lifting the drainage water are classed as drainage pumps, and all varieties of engines or motors for operating those pumps are termed pumping engines.

#### ACCURACY OF THE STATISTICS.

**Drainage on farms.**—The figures relating to number of farms and farm acreage having drainage or needing drainage are probably as accurate as could be obtained, and sufficiently so for all practical purposes. The area provided with drainage could only be determined by the farm operator's estimate of the amount of land that had received benefit from the drains. The additional area that could be made suitable for crops by drainage, or by drainage and clearing, could only be estimated by the farm operator. It is not improbable that a few tenants or recent purchasers of farms did not report some land that actually had been artificially drained, through lack of knowledge of the work that had been done, but it is not believed such errors would affect the accuracy of the statistics.

A comparison of the figures by counties regarding number of farms in drainage and levee districts with the acreage in drainage enterprises indicates positively that in some states, at least, too few farms were so reported. The discrepancy undoubtedly is due in many instances to the fact that a new owner may not know of drainage assessments paid by a former possessor, and that a tenant may not be aware of payments for drainage work made by the owner. In other instances the enumerators or the farm operators may not have been properly diligent in answering all questions, and no answer regarding a drainage inquiry on the agricultural schedule was tabulated the same as an answer "No" or "None."

**Drainage enterprises.**—The land in drainage enterprises is believed to be reasonably accurate in most counties, and the acreage assessed subject to only such error as might be due to using approximations when exact figures were not obtainable by the persons making the canvass. Agents who were obliged to compile the figures from records found the information incomplete in several respects. In a few instances, drainage records of a county had been destroyed by fire, and in other cases some of the records had been misplaced or lost. The records frequently were incomplete and indefinite; acreages were not always given, and descriptions often were inadequate. Very often overlapping of enterprises could be determined only by platting the boundaries upon a map, no mention of such overlapping appearing in the records. For those counties where overlapping was believed to exist,

such platting was done as accurately as possible in the Census Bureau from the descriptions given on the schedules, and it is believed that the duplication of area thus determined is approximately correct.

In nearly all states, the number of enterprises stated is too large by reason of intercounty enterprises being counted in each county; otherwise, the number undoubtedly is correct for the states where each enterprise has a continuing existence and maintains the improvement works systematically. In some states, particularly Indiana, Michigan, and Ohio, new enterprises have been organized when old public drains have needed cleaning or enlarging, and the greater number of enterprises have been established for repairing, reconstructing, extending, and combining old ditches rather than for constructing new drains or for benefiting additional acreage.

The figures regarding capital invested should fairly represent the cash cost of the enterprises. In few of the cases where the work of construction was divided among the persons benefited, probably, was there a record made of the value of the work thus performed. It is known that the figures for a few counties include expenditures for repairing and extending the drains; it is probable that the same is true in some other counties. In states where it is customary to establish a new enterprise whenever an old drain is to be improved, the records give no basis for determining what amount should be considered as repair charges and what amount for new construction; no deduction has been made from the total cost of all the enterprises. Estimates of additional investments necessary to complete the works authorized are in some cases based upon contract prices for works under construction and in some cases upon engineers' estimates; the instructions to special agents explained that estimates were wanted for only works that had been authorized.

The condition of the land in drainage enterprises can be given only by estimates secured from the persons acquainted with the enterprises or with the localities. In the case of small enterprises mostly under cultivation, the estimates should be very nearly correct, but for large enterprises mostly undeveloped, for some counties the estimates of improved land in drainage enterprises exceeded the total improved land in farms as determined by the general census of agriculture. Under such circumstances a reduction was made in the bureau from the best information obtainable; the estimates thus determined have been indicated in the state reports. The figures for condition before drainage may be slightly less accurate than those for conditions on January 1, 1920. The condition before drainage does not refer to any specific date, but for each enterprise refers to the time when that enterprise was organized. In a number of counties where a great many enterprises have been completed, and the work has been done during a period of several decades, the figures for condition of land were obtained

as averages for all of each township or, in a few cases, for the county as a whole.

The lengths of completed and incompletd drains for enterprises having works under construction were computed on the assumption that the ditches and levees would be completed before the tile were installed. In some instances only lengths of completed drains were reported, and the statistics do not include the additional lengths to be installed to complete the improvements for which expenditures have been authorized. So far as was possible, deduction was made from the length of ditches in each enterprise to cover the amount that was merely enlarging or cleaning out a ditch tabulated in an earlier enterprise, or that was replacing such a ditch with tile, but in those states where maintenance and enlargement are done by organizing new enterprises the actual lengths of ditches probably are somewhat less than the figures show.

#### GENERAL DISCUSSION OF RESULTS OF DRAINAGE.

A complete analysis of all the statistics is not attempted. Such explanations are given as are deemed necessary to prevent a misunderstanding of the figures, and the significance of some of the more important items is noted. Maps have been used in the state bulletins and in the United States summary to show the approximate location and area of the operating drainage enterprises. Throughout the publications, effort has been made to give the statistics complete in tabular form so that the comparable figures would be brought close together and be most easily comprehended.

#### DRAINAGE ON FARMS.

The first drainage of land for agriculture was, naturally, by individual effort of each farm owner or operator upon his own farm. Though proper drainage many times requires cooperation by a great number of landowners, and most states have enacted laws specially designed to accommodate organized cooperative enterprises, the full benefits from the cooperative drainage works usually are not obtained until supplemental drains have been installed by the individual owners. It is known, however, that a few districts organized for draining irrigated land in western states have undertaken to drain and protect all the land in those enterprises so thoroughly that supplemental construction by the individual owners will be unnecessary. Land lying close to the outlet drains constructed by public enterprises also may be made more suitable for crop production by those drains. The statistics for artificial drainage provided on farms relate to the area actually improved by the installation of ditches, tile, or other drainage works. While no distinction is made between the land drained by individual effort and that benefited by the work of organ-

#### METHOD OF PRESENTING THE STATISTICS.

As has been stated previously, this volume contains all the statistics relating to drainage that have been printed by the census. In the discussion that follows, most of the data are grouped according to the nine geographic divisions of the country. The principal advantage of this arrangement is to combine the figures into a smaller number of divisions that are more easily comprehended than the larger number of individual states; it also makes easier the comparison of the statistics for neighboring states.

Since no census of drainage has been taken heretofore, no opportunity is afforded for making comparison with the status of drainage at some previous date, other than the classifications given by date of organization of the enterprises. However, the importance of drainage in agriculture is suggested by comparison of the acreages drained with the acreages of all land and with the acreages of improved land in farms.

ized enterprises, examination of the information obtained indicates that land receiving merely outlet facilities through the construction of public drains has not been included in this part of the statistics.

In presenting the figures for drainage on farms, it is recognized that undoubtedly there has been considerable difference in the conception of when land is provided with drainage. Where the more intensive methods of agriculture are not generally practiced, fields often are considered as drained if a few shallow ditches have been dug across or around them to carry away the surface water; elsewhere, in regions where expensive farm drainage is common, land will be said still to need drainage though many lines of tile may have been laid through it, if the excess moisture is not removed from the soil so promptly that there is no interference with farming operations and no diminution in the crop yield.

Need for drainage on farms.—In any region or locality, the amount of land that actually requires artificial drainage to make it suitable or most profitable for growing crops depends chiefly upon the topography, soil, and climate. A level ground surface, or dish-like pockets or depressions in a rolling surface, ordinarily must have more than the natural drainage before the land can have a high value for agriculture. A pervious subsoil or fissured stratum may provide natural drainage if it connects with some lower surface or subterranean watercourse. The amount and distribution of the rainfall and of the run-off from melting snow, particularly as related to the growing season and the kinds of crops suitable to the region, affect the practical sufficiency of the natural drainage. In the West where irrigation is generally practiced, seepage losses from canals and deep percolation from irrigated fields in a great many localities may water-log the soil

in depressions or at the foot of the benches, or may raise the water table sufficiently for evaporation from the ground surface to concentrate mineral salts, commonly called alkali, in the top soil until the crops are

injured or killed. The amount of land reported as needing drainage is affected, too, by the opinions of the farm operators regarding the potential value of the soil and the benefits that will accrue from drainage.

TABLE 1.—NUMBER OF FARMS AND LAND IN FARMS, PROVIDED WITH DRAINAGE AND NEEDING DRAINAGE: 1920.

DIVISION AND STATE.	NUMBER OF FARMS.						LAND IN FARMS.							
	All farms.	Provided with or needing drainage.		Provided with drainage.		Needing drainage.		All land in farms (acres).	Provided with drainage.		Additional needing drainage.			
		Number. <sup>1</sup>	Per cent of all farms.	Number.	Per cent of all farms.	Number.	Per cent of all farms.		Acres.	Per cent of all land in farms.	Acres.	Per cent of all land in farms.	Clearing required, also.	
											Acres.	Per cent of all land in farms.		
<b>United States.....</b>	<b>6,448,348</b>	<b>1,478,287</b>	<b>22.9</b>	<b>924,815</b>	<b>14.3</b>	<b>956,095</b>	<b>14.8</b>	<b>955,833,715</b>	<b>53,024,975</b>	<b>5.5</b>	<b>39,169,639</b>	<b>4.1</b>	<b>28,716,458</b>	<b>3.0</b>
<b>GEOGRAPHIC DIVISIONS:</b>														
New England.....	156,564	22,577	14.4	9,083	5.8	17,571	11.2	16,990,642	129,799	0.8	397,267	2.3	310,276	1.8
Middle Atlantic.....	425,147	102,567	24.1	61,549	14.5	69,216	16.3	40,572,901	1,673,638	4.1	1,412,038	3.5	906,128	2.2
East North Central.....	1,084,744	539,146	49.7	429,584	39.6	302,008	27.8	117,735,179	30,737,056	26.1	8,870,356	7.5	5,628,929	4.8
West North Central.....	1,096,951	256,388	23.4	163,714	14.9	169,593	15.5	256,973,229	11,758,939	4.6	7,260,539	2.8	3,073,154	1.2
South Atlantic.....	1,158,978	219,890	19.0	114,983	9.9	156,780	13.5	97,775,443	2,865,072	2.9	7,511,230	7.7	6,814,543	7.0
East South Central.....	1,051,600	150,536	14.3	69,597	6.6	106,972	10.2	78,897,463	1,720,517	2.2	4,279,968	5.4	3,817,828	4.8
West South Central.....	996,088	125,285	12.6	44,835	4.5	91,595	9.2	173,449,127	2,365,701	1.4	7,134,572	4.1	6,400,267	3.7
Mountain.....	244,109	21,740	8.9	9,754	4.0	14,988	6.1	117,337,226	456,015	0.4	969,948	0.8	640,589	0.5
Pacific.....	234,164	40,160	17.2	21,716	9.3	27,372	11.7	56,152,705	1,318,238	2.3	1,333,721	2.4	1,120,644	2.0
<b>NEW ENGLAND:</b>														
Maine.....	48,227	6,490	13.5	2,068	4.3	5,425	11.2	5,425,068	26,302	0.5	142,053	2.6	122,123	2.3
New Hampshire.....	20,523	2,351	11.5	1,013	4.9	1,794	8.7	2,603,806	11,777	0.5	40,783	1.6	30,869	1.2
Vermont.....	29,075	4,116	14.2	1,728	5.9	3,042	10.5	4,235,811	85,649	0.8	68,912	1.6	49,647	1.2
Massachusetts.....	32,001	5,736	17.9	2,955	9.2	4,112	12.8	2,494,477	39,022	1.6	30,833	3.2	59,671	2.4
Rhode Island.....	4,083	414	10.1	116	2.8	359	8.8	331,800	2,403	0.7	8,174	2.5	5,934	1.8
Connecticut.....	22,655	3,461	15.3	1,203	5.3	2,939	12.5	1,898,980	14,646	0.8	56,462	3.0	42,032	2.2
<b>MIDDLE ATLANTIC:</b>														
New York.....	193,195	56,496	29.2	33,896	17.5	39,523	19.9	20,632,803	1,180,423	5.7	779,467	3.8	460,602	2.2
New Jersey.....	29,702	6,712	22.6	4,903	16.5	3,428	11.5	2,282,585	174,260	7.6	77,881	3.4	48,688	2.1
Pennsylvania.....	202,250	39,369	19.5	22,760	11.2	27,265	13.5	17,657,513	318,955	1.8	554,690	3.1	396,838	2.2
<b>EAST NORTH CENTRAL:</b>														
Ohio.....	256,085	148,022	57.7	130,117	50.7	85,326	33.2	23,515,888	7,365,532	31.3	2,014,889	8.6	1,128,332	4.8
Indiana.....	205,126	122,268	59.6	111,435	54.3	66,413	32.4	21,063,832	8,308,844	39.4	1,717,068	8.2	1,043,116	5.0
Illinois.....	237,181	111,759	47.1	99,246	41.8	33,731	14.2	81,974,775	11,247,637	35.2	1,228,739	3.8	587,246	1.9
Michigan.....	196,447	95,215	48.5	66,948	34.1	64,310	32.7	19,032,961	3,156,632	16.6	2,070,387	10.9	1,490,574	7.8
Wisconsin.....	189,295	61,882	32.7	21,838	11.5	52,228	27.6	22,148,223	658,411	3.0	1,839,273	8.3	1,377,661	6.2
<b>WEST NORTH CENTRAL:</b>														
Minnesota.....	178,478	93,453	52.4	53,011	29.7	73,906	41.4	30,221,758	2,983,034	9.9	3,504,574	11.6	1,703,117	5.6
Iowa.....	213,439	107,746	50.5	88,865	41.6	56,083	26.3	35,474,896	7,334,404	21.9	2,052,942	6.1	391,198	1.2
Missouri.....	263,004	26,653	10.9	11,917	4.5	19,572	7.4	34,774,679	859,663	2.5	830,693	2.4	667,515	1.9
North Dakota.....	77,690	3,147	4.1	682	0.9	2,669	3.4	36,214,751	89,054	0.2	211,305	0.6	158,144	0.4
South Dakota.....	74,637	13,918	18.6	4,077	5.5	11,828	15.8	34,636,491	161,371	0.5	446,915	1.3	90,866	0.3
Nebraska.....	124,417	4,701	3.8	2,356	1.9	2,963	2.4	42,225,475	214,428	0.5	145,818	0.3	30,393	0.1
Kansas.....	165,266	4,768	2.9	2,806	1.7	2,573	1.6	46,426,179	106,985	0.2	68,292	0.2	81,921	0.1
<b>SOUTH ATLANTIC:</b>														
Delaware.....	10,140	5,114	50.4	4,246	41.9	2,488	24.5	944,511	185,831	19.7	68,969	7.3	61,002	6.5
Maryland.....	47,908	10,964	22.9	6,911	14.4	6,658	13.9	4,757,999	249,799	5.3	184,820	3.9	151,563	3.2
District of Columbia.....	204	30	14.7	21	10.3	12	5.9	115	197	3.5	115	2.0	57	1.0
Virginia.....	186,242	32,854	17.6	9,899	5.3	27,740	14.9	18,561,112	225,068	1.2	1,172,580	6.3	1,085,388	5.9
West Virginia.....	87,289	11,238	12.9	1,949	2.2	10,304	11.8	9,569,790	88,464	0.4	310,868	3.2	278,515	2.9
North Carolina.....	269,763	65,976	24.5	45,246	16.8	42,247	15.7	20,021,736	1,066,933	5.3	1,925,343	9.6	1,735,942	8.7
South Carolina.....	192,692	40,015	20.8	26,903	14.0	24,508	12.7	12,426,675	676,152	5.4	1,341,903	10.8	1,216,355	9.8
Georgia.....	310,732	42,912	13.8	15,121	4.9	34,337	11.1	25,441,061	274,688	1.1	1,819,611	7.2	1,676,424	6.6
Florida.....	54,005	10,787	20.0	4,597	8.5	8,486	15.7	6,046,691	147,940	2.4	687,021	11.4	599,207	9.9
<b>EAST SOUTH CENTRAL:</b>														
Kentucky.....	370,626	23,424	6.3	5,817	1.6	19,592	5.3	21,612,772	225,228	1.0	573,299	2.7	439,110	2.0
Tennessee.....	262,774	26,739	10.2	8,887	3.4	20,997	8.0	19,510,856	254,118	1.3	640,479	3.3	563,835	2.9
Alabama.....	256,099	46,675	18.2	19,967	7.8	36,511	14.3	19,576,856	415,293	2.1	1,610,656	8.2	1,460,628	7.5
Mississippi.....	272,101	53,698	19.7	34,926	12.8	29,872	11.0	18,196,979	826,878	4.5	1,455,534	8.0	1,304,355	7.2
<b>WEST SOUTH CENTRAL:</b>														
Arkansas.....	232,604	43,223	18.6	13,426	5.8	33,437	14.4	17,456,750	497,489	2.8	1,642,403	9.4	1,512,416	8.7
Louisiana.....	135,468	31,964	23.6	21,271	15.7	14,935	11.1	10,019,822	1,004,935	10.0	1,095,769	10.9	916,464	9.1
Oklahoma.....	191,988	9,366	4.9	2,032	1.1	8,065	4.2	31,951,934	107,014	0.3	255,786	0.8	225,998	0.7
Texas.....	436,983	40,732	9.3	8,106	1.9	35,108	8.1	114,020,621	756,263	0.7	4,130,614	3.6	3,745,389	3.3
<b>MOUNTAIN:</b>														
Montana.....	57,677	2,222	3.9	756	1.3	1,728	3.0	35,070,656	51,148	0.1	113,293	0.3	76,951	0.2
Idaho.....	42,106	3,704	8.8	1,167	2.8	2,895	6.9	8,375,873	64,648	0.8	199,874	2.4	162,308	1.9
Wyoming.....	15,748	1,430	9.1	433	2.7	1,127	7.2	11,809,351	85,654	0.8	68,066	0.6	45,229	0.4
Colorado.....	80,934	6,138	10.2	2,749	4.6	4,399	7.3	24,462,014	127,037	0.5	270,997	1.1	190,376	0.8
New Mexico.....	29,844	1,990	6.7	1,294	4.3	998	3.3	24,409,633	47,311	0.2	49,102	0.2	20,088	0.1
Arizona.....	9,975	560	5.6	241	2.4	435	4.4	5,802,126	9,651	0.2	41,951	0.7	32,355	0.6
Utah.....	26,662	5,068	19.7	2,729	10.6	3,085	12.0	5,050,410	74,316	1.5	165,926	3.3	91,140	1.8
Nevada.....	3,163	638	20.2	385	12.0	321	10.1	2,367,168	46,262	2.0	59,739	2.6	21,644	0.9
<b>PACIFIC:</b>														
Washington.....	66,288	19,155	28.9	10,020	15.1	14,323	21.6	13,244,720	374,696	2.1	576,005	4.3	530,799	4.0
Oregon.....	80,206	13,450	26.8	6,618	13.9	9,862	19.6	13,542,318	229,582	1.7	471,396	3.5	396,333	2.9
California.....	117,670	7,553	6.4	5,078	4.3	3,187	2.7	29,385,667	813,960	2.8	286,320	1.0	193,512	0.7

<sup>1</sup> There are 402,623 farms reported as having both land provided with drainage and additional land needing drainage.

The conditions influencing the need for artificial drains to remove water from the ground surface are generally recognized, while the unfavorable conditions that could be eliminated or mitigated by better drainage of the soil itself are not generally recognized. Lack of drainage makes a soil hard and lumpy when dry, difficult to cultivate and unsuited to the development of plant roots or to the release of plant food; it keeps the soil acid or "sour," counteracting the inherent fertility; it keeps the soil cold, delaying planting in the spring; and when only part of a field has poor drainage, it interferes with cultivation of the other parts. In the irrigated region, the need of protection against seepage and alkali often is not recognized until injury has resulted. If the benefits to be derived from soil drainage were more generally understood, undoubtedly in some sections a larger acreage would have been reported as needing drainage. The statistics given, as previously explained, relate only to the land included in farms on the date of the census.

**Number of farms having drainage.**—The figures in Table 1 show rather less than one-fourth (22.9 per cent) of all the farms in the United States as having land that has needed or does need artificial drainage. The percentages of such farms range from 8.9 for the Mountain division to 49.7 per cent for the East North Central division; for the individual states they range from 2.9 for Kansas to 59.6 for Indiana. For all the 1,478,287 farms not having adequate natural drainage, 35.3 per cent have provided the additional drainage recognized as necessary, 27.2 per cent have provided part of the work, and 37.4 per cent have yet to begin construction of the artificial drains required in order that the land may be most fully available for growing crops.

**Area provided with drainage.**—Drainage of farm land is most universally practiced in northern Indiana and the adjacent parts of Illinois and Ohio. This kind of farm improvement is general also in north central Iowa and southeastern Michigan, and it is common in southern and northwestern Minnesota, in

western New York, between the Delaware and Chesapeake Bays, in the coastal plain of the Carolinas, Louisiana, and eastern Texas, along lower Mississippi River, and in the San Joaquin Valley of California.

Table 1 shows that 9.6 per cent of all land in farms in the United States was reported as having been provided with artificial drainage or to be in need of that improvement. The portions in the geographic divisions and states range from 1.2 per cent for the Mountain division to 33.6 per cent for the East North Central division, and from 0.4 per cent for Kansas, Montana, and New Mexico to 47.6 per cent for Indiana.

Of the total area that has or requires artificial drainage on farms, the greatest portion is in the East North Central division, which embraced 43.0 per cent of all that land at the beginning of 1920. The West North Central division has the second largest portion, 20.6 per cent. Illinois has a greater area of such land than any other state, having 13.5 per cent of the total; Indiana has 10.9 per cent and Iowa and Ohio each has 10.2 per cent.

It was deemed impracticable to undertake to secure information regarding the kind and amount of drains, or the cost or value of the drainage provided. Seldom would an operator have definite knowledge of the work that was done before he came upon the farm. It is even probable that some land which was provided with tile drainage many years ago has been omitted from the enumeration because the present operator was entirely ignorant of the fact that such work had been done, but it is not supposed that the total of such omissions would materially affect the statistics obtained.

**Farms in drainage enterprises.**—The census of agriculture endeavored to learn the number of farms in drainage and levee districts, asking of each farm operator, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, county, or by a private company or individual?"

TABLE 2.—FARMS REPORTED IN DRAINAGE AND LEVEE DISTRICTS: 1920.

DIVISION.	Number of all farms.	FARMS IN DRAINAGE AND LEVEE DISTRICTS.		Approximate land area (acres).	LAND IN OPERATING DRAINAGE ENTERPRISES.		IMPROVED LAND IN FARMS.				
		Number.	Per cent of all farms.		Acreage.	Per cent of total land area.	For all farms.		For farms in drainage enterprises.		
							Total acreage.	Average per farm (acres).	Total acreage.	Per farm.	
								Acreage.	Per cent of average for all farms.		
United States <sup>1</sup> .....	5, 278, 750	168, 840	3. 2	1, 717, 932, 160	65, 495, 038	3. 8	441, 728, 054	83. 7	44, 288, 235	* 262. 3	313. 4
East North Central.....	1, 084, 744	63, 789	5. 9	157, 160, 960	31, 627, 176	20. 1	87, 894, 835	81. 0	25, 282, 065	* 396. 3	489. 3
West North Central.....	1, 096, 951	47, 883	4. 4	326, 914, 560	19, 217, 367	5. 9	171, 394, 439	156. 2	11, 630, 279	242. 9	155. 5
South Atlantic <sup>1</sup> .....	827, 193	5, 213	0. 6	123, 405, 440	2, 385, 384	1. 9	29, 735, 048	35. 9	388, 345	74. 5	267. 6
East South Central <sup>1</sup> .....	795, 501	16, 938	2. 1	82, 067, 200	2, 323, 595	2. 8	34, 488, 725	43. 4	1, 349, 791	79. 7	183. 6
West South Central.....	996, 083	25, 010	2. 5	275, 037, 440	7, 924, 197	2. 9	64, 189, 606	64. 4	3, 877, 166	155. 0	249. 7
Mountain.....	244, 109	3, 551	1. 5	549, 785, 780	810, 076	0. 1	30, 105, 868	123. 3	635, 868	179. 1	145. 3
Pacific.....	234, 164	6, 456	2. 8	203, 580, 800	1, 207, 243	0. 6	23, 921, 533	102. 2	1, 124, 721	174. 2	170. 5

<sup>1</sup> Omitting Alabama, Virginia, West Virginia, and all states north of Potomac River.  
<sup>2</sup> Those figures indicate that, especially in the East North Central states, the actual number of farms in drainage and levee districts is greater than the number so reported.

Computation of the average acreage of improved land per farm in drainage enterprises, in comparison with the average improved acreage for all farms, indicates that the number of farms reported as in such enterprises is much less than the actual number so included. (See Table 2.) The discrepancy is much more evident when comparisons are made for individual states and counties.

#### DRAINAGE ENTERPRISES.

Statistics were collected relating to both operating and nonoperating drainage enterprises. Concerning many of the nonoperating enterprises, complete information could not be secured because plans for the improvement works had not been completed, and the cost of the enterprise, and even the area to be included, were in some instances more or less uncertain. Therefore it is expedient, in much of the discussion that follows, to consider only the operating enterprises.

**Character of enterprises.**—It is a general condition in considerable parts of most states that the drainage of one individual's land can not be obtained without the construction of an artificial drain or the improvement of a natural watercourse through the land of another individual, or without materially benefiting other owners. Usually, under such circumstances the cost of the outlet drain is much greater than the benefit to any one farm, and much greater than any of the individuals could assume. In order that some farm owners may not be prevented from obtaining such drainage as is necessary for the full utilization of their land, and that the expense of reclaiming or improving considerable areas may be equitably apportioned, very nearly all of the states have recognized, directly or tacitly, that drainage of land for agriculture is a public good, and have passed laws permitting or encouraging the organization of public corporations or local improvement districts for this purpose.

Drainage laws have been enacted in all the states covered by the census of organized drainage enterprises. These statutes for each state are abstracted briefly in the bulletin for that state. The year in which the first general statute authorizing such organizations was enacted in each state is shown in Table 3. Before these dates, many enterprises were authorized by special acts of the legislatures, each act creating a special district. The information secured by the census indicates, however, that most if not all of those early districts have been abandoned or have been reorganized under later statutes. There are still a considerable number of special districts, particularly in Arkansas, California, and Florida, created either because the general laws were defective or because the promoters of the projects deemed it easier to secure special legislation than to adapt their plans to the laws then in force and perhaps not fully tested in practice.

TABLE 3.—DATES OF FIRST GENERAL LAWS AUTHORIZING THE ESTABLISHMENT OF PUBLIC DRAINAGE ENTERPRISES, BY STATES.

[Statutes authorizing merely the construction of levees, or drainage for sanitary purposes, are not included.]

STATE.	Year.	STATE.	Year.
Michigan.....	1847	Colorado <sup>1</sup> .....	1893
Ohio.....	1847	Florida.....	1893
Indiana.....	1852	Kentucky.....	1893
South Carolina.....	1856	Texas.....	1895
Minnesota.....	1858	Utah.....	1896
Missouri.....	1859	Mississippi <sup>2</sup> .....	1898
Wisconsin.....	1862	Idaho <sup>4</sup> .....	1903
Illinois.....	1865	Montana.....	1905
California.....	1868	Oklahoma.....	1906
North Carolina.....	1869	Virginia.....	1906
Kansas.....	1870	Tennessee.....	1909
Iowa.....	1872	Georgia.....	1911
Nebraska.....	1873	Nevada.....	1911
Washington <sup>1</sup> .....	1875	Wyoming.....	1911
Oregon.....	1880	Arizona.....	1912
North Dakota <sup>1</sup> .....	1883	New Mexico.....	1912
South Dakota <sup>1</sup> .....	1883	Alabama.....	1915
Louisiana.....	1888	West Virginia.....	1917
Arkansas.....	1931		

<sup>1</sup> These first statutes were enacted by the territories before admission as states.

<sup>2</sup> A law was enacted in 1883 and repealed in 1885.

<sup>3</sup> A law applying only in Lee County was enacted in 1886.

<sup>4</sup> This statute was declared unconstitutional in 1912, and a new law was enacted in 1913.

Table 4 shows, by periods, the date of organization of the first public drainage enterprise in each state as reported upon the schedules secured. Undoubtedly enterprises were organized before 1860 in Michigan as well as in Indiana and Ohio, as laws providing for the establishment of public drains were enacted as early as 1847. Then all the East North Central and West North Central states except the Dakotas had organized drainage enterprises before 1890, and before any other states except California and North Carolina.

TABLE 4.—DATE OF ORGANIZATION OF FIRST DRAINAGE ENTERPRISES REPORTED, BY STATES.

DATE OF ORGANIZATION.	STATES.
Before 1860.....	Indiana, Ohio.
1860 to 1869.....	California.
1870 to 1879.....	Illinois, Iowa, Kansas, Wisconsin.
1880 to 1889.....	Minnesota, Missouri, Nebraska, North Carolina. <sup>1</sup>
1890 to 1899.....	Kentucky, Louisiana, Michigan, <sup>2</sup> Mississippi, North Dakota.
1900 to 1904.....	Texas, Washington.
1905 to 1909.....	Arkansas, Florida, Montana, New Mexico, Oklahoma, South Dakota, Utah.
1910 to 1914.....	Arizona, Colorado, Georgia, <sup>3</sup> Idaho, South Carolina, Tennessee, Wyoming.
1915 to 1919.....	Nevada, Oregon.

<sup>1</sup> The enterprises reported in North Carolina before 1880 were under individual ownership.

<sup>2</sup> The canvass in Michigan omitted the enterprises established before 1897.

<sup>3</sup> The enterprises reported in Georgia before 1910 were under individual ownership.

Previous to the earliest acts for establishing public drains, a number of the states had recognized the right of every landowner to a drainage outlet by providing that an owner desiring drainage might apply to a designated official, and, if the necessity were proved, upon payment of damages secure easement to construct and maintain a private drain across his neighbor's land. The first of these laws were enacted by North Carolina in 1795, Florida in 1834, Michigan in 1839, Tennessee in 1842, and Virginia in 1848. Such private drains, however, are not generally included in the census statistics for drainage enterprises.

There are many shades of difference between the drainage laws of the various states, but there are in



general two principal types of organization. The corporate district is governed by its own officers, who either are elected by the residents or land owners of the district, or are specially appointed by the authority which creates the enterprise. The county drain is established and constructed as any other public work or local improvement, the enterprise being managed by regular officers who have charge of all these enterprises in their county. Some enterprises are administered by a commission or board consisting of one or more officials of the county and one or more members selected by the owners of the land assessed for the cost of the drainage.

The drainage districts and county drains represented, on January 1, 1920, 96 per cent in area of all the organized drainage enterprises, and 94 per cent in amount of capital invested. The other enterprises included in the statistics are township drains, similar in form to county drains but controlled by officers of the townships; state drainage projects controlled by state officials and embracing considerable amounts of state land; irrigation districts, similar in character to drainage districts, that have undertaken drainage of land in those districts; irrigation projects of the United States Reclamation Service; commercial companies reclaiming and improving wet land for sale; and individual owners draining as much as 500 acres each, to be used for agricultural purposes. The total acreage and capital invested in all drainage enterprises are shown classified by character of enterprise in Table 6, page 369.

**Area in drainage enterprises.**—The area embraced in all the organized drainage enterprises is approximately 69,419,859 acres. This is 3.65 per cent of the total land area of the United States, and 4.04 per cent of the land area of the 34 states included in the census of drainage enterprises. Nearly half (46.2 per cent) of the land in these enterprises is situated in the East North Central division, and more than a fourth (28.7 per cent) in the West North Central division. The West South Central division has 13.1 per cent of the total, and none of the others has more than 5 per cent.

The area in operating drainage enterprises is 65,495,038 acres, 94.3 per cent of that in all enterprises. The location and area of these enterprises are shown by the map following page 345, and by the state and county tables. The single states having the largest areas in operating enterprises are, in order, Michigan, Minnesota, and Indiana, each with more than 9,000,000 acres. Of the 3,924,821 acres in nonoperating enterprises, 1,138,283 acres are reported in Arkansas and Louisiana together, and more than 1,000,000 acres in Florida. State Table II, page 373, shows also the distribution of the land in nonoperating enterprises by geographic divisions and states.

The drainage works authorized to be constructed by the enterprises have been completed for 56,763,751

acres. This may be interpreted as indicating that the farms in this area have been at least fairly well provided with main or outlet drains. In some regions it is customary for the drainage districts to construct the drainage systems in such detail that a public drain will reach each farm; in other regions, where there is much unimproved land not in farms, a large district may construct only the main ditches that will serve the area as a whole, leaving the branch drains for construction by subdistricts to be organized as the landowners in those sections to be benefited by the respective branches may desire the improvements. Of the enterprises that have completed construction, 53.7 per cent in area is in the East North Central division and 29.9 per cent in the West North Central division. In each of the South Atlantic, Mountain, and Pacific divisions, the enterprises that have completed the authorized works comprise less than 1,000,000 acres.

The enterprises that were constructing drainage works on January 1, 1920, comprised 8,731,287 acres, of which more than 2,000,000 acres are situated in each of the West North Central and West South Central divisions and more than 1,000,000 acres each in the East North Central and South Atlantic divisions. In Arkansas and Florida together there are 2,640,150 acres in the partly completed enterprises. In some of these enterprises that are nearing completion a considerable part of the land may have been completely drained, and in others that had been started but recently no benefit may have yet been secured.

The condition of the land in drainage enterprises, both operating and nonoperating, is shown in State Table IV, page 375. As has already been explained, the entire acreage in the enterprises is divided under the three headings, improved, timber and cut-over, and other unimproved land, and the area reported as swampy or subject to overflow includes land injured by seepage or alkali and is partly timbered and partly open or cleared land.

The portions improved of the total areas in operating enterprises range from 16.3 per cent in the South Atlantic division to 79.9 in the East North Central division and 93.2 per cent in the Pacific division, the average for the United States being 67.6 per cent. The states having the greatest portions improved of all land in operating enterprises are Oregon and California, for which the percentages are 100.0 and 93.7, respectively. The improved portion in nonoperating drainage enterprises is 35.1 per cent for all the states, varying from 3.5 per cent for the South Atlantic division to 72.1 per cent for the Mountain division. The states having the largest portions are Kansas, with 93.4 per cent, and Arizona, with 87.9 per cent.

The percentage improved of all land in operating drainage enterprises is greater than the percentage improved of all land in farms for the United States as a whole, and for each geographic division except

the West North Central and the South Atlantic. For nonoperating enterprises the percentages improved are less than the averages for all farms, except in the Mountain and Pacific divisions where so large a part of the enterprises are for draining irrigated land.

Of the unimproved land in operating enterprises, slightly more than half is covered with timber, stumps, or other growth that will necessitate more or less expensive clearing in addition to drainage, to make it fully available for cultivation. The amount of land covered with merchantable timber was not determined by the census, nor were inquiries made to learn what part of all land in the enterprises is included in farms. In the nonoperating enterprises the relation between timbered and cleared land is roughly the same as for the operating enterprises, in all the divisions and in most of the states, suggesting that the open land has not been developed after drainage to any remarkably greater proportion than the timbered land. This fact is shown by the statistics for development of land in State Table V (pages 376 to 379), which show that in the operating enterprises the area timbered or cut-over prior to drainage has been reduced 48.1 per cent, and the other unimproved land 48.2 per cent for the United States as a whole. The percentages for the geographic divisions and for the individual states vary considerably, but the figures seem to indicate that development and utilization of the land usually have been determined by other conditions than the amount of clearing required. The amount of timber and stumps and the cost of clearing undoubtedly have their influence in determining whether any particular enterprise shall be organized.

**Crops on drained land.**—The crops grown upon the drained land generally are those most common to the regions in which the drainage enterprises are situated. The area actually devoted to any crop was not determined in any instance, but corn was reported as the principal crop by enterprises embracing 61 per cent of the improved land in all operating enterprises in the United States. It was reported as the principal crop by enterprises having 55 to 72 per cent of the improved land in enterprises in the East and West North Central and the South Atlantic divisions, and by enterprises having the greatest improved acreages in 12 of the 34 individual states canvassed. Wheat was reported the principal crop for Michigan, Minnesota, North Dakota, Kansas, Montana, and California; cotton for South Carolina, Mississippi, Arkansas, Oklahoma, and Arizona; vegetables for Florida; sugar cane for Louisiana; hay for Wisconsin; and alfalfa for Washington, Oregon, and the Mountain states except Arizona and Montana.

#### DRAINAGE WORKS OF ENTERPRISES.

**Drains and levees.**—The improvement works of the operating drainage enterprises consist of 107,468.2

miles of open ditches and 42,311.7 miles of tile drains completed, and 4,301.8 miles of ditches and 2,862.1 miles of tile drains under construction, together with accessory levees, pumping plants, and appurtenant structures. Of the levees, 3,519.8 miles had been completed and 810.2 miles additional were under construction at the beginning of 1920.

More than half the open ditch drains and more than half the tile drains constructed by organized enterprises are located in the East North Central states, and 40 per cent of the tile are in the West North Central states. The length of the open ditches is very much greater than the length of tile drains for the United States as a whole, and for each geographic division except the Mountain states, where the length of tile drains is two and one-half times as great as the length of open ditches (see Table 5). The drainage there is almost entirely for the reclamation or protection of land under irrigation, and in soils containing so-called alkali the ground water table should be kept below the range of capillarity to prevent evaporation from the ground surface and the concentration of the alkali in the top soil with the consequent injury to crops. Where the required capacity is much less than that of an open ditch of the necessary depth, covered tile drains of clay, concrete, or wood, though often more costly, usually have many advantages.

TABLE 5.—DRAINAGE WORKS OF OPERATING ENTERPRISES, CLASSIFIED BY KIND AND BY GEOGRAPHIC DIVISIONS: 1920.

KIND OF WORKS.	ALL AUTHORIZED.		Completed (miles).	Under construction (miles).
	Miles.	Per cent of total.		
<b>UNITED STATES:</b>				
Total.....	161,273.8	100.0	153,299.7	7,974.1
Open ditches.....	111,770.0	69.3	107,468.2	4,301.8
Tile drains.....	45,173.8	28.0	42,311.7	2,862.1
Levees and dikes.....	4,330.0	2.7	3,519.8	810.2
<b>EAST NORTH CENTRAL:</b>				
Total.....	90,007.2	100.0	89,115.9	891.3
Open ditches.....	65,333.2	72.6	64,924.3	408.9
Tile drains.....	23,694.8	26.3	23,325.2	369.6
Levees and dikes.....	979.2	1.1	866.4	112.8
<b>WEST NORTH CENTRAL:</b>				
Total.....	43,837.0	100.0	41,720.6	2,116.4
Open ditches.....	24,658.3	56.2	23,912.7	745.6
Tile drains.....	18,394.3	42.0	17,109.3	1,285.0
Levees and dikes.....	784.4	1.8	698.6	85.8
<b>SOUTH ATLANTIC:</b>				
Total.....	5,441.7	100.0	3,914.8	1,526.9
Open ditches.....	4,031.0	90.6	3,701.6	1,229.4
Tile drains.....	262.5	4.8	101.5	161.0
Levees and dikes.....	248.2	4.6	111.7	136.5
<b>EAST SOUTH CENTRAL:</b>				
Total.....	4,169.7	100.0	3,631.4	538.3
Open ditches.....	3,692.9	88.6	3,256.9	436.0
Tile drains.....	380.6	9.1	325.3	55.3
Levees and dikes.....	96.2	2.3	49.2	47.0
<b>WEST SOUTH CENTRAL:</b>				
Total.....	9,861.4	100.0	8,318.7	1,542.7
Open ditches.....	8,906.8	90.3	7,672.8	1,234.0
Tile drains.....	22.6	0.2	20.6	2.0
Levees and dikes.....	932.0	9.5	625.3	306.7
<b>MOUNTAIN:</b>				
Total.....	3,115.0	100.0	2,113.4	1,001.6
Open ditches.....	863.8	27.7	827.7	36.1
Tile drains.....	2,213.7	71.1	1,248.2	965.5
Levees and dikes.....	37.5	1.2	37.5	.....
<b>PACIFIC:</b>				
Total.....	4,841.8	100.0	4,484.9	356.9
Open ditches.....	3,384.0	69.9	3,172.2	211.8
Tile drains.....	205.3	4.2	181.6	23.7
Levees and dikes.....	1,252.5	25.9	1,131.1	121.4



The length of levees for the drainage enterprises is less than 3 per cent of the length of ditches and tile drains authorized for the whole country, but in the Pacific states slightly more than one-third as much as the total length of the drains.

When the works under construction have been completed, the drains provided by the enterprises will be all open ditches for three-fourths of the land in the operating enterprises. For one-sixth of the area, systems combining tile and open drains will be used, and for the remaining small amount tile drains only. The areas in operating enterprises in each geographic division are thus classified by kind of works in Table 6, which shows also the average length of drain per acre.

TABLE 6.—AREA DRAINED AND LENGTH OF DRAINS PER ACRE FOR OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINS AND GEOGRAPHIC DIVISIONS: 1920.

KIND OF DRAIN.	AREA DRAINED.		LENGTH OF DRAINS.		
	Acreage.	Per cent of total.	Total authorized (miles).	Per acre.	
				Feet.	Per cent of mean.
<b>UNITED STATES:</b>					
Total or mean.....	65,495,038	100.0	156,943.8	12.7	100.0
Open ditches only.....	49,314,485	75.3	93,244.3	10.0	78.7
Tile drains only.....	4,974,261	7.6	23,204.4	24.6	193.7
Open ditches and tile drains.....	11,206,292	17.1	40,495.1	19.1	150.4
<b>EAST NORTH CENTRAL:</b>					
Total or mean.....	31,627,176	100.0	89,028.0	14.9	100.0
Open ditches only.....	21,330,687	67.5	51,959.9	12.9	86.6
Tile drains only.....	3,038,495	9.8	12,524.0	21.3	143.0
Open ditches and tile drains.....	7,188,994	22.7	24,544.1	18.0	120.8
<b>WEST NORTH CENTRAL:</b>					
Total or mean.....	19,217,367	100.0	43,052.6	11.8	100.0
Open ditches only.....	14,301,750	74.4	20,885.3	7.7	65.3
Tile drains only.....	1,747,658	9.1	10,096.3	30.5	258.5
Open ditches and tile drains.....	3,167,959	16.5	12,070.0	20.1	170.8
<b>SOUTH ATLANTIC:</b>					
Total or mean.....	2,385,384	100.0	5,193.5	11.5	100.0
Open ditches only.....	2,378,184	99.6	4,818.0	10.7	93.0
Tile drains only.....					
Open ditches and tile drains.....	19,200	0.4	377.5	216.7	1,894.8
<b>EAST SOUTH CENTRAL:</b>					
Total or mean.....	2,323,695	100.0	4,073.5	9.3	100.0
Open ditches only.....	2,263,610	97.4	3,548.3	8.3	89.2
Tile drains only.....	8,917	0.4	115.0	68.1	732.3
Open ditches and tile drains.....	51,068	2.2	410.2	42.4	455.9
<b>WEST SOUTH CENTRAL:</b>					
Total or mean.....	7,924,197	100.0	8,929.4	5.9	100.0
Open ditches only.....	7,882,741	99.5	8,809.2	5.9	100.0
Tile drains only.....	3,100	(*)	20.0	34.1	578.0
Open ditches and tile drains.....	38,356	0.5	100.2	18.8	233.9
<b>MOUNTAIN:</b>					
Total or mean.....	810,076	100.0	3,077.5	20.1	100.0
Open ditches only.....	242,028	29.9	451.0	9.8	48.8
Tile drains only.....	105,625	13.0	402.8	20.2	100.5
Open ditches and tile drains.....	462,423	57.1	2,223.7	25.4	126.4
<b>PACIFIC:</b>					
Total or mean.....	1,207,243	100.0	3,539.3	15.7	100.0
Open ditches only.....	908,485	75.3	2,773.6	16.1	102.5
Tile drains only.....	10,566	0.9	46.3	23.1	147.1
Open ditches and tile drains.....	288,192	23.9	769.4	14.1	89.8

\* All individual ownership enterprises.  
 † Less than one-tenth of 1 per cent.

It is to be understood that these figures are only approximations. Owing to the method of eliminating the overlapping of enterprises, as previously explained, the classification of land by drainage works was made according to the kind of works provided by the first

enterprise embracing any particular area. To correct the errors in this classification would increase the area shown for open ditches and tile together, and decrease the areas for open ditches only and for tile drains only. While some ditches have been replaced by tile drains, and probably a few tile by open drains, it is not probable that such changes would offset more than a small part of those in which ditches or tile have been supplemented by tile or ditches, respectively.

The average length of all drains per acre varies from 5.9 feet to 20.1 feet for the geographic divisions, and is 12.7 feet for the United States as a whole. These lengths are equivalent to parallel drains 1.40, 0.41, and 0.65 miles apart, respectively, without making any deduction of length for connecting one drain with another. The figures for the United States show an equivalent of drains 0.83 mile apart for drainage by open ditches only, and 0.34 mile apart for tile drains only, without deducting for connections.

The earliest drains constructed by public drainage enterprises were mostly open ditches. This was natural, because tile were relatively costly and were not generally made in large sizes; land was sufficiently plentiful that the area occupied by the ditches was not considered important; and the cost of construction could be paid in labor by the persons to be benefited by the drains. Before 1880, tile drains comprised less than 5 per cent in length of the public drains begun. During the next twenty years tile were adopted for 20 per cent of all drains undertaken. For the enterprises organized since 1900, tile are used for 34 per cent of the total length, and those operating enterprises organized in 1915 to 1919 have planned to use tile for 46 per cent of the total length of drains. The increase in use of tile for public drains is shown in Table 7.

TABLE 7.—OPEN DITCHES AND TILE DRAINS OF OPERATING ENTERPRISES, SHOWING INCREASING USE OF TILE DRAINS: 1920.

DATE.	ALL DRAINS.		OPEN DITCHES.		TILE DRAINS.	
	Miles.	Per cent of total.	Miles.	Per cent of all drains.	Miles.	Per cent of all drains.
Total.....	156,943.8	100.0	111,770.0	71.2	45,173.8	28.8
Before 1860.....	177.9	0.1	173.7	97.6	4.2	2.4
1860 to 1869.....	2,343.0	1.5	2,295.6	98.0	47.5	2.0
1870 to 1879.....	7,044.4	4.5	6,671.9	94.7	372.5	5.3
1880 to 1889.....	17,345.2	11.1	14,763.2	85.1	2,582.0	14.9
1890 to 1899.....	17,053.3	10.9	12,747.3	74.7	4,306.0	25.3
1900 to 1904.....	16,043.7	10.2	12,308.8	76.7	3,735.4	23.3
1905 to 1909.....	28,416.7	18.1	20,538.9	72.3	7,877.8	27.7
1910 to 1914.....	38,658.0	23.4	24,875.7	67.8	11,812.3	32.2
1915 to 1919.....	31,133.2	19.8	16,897.5	54.3	14,237.7	45.7
Not reported.....	698.4	0.4	498.0	71.5	198.4	28.5

The length of drains per acre provided by the enterprises was 9.7 feet for those undertakings organized before 1860. It increased to 17.1 feet for all organized before 1880, and has decreased to 12.7 feet for all established before 1920. The changes are shown, by periods, in Table 8.

TABLE 8.—LENGTH OF DRAINS PER ACRE IN OPERATING ENTERPRISES, SHOWING CHANGE IN LENGTH PROVIDED PER ACRE: 1920.

DATE.	Land in enterprises (acres).	Length of all drains <sup>1</sup> (miles).	Length per acre <sup>1</sup> (feet).
All operating enterprises reported as established before 1860.....	97,319	177.9	9.7
1870.....	880,676	2,520.9	15.1
1880.....	2,958,393	9,565.3	17.1
1890.....	8,382,687	26,910.5	17.0
1900.....	14,409,624	43,963.8	16.1
1905.....	22,016,377	60,007.5	14.4
1910.....	36,546,774	88,424.2	12.8
1915.....	53,890,872	125,112.2	12.3
1920.....	65,265,491	156,247.4	12.6
Total, including those not reporting date.	65,495,038	156,943.8	12.7

<sup>1</sup> When works under construction have been completed.

**Drainage by pumping.**—The area drained by pumping, wholly or for part of the time, is 1,544,010 acres. Of this, 781,441 acres are in enterprises drained entirely by pumping, the other 762,569 acres are embraced in enterprises drained partly by pumping and partly by gravity (see Table 14, page 363). The total capacities of all the pumping plants are 67,189 horsepower and 15,949,166 gallons per minute. The figures for each state and the totals for each geographic division are given in State Table V, pages 376–379 and by counties in the state reports, pages 381–728.

TABLE 9.—PUMPING PLANTS OF OPERATING DRAINAGE ENTERPRISES: 1920.

DIVISION AND STATE.	PUMP CAPACITY.			Mean lift of water (feet).	Engine capacity (horsepower).	Plant ratio. <sup>1</sup>
	Total (gallons per minute).	Per acre (gallons per minute).	Depth per 24 hours (ins.).			
UNITED STATES.....	15,949,166	10.3	0.55	11.4	67,189	1.46
GEOGRAPHIC DIVISIONS:						
East North Central..	2,964,014	9.4	0.50	11.0	20,190	2.45
West North Central..	1,086,900	5.2	0.28	10.9	6,003	2.01
South Atlantic.....	1,083,600	10.1	0.54	4.9	1,275	0.95
East South Central..	78,000	1.8	0.10	5.0	250	2.54
West South Central..	5,965,150	25.8	1.37	7.1	10,465	0.98
Mountain.....	72,600	2.1	0.11	15.4	480	1.95
Pacific.....	4,699,042	7.8	0.41	19.5	28,526	1.28
EAST NORTH CENTRAL:						
Ohio.....	3,800	2.1	0.11	8.1	125	16.98
Indiana.....	55,348	9.9	0.52	15.9	625	2.81
Illinois.....	2,943,066	9.7	0.51	10.8	18,225	2.35
Michigan.....	62,000	6.1	0.32	11.9	1,065	5.72
Wisconsin.....					150	
WEST NORTH CENTRAL:						
Iowa.....	530,800	3.9	0.21	11.3	3,153	2.08
Missouri.....	552,000	7.9	0.42	10.7	2,785	1.87
Kansas.....	4,000	1.8	0.10	12.0	65	5.36
SOUTH ATLANTIC:						
North Carolina.....	1,000,000	10.0	0.53	4.5	1,000	0.88
South Carolina.....	44,600	15.2	0.81	17.4	155	0.79
Florida.....	39,000	8.7	0.46	2.1	120	5.80
EAST SOUTH CENTRAL:						
Mississippi.....	78,000	1.8	0.10	5.0	250	2.54
WEST SOUTH CENTRAL:						
Arkansas.....	720,000	8.0	0.42	10.0	2,800	1.54
Louisiana.....	5,245,150	37.3	1.98	6.6	7,665	0.63
MOUNTAIN:						
Idaho.....	36,200	4.6	0.24	18.0	285	1.73
Arizona.....	33,600	1.8	0.07	9.0	175	2.29
Utah.....	2,700	1.9	0.10	8.0	90	3.67
PACIFIC:						
California.....	4,699,042	7.8	0.41	19.5	28,526	1.28

<sup>1</sup> Engine capacity divided by product of total pump capacity into mean lift reduced to horsepower.

The enterprises that pump either all or a part of the drainage water, because drainage by gravity is not obtainable, are situated mostly in the states bordering the Mississippi River, although California has nearly twice as great an acreage drained by pumping as any

other state, and North Carolina has the largest pumping district of any state. The information concerning pumping plants is summarized in Tables 9 and 14 and in State Table V, pages 376–379. In Table 9 the average computed capacities of the pumps are given both in gallons per minute per acre and in depth in inches of water per day over the area served. The mean heights that the water is lifted by the pumps are shown, and the ratios of the engine capacities to the effective horsepower of the pumps operating at their stated capacities and at the mean lifts. The mean lift of water is computed from the average lift for each enterprise weighted according to the capacity of the pumps of that enterprise. Louisiana has the greatest total capacity of pumps of any state, and more than twice the capacity per acre of any other state. California has much the greatest total engine capacity, which is reasonably required by the greatest mean lift of water and greatest area served by pumps.

More than nine-tenths of the drainage pumps are of the centrifugal type (see Table 10, page 370), having fully nine-tenths of the total capacity of all the pumps. The average capacity of the centrifugal pumps is 34,280 gallons per minute each. The eleven screw pumps have an average capacity of 111,242 gallons per minute each. More than half the power is supplied by electric motors (see Table 9, page 370), and almost 30 per cent by steam engines. Internal combustion engines supply only about one-tenth of the total horsepower.

#### COST OF DRAINAGE ENTERPRISES.

The statistics gathered by the census for capital invested in drainage enterprises to December 31, 1919, represent actual cash expenditures for drainage. Though a large part of the earlier drains were constructed by the labor of the men whose land would be benefited, no estimate of the value of such labor is included. It was intended that the figures should represent the cost for original construction and for enlargements and extensions, but not expenses for maintenance or repairs. However, where the enterprises do not have a continued separate existence, and repair of the drains is undertaken only by the establishment of new enterprises, part or all of the cost of many enterprises would be properly chargeable as for repair or renewal work. Information for making even an estimate of the expenditures for this kind of work was not obtainable, and the amount has been tabulated with the cost of new drains. It is known also that the costs for a small part of the enterprises that have a continuous existence included some charges for repairs. The amount thus included for those enterprises, though not known, is believed to be relatively small.

The capital invested in all operating drainage enterprises and the cost per acre, for each geographic division and state, are shown in Table 10. The aver-

age investment for those enterprises that have completed construction of drainage improvements undertaken is shown to be \$5.18 per acre, and that for all the enterprises to December 31, 1919, is \$5.68 per acre. The estimated investment, when the works under construction have been completed, is \$6.64 per acre, which is 28 per cent greater than the cost of the enterprises already completed. For the United States, the estimated average cost for the enterprises under construction, when they have been completed, is \$14.84 per acre upon the total area assessed. This cost probably would be increased slightly if the amount of overlapping among these enterprises were known and eliminated. However, it is undoubtedly much nearer

correct than the average cost computed after eliminating all overlapping, including duplication with completed enterprises, which would be \$16.12 per acre. In a few states the average for the later enterprises is less than in the completed enterprises, but in 11 states it is more than twice as great. Table 11 shows the capital invested and cost per acre assessed for each 10-year period before 1900 and each 5-year period since that date. It shows also the average cost per acre for all land in operating enterprises organized prior to the end of each period. It will be noted that the average cost per acre assessed was continuously less than \$3 before 1905, but for each period since then has increased by \$1.78 to \$1.92 over the preceding period.

TABLE 10.—CAPITAL INVESTED AND COST PER ACRE OF ALL OPERATING ENTERPRISES, AND OF OPERATING ENTERPRISES DRAINED WHOLLY BY GRAVITY: 1920.

DIVISION AND STATE.	ALL OPERATING ENTERPRISES.				COMPLETED ENTERPRISES.			ENTERPRISES UNDER CONSTRUCTION.			GRAVITY DISTRICTS ONLY.			
	Land in enterprises (acres).	Cost when completed.		Cost to Dec. 31, 1919.		Land in enterprises (acres).	Cost.		Assessed acreage.	Cost when completed.		Acreage.	Cost when completed.	
		Total.	Per acre.	Total.	Per acre.		Total.	Per acre.		Total.	Per acre.		Total.	Per acre.
UNITED STATES..	65,495,038	\$434,594,979	\$6.64	\$372,273,567	\$5.68	56,783,751	\$293,857,023	\$5.18	9,482,414	\$140,737,956	\$14.84	63,602,475	\$354,839,625	\$5.58
<b>GEOGRAPHIC DIVISIONS:</b>														
East North Central.	31,627,176	143,722,327	4.54	134,269,666	4.25	30,475,905	119,525,193	3.92	1,446,710	24,197,134	16.73	31,276,297	125,862,718	4.02
West North Central.	19,217,367	133,194,663	6.93	121,562,077	6.33	16,959,103	102,365,306	6.04	2,520,812	30,829,357	12.23	18,998,695	129,704,641	6.83
South Atlantic.	2,385,394	33,323,268	13.97	18,947,093	7.90	861,312	6,805,285	7.90	1,583,572	26,517,983	16.75	2,271,184	32,204,394	14.18
East South Central.	2,323,596	13,830,251	5.95	11,523,833	4.96	1,732,583	9,085,234	5.24	594,049	4,745,017	7.99	2,226,195	13,120,151	5.89
West South Central.	7,924,197	42,357,607	5.35	28,946,385	3.65	5,750,958	20,473,933	3.56	2,303,839	21,883,674	9.50	7,584,427	32,948,089	4.34
Mountain.	810,076	12,508,817	15.44	7,839,941	9.68	236,572	3,248,713	13.72	573,204	9,260,104	16.15	745,464	10,585,817	14.20
Pacific.	1,207,243	55,658,046	46.10	49,284,572	40.82	747,015	32,353,359	43.31	460,228	23,304,687	50.64	499,913	10,413,815	20.83
<b>EAST NORTH CENTRAL:</b>														
Ohio.	8,107,204	30,771,620	3.80	30,680,145	3.78	8,063,994	30,636,857	3.79	15,857	134,763	8.50	8,104,275	30,687,591	3.79
Indiana.	9,087,163	31,943,858	3.52	31,147,682	3.43	8,867,674	30,154,296	3.40	392,310	1,789,562	4.56	9,078,072	31,714,794	3.49
Illinois.	3,909,049	51,393,244	13.15	43,595,099	11.15	3,430,474	31,424,167	9.16	484,775	19,969,077	41.19	3,583,206	34,042,167	9.50
Michigan.	9,729,171	25,048,980	2.57	24,683,715	2.54	9,511,555	24,100,929	2.53	831,407	948,051	2.96	9,718,471	24,878,541	2.56
Wisconsin.	794,569	4,664,626	5.74	4,193,055	5.24	572,208	3,208,944	5.61	222,361	1,355,681	6.10	792,273	4,539,625	5.73
<b>WEST SOUTH CENTRAL:</b>														
Minnesota.	9,232,709	44,188,838	4.79	42,017,447	4.56	8,552,900	36,764,850	4.30	703,309	7,418,988	10.55	9,232,709	44,188,838	4.79
Iowa.	5,224,478	54,189,878	10.37	49,627,304	9.50	4,685,080	44,630,537	9.53	608,235	9,539,341	15.68	5,085,312	53,024,686	10.43
Missouri.	2,596,204	24,749,735	9.53	20,723,128	7.98	1,858,945	13,294,035	7.15	907,470	11,455,700	12.62	2,518,898	22,468,905	8.92
North Dakota.	1,240,328	2,261,449	1.82	2,208,049	1.78	1,100,044	1,863,788	1.69	140,284	397,661	2.83	1,240,328	2,261,449	1.82
South Dakota.	222,062	1,732,729	7.80	1,461,063	6.58	124,132	942,757	7.59	97,930	789,072	8.07	222,062	1,732,729	7.80
Nebraska.	607,730	4,896,681	8.04	4,588,578	7.55	565,222	4,121,486	7.29	42,508	785,195	18.00	607,730	4,896,681	8.04
Kansas.	93,856	1,210,353	12.90	936,508	9.98	72,780	747,583	10.28	21,076	462,500	21.94	91,666	1,146,353	12.51
<b>SOUTH ATLANTIC:</b>														
North Carolina.	542,828	4,626,018	8.54	3,623,513	6.68	440,657	3,075,018	6.98	102,171	1,451,000	14.20	442,828	3,790,644	8.56
South Carolina.	140,031	838,514	6.69	582,183	4.16	24,864	198,370	7.98	115,167	738,144	6.41	131,831	661,514	5.02
Georgia.	65,432	1,098,239	16.78	794,585	12.14	43,723	614,638	14.06	21,729	483,603	22.26	65,432	1,098,239	16.78
Florida.	1,637,078	26,762,497	16.35	13,846,807	8.46	352,068	2,917,261	8.29	1,344,506	23,845,236	17.74	1,631,073	26,653,997	16.34
<b>EAST SOUTH CENTRAL:</b>														
Kentucky.	358,490	1,820,996	5.08	1,521,725	4.24	288,147	1,278,701	4.44	70,337	542,295	7.71	358,490	1,820,996	5.08
Tennessee.	363,671	3,447,991	9.48	2,925,944	8.05	268,563	2,283,589	8.50	95,004	1,164,402	12.26	363,671	3,447,991	9.48
Mississippi.	1,601,444	8,561,264	5.35	7,076,164	4.42	1,176,776	5,522,944	4.70	428,708	3,038,320	7.09	1,504,044	7,851,164	5.22
<b>WEST SOUTH CENTRAL:</b>														
Arkansas.	3,479,591	25,888,599	7.44	14,147,174	4.07	2,124,446	9,385,025	4.42	1,456,545	16,503,574	11.33	3,294,591	20,888,599	6.34
Louisiana.	2,266,328	9,980,788	4.41	9,021,991	3.98	1,534,634	6,956,938	3.88	760,894	4,033,850	5.36	2,111,853	9,581,270	4.64
Oklahoma.	12,150	77,415	6.37	76,415	6.29	11,750	76,165	6.48	400	1,250	3.13	12,150	77,415	6.37
Texas.	2,166,128	6,400,806	2.95	5,700,806	2.63	2,080,128	5,055,806	2.43	86,000	1,345,000	15.64	2,166,128	6,400,806	2.95
<b>MOUNTAIN:</b>														
Montana.	168,682	846,466	5.02	664,990	3.94	44,682	393,969	8.82	124,000	452,497	3.65	168,682	846,466	5.02
Idaho.	64,642	1,783,569	27.67	1,668,569	25.81	43,892	1,237,578	28.20	20,730	550,991	26.55	64,642	1,783,569	27.67
Wyoming.	95,474	1,667,367	17.46	1,176,962	12.32	11,740	32,231	2.75	83,734	1,635,136	19.53	95,474	1,667,367	17.46
Colorado.	171,656	1,285,070	7.49	1,081,875	6.30	66,816	608,663	7.61	104,840	776,407	7.41	171,656	1,285,070	7.49
New Mexico.	140,219	2,906,296	20.73	1,710,798	12.20	30,169	361,989	17.96	120,050	2,644,307	21.19	140,219	2,906,296	20.73
Arizona.	39,640	1,026,425	25.89	414,425	10.45	9,640	101,425	10.52	30,000	925,000	30.83	39,640	1,026,425	25.89
Utah.	113,823	2,870,773	25.22	1,005,473	8.83	23,993	495,007	20.63	89,830	2,375,766	26.46	113,823	2,870,773	25.22
Nevada.	16,940	117,851	7.39	117,851	7.39	16,940	117,851	7.39				16,940	117,851	7.39
<b>PACIFIC:</b>														
Washington.	94,924	1,436,419	15.13	1,397,419	14.72	90,084	1,376,809	15.28	4,840	59,610	12.32	94,924	1,436,419	15.13
Oregon.	4,000	200,000	50.00	200,000	50.00	4,000	200,000	50.00				4,000	200,000	50.00
California.	1,108,319	54,021,627	48.74	47,687,153	43.08	852,931	30,776,550	47.14	455,388	23,245,077	51.04	1,108,319	54,021,627	48.74

Cost according to location.—The capital invested in operating enterprises is divided among the geographic divisions and states somewhat differently than the land in the enterprises, which fact is reflected in the cost per acre. The East North Central division has the largest portion of the total investment to Decem-

ber 31, 1919, and the lowest expenditure per acre in the enterprises except the West South Central division; it has the greatest portion of the total estimated investment when the drainage works under construction have been completed, but the smallest cost per acre of any division. The Pacific division,

with 13 per cent of the capital invested and less than 2 per cent of the acreage, on the census date had expended four times as much per acre as the average for any other division, and upon completion of the works authorized will have expended three times as much per acre as any other division. The costs per acre are greatest in Oregon and California, being nearly

twice that in any other state. For the central and eastern divisions, where irrigation is not generally practiced, the past investment per acre is greater in Illinois than in any other state except Georgia, and the anticipated investment for the operating enterprises is greater than in any other state except Georgia and Florida.

TABLE 11.—CAPITAL INVESTED AND COST PER ACRE FOR OPERATING ENTERPRISES, WHEN WORKS UNDER CONSTRUCTION HAVE BEEN COMPLETED, CLASSIFIED BY DATE OF ORGANIZATION: 1920.

DATE OF ORGANIZATION.	United States.	GEOGRAPHIC DIVISIONS.						
		East North Central.	West North Central.	South Atlantic.	East South Central.	West South Central.	Mountain.	Pacific.
<b>Total:</b>								
Capital invested when works completed.....	\$434,594,979	\$143,722,327	\$133,194,663	\$33,323,268	\$13,830,251	\$42,357,607	\$12,508,817	\$55,658,046
Land in enterprises..... acres.....	65,495,038	31,627,176	19,217,367	2,385,384	2,323,595	7,924,197	810,076	1,207,243
Cost per acre.....	\$6.64	\$4.54	\$6.93	\$13.97	\$5.95	\$5.35	\$15.44	\$46.10
Acreage assessed.....	95,629,291	59,131,679	21,262,129	2,517,852	2,326,635	8,263,124	810,076	1,217,796
Cost per acre.....	\$4.54	\$2.43	\$3.26	\$13.23	\$5.94	\$5.06	\$15.44	\$45.70
<b>Before 1860:</b>								
Capital invested when works completed.....	\$182,716	\$172,716		\$10,000				
Land in enterprises..... acres.....	97,319	95,669		1,650				
Cost per acre.....	\$1.83	\$1.81		\$6.06				
Acreage assessed.....	93,119	90,469		1,650				
Cost per acre.....	\$1.86	\$1.79		\$6.06				
<b>1860 to 1869:</b>								
Capital invested, including earlier periods.....	\$1,872,568	\$1,512,568		\$10,000				\$350,000
Land in enterprises..... acres.....	890,676	865,826		1,650				13,200
Cost per acre.....	\$2.13	\$1.75		\$6.06				\$26.52
Capital invested for this period.....	\$1,689,852	\$1,339,852						\$350,000
Acreage assessed for this period.....	932,565	919,365						13,200
Cost per acre.....	\$1.81	\$1.46						\$26.52
<b>1870 to 1879:</b>								
Capital invested, including earlier periods.....	\$9,993,959	\$7,101,571	\$37,388	\$10,000				\$2,850,000
Land in enterprises..... acres.....	2,958,393	2,913,243	4,200	1,650				39,300
Cost per acre.....	\$3.38	\$2.44	\$8.90	\$6.06				\$72.52
Capital invested for this period.....	\$3,126,391	\$5,589,003	\$37,388					\$2,500,000
Acreage assessed for this period.....	3,413,277	3,382,977	4,200					28,100
Cost per acre.....	\$2.38	\$1.65	\$8.90					\$95.79
<b>1880 to 1889:</b>								
Capital invested, including earlier periods.....	\$35,774,118	\$29,317,100	\$197,083	\$23,000	\$4,000			\$9,232,935
Land in enterprises..... acres.....	8,382,687	8,198,459	53,234	14,157	800			116,037
Cost per acre.....	\$4.27	\$3.58	\$3.70	\$1.62	\$5.00			\$53.72
Capital invested for this period.....	\$25,775,159	\$22,215,529	\$159,695	\$13,000	\$4,000			\$3,882,935
Acreage assessed for this period.....	8,843,654	8,704,578	49,034	12,507	800			76,737
Cost per acre.....	\$2.91	\$2.55	\$3.26	\$1.04	\$5.00			\$44.08
<b>1890 to 1899:</b>								
Capital invested, including earlier periods.....	\$60,794,289	\$47,600,287	\$1,931,577	\$23,000	\$226,326	\$480,949		\$10,543,150
Land in enterprises..... acres.....	14,409,624	13,189,926	856,464	14,157	142,280	142,280		187,736
Cost per acre.....	\$4.22	\$3.61	\$2.26	\$1.62	\$11.87	\$3.24		\$56.16
Capital invested for this period.....	\$25,020,171	\$18,292,187	\$1,734,494		\$222,326	\$460,949		\$4,310,215
Acreage assessed for this period.....	11,575,924	10,528,526	815,158		18,261	142,280		71,699
Cost per acre.....	\$2.16	\$1.74	\$2.13		\$12.17	\$3.24		\$60.12
<b>1900 to 1904:</b>								
Capital invested, including earlier periods.....	\$88,209,816	\$66,139,124	\$9,214,056	\$23,000	\$553,825	\$1,056,949		\$12,222,962
Land in enterprises..... acres.....	22,010,377	18,623,198	2,694,038	14,157	59,075	401,278		224,631
Cost per acre.....	\$4.01	\$3.55	\$3.05	\$1.62	\$9.37	\$2.63		\$54.41
Capital invested for this period.....	\$27,415,527	\$18,529,837	\$6,282,479		\$327,499	\$595,000		\$1,679,712
Acreage assessed for this period.....	12,200,468	9,852,345	2,612,216		40,014	253,998		36,893
Cost per acre.....	\$2.25	\$1.88	\$3.12		\$8.18	\$2.30		\$45.53
<b>1905 to 1909:</b>								
Capital invested, including earlier periods.....	\$171,913,215	\$100,201,042	\$41,738,030	\$487,500	\$1,648,270	\$7,458,389	\$226,599	\$20,153,435
Land in enterprises..... acres.....	36,546,774	29,747,473	8,846,849	73,680	372,829	2,953,158	38,223	514,562
Cost per acre.....	\$4.70	\$4.22	\$4.72	\$6.62	\$4.42	\$2.53	\$5.93	\$39.17
Capital invested for this period.....	\$83,703,399	\$34,061,918	\$33,623,974	\$464,500	\$1,094,445	\$6,401,390	\$226,599	\$7,930,578
Acreage assessed for this period.....	20,228,636	10,136,903	6,681,182	67,723	315,794	2,668,860	38,223	289,931
Cost per acre.....	\$4.14	\$3.36	\$5.02	\$6.86	\$3.47	\$2.37	\$5.93	\$27.35
<b>1910 to 1914:</b>								
Capital invested, including earlier periods.....	\$306,644,221	\$122,456,477	\$83,971,896	\$19,667,293	\$7,797,858	\$25,850,833	\$4,396,596	\$42,503,268
Land in enterprises..... acres.....	53,890,872	28,293,369	15,282,766	1,309,757	1,546,730	6,216,975	283,401	957,674
Cost per acre.....	\$5.69	\$4.33	\$5.49	\$15.02	\$5.04	\$4.16	\$15.51	\$44.38
Capital invested for this period.....	\$184,731,006	\$22,255,435	\$42,233,866	\$19,179,793	\$6,149,588	\$18,392,494	\$4,169,997	\$22,349,833
Acreage assessed for this period.....	23,245,539	8,538,560	7,117,670	1,271,677	1,173,901	3,450,898	245,178	447,655
Cost per acre.....	\$6.06	\$2.61	\$5.93	\$15.08	\$5.24	\$5.33	\$17.01	\$49.93
<b>1915 to 1919:</b>								
Capital invested, including earlier periods.....	\$430,770,285	\$143,103,503	\$132,879,715	\$33,323,268	\$13,809,963	\$42,157,607	\$12,090,998	\$53,405,231
Land in enterprises..... acres.....	65,265,491	31,585,556	19,183,609	2,385,384	2,321,795	7,876,197	783,016	1,129,934
Cost per acre.....	\$6.60	\$4.53	\$6.93	\$13.97	\$5.95	\$5.35	\$15.44	\$47.26
Capital invested for this period.....	\$124,126,064	\$20,647,026	\$48,907,819	\$13,655,975	\$6,012,105	\$16,306,774	\$7,694,402	\$10,901,963
Acreage assessed for this period.....	15,823,501	6,897,435	4,548,753	1,164,295	776,065	1,764,068	499,615	178,270
Cost per acre.....	\$7.84	\$2.99	\$10.75	\$11.73	\$7.76	\$9.24	\$15.40	\$61.15
<b>Data not reported:</b>								
Capital invested when works completed.....	\$3,824,694	\$618,824	\$314,948		\$20,288	\$200,000	\$417,819	\$2,252,815
Land in enterprises..... acres.....	229,547	41,620	33,756		1,800	48,000	27,060	77,309
Cost per acre.....	\$16.68	\$14.87	\$9.33		\$11.27	\$4.17	\$15.44	\$29.14
Acreage assessed.....	202,008	74,623	33,918		1,800	48,000	27,060	77,309
Cost per acre.....	\$14.56	\$8.30	\$9.29		\$11.27	\$4.17	\$15.44	\$29.14

The higher cost of drainage in many of the Pacific and Mountain states is at least partly due to the fact that the drainage of irrigated land is usually more expensive than the drainage of land in the humid

region, where nature has provided a part of the drains and generally has washed from the soil whatever salts may have been formed there. Deeper drains are required to prevent concentration of the alkali

in the top soil by the upward movement of the water as evaporation occurs at the ground surface. The nature of the soil when saturated often is such that the sides of open ditches must have comparatively flat slopes, and trenches for tile many times must be elaborately braced or sheeted during construction of the drains. No inconsiderable part of the cost in many localities has been due to inexperience with the new engineering problems involved, and in work that proved to be experimental in character.

**Cost by character of enterprise.**—The anticipated costs per acre for drainage work authorized are least for township and county drains, and greatest for irrigation districts and irrigation projects of the United States Reclamation Service, as shown by Table 12. Practically all of the enterprises not reporting character are in Indiana, and are either drainage districts or county drains.

TABLE 12.—CAPITAL INVESTED AND COST PER ACRE FOR OPERATING ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	Land in enterprises (acres).	Capital invested when works completed.	COST PER ACRE.	
			Amount.	Per cent of mean.
Total or mean .....	65,495,038	\$434,594,979	\$6.64	100.0
Drainage districts.....	22,069,597	211,150,540	9.57	144.1
General acts.....	20,239,956	172,104,782	8.50	128.0
Special acts.....	1,829,641	39,045,758	21.34	321.4
County drains.....	37,370,803	179,425,570	4.74	71.4
Township drains.....	195,133	579,463	2.97	44.7
State enterprises.....	1,422,844	13,279,869	9.33	140.5
U. S. Reclamation Service.....	1,287,899	6,442,613	22.38	337.0
Irrigation districts.....	1,175,200	4,013,543	22.91	345.0
Commercial developments.....	212,421	4,407,829	20.75	312.5
Individual ownerships.....	432,397	7,291,002	16.88	253.9
Not reported.....	2,828,744	8,004,550	2.83	42.6

<sup>1</sup>The area actually assessed for the cost of drainage in United States Reclamation Service projects and irrigation districts includes 600,578 acres that did not require drainage or protection.

The reasons for the low cost for the township and county drains may be that in those states where most drainage has been done these forms were the earliest used, when the price of labor was lowest; that the forms are most suited and economical for the smaller and simpler undertakings; and that much of the cost was paid in labor for which no value was entered in the records. The cost of draining irrigated land generally is greater than for land in the humid region, for reasons already stated. The higher cost is justified by the higher value of the land, which is largely improved. As explained on page 349, the cost of the drainage in the irrigation enterprises is charged partly against other land contributing to the injury, this other land considerably exceeding the acreage to be drained or protected. The average cost of the drainage by irrigation enterprises is \$9.83 per acre on all the land assessed.

The states reporting drainage districts established by special acts of the legislatures are Wisconsin, Florida, Arkansas, Louisiana, and California. Table

12 shows these districts to cost two and one-half times as much per acre as those districts organized under the general drainage laws. In three of these states the special act districts average less per acre than the others, but in Arkansas and California, which together have 1,577,061 acres in special districts, the average costs per acre are, respectively, \$11.40 and \$69.52 for the special districts and \$5.22 and \$50.92 for those formed under the general statutes.

Commercial enterprises reclaiming wet land for sale generally consist of land that is less favorably situated, which is mostly if not entirely unimproved, and which has relatively few natural drainage courses. Therefore the drainage systems that the commercial companies must undertake to construct, in order to find ready sale for the land, ordinarily will be more elaborate and more costly than those constructed by public drainage enterprises comprised more largely of land in farms.

**Cost by nature of drainage works.**—The kind of drains and accessory works installed by the enterprises materially affects the cost of the drainage in most cases. Table 13 shows that the average cost per acre for the operating enterprises that have installed only open ditches is not much more than half the average cost of those that have installed tile drains entirely; the cost per acre for systems combining both tile and open drains is just one and one-half times as great as for those providing open ditches only.

The costs per acre for most of the geographic divisions show the same general relation—the cost where only tile drains are used is much larger than where only open ditches are constructed, and the cost of combined systems lies between. The exceptions are that the combined systems have cost most per acre in the East South Central division, while in the Mountain and Pacific divisions the combined systems have cost least and open ditches only have cost most per acre.

The drainage enterprises that have constructed levees as part of the improvement works comprise less than 10 per cent of the area in all operating enterprises, but will have cost nearly 29 per cent of the total investment when the works under construction have been completed. As shown in State Table V, pages 376-379, the average cost for all enterprises constructing levees is \$20.22 per acre, and for those not constructing levees is \$5.23 per acre. For the United States, and for each geographic division except the East South Central, the cost of the enterprises constructing levees is from one and one-third to seven times as great per acre as for the other enterprises. These figures do not include the cost of levees or dikes built by the government, or by levee districts or flood protection enterprises that had not constructed ditches or other drains, even though land in the drainage enterprises receives protection by reason of those levees and may have been assessed for the cost of them.

TABLE 13.—CAPITAL INVESTED AND COST PER ACRE FOR OPERATING ENTERPRISES, CLASSIFIED BY GEOGRAPHIC DIVISIONS AND KIND OF WORKS: 1920.

KIND OF WORKS.	Land in enterprises (acres).	CAPITAL INVESTED.				KIND OF WORKS.	Land in enterprises (acres).	CAPITAL INVESTED.			
		When works completed.		To Dec. 31, 1919.	Additional required to complete.			When works completed.		To Dec. 31, 1919.	Additional required to complete.
		Total.	Per acre.					Total.	Per acre.		
<b>UNITED STATES.</b>					<b>EAST SOUTH CENTRAL.</b>						
Total or mean.....	65,495,038	\$434,594,979	\$6.64	\$372,273,567	\$62,321,412	Total or mean.....	2,323,595	\$13,830,251	\$5.95	\$11,523,833	\$2,306,418
Open ditches only.....	49,314,485	287,125,105	5.82	238,211,512	48,913,593	Open ditches only.....	2,263,610	13,109,485	5.79	10,951,137	2,158,348
Tile drains only.....	4,974,281	49,318,155	9.91	46,801,986	2,516,169	Tile drains only.....	8,917	80,479	9.03	64,979	15,500
Open ditches and tile drains	11,206,292	98,151,719	8.78	87,260,069	10,891,650	Open ditches and tile drains	51,068	640,287	12.54	507,717	132,670
<b>EAST NORTH CENTRAL.</b>					<b>WEST SOUTH CENTRAL.</b>						
Total or mean.....	31,627,176	143,722,327	4.54	134,269,666	9,452,661	Total or mean.....	7,924,197	42,357,607	5.35	23,946,385	13,411,222
Open ditches only.....	21,339,687	84,958,586	3.98	77,413,340	7,545,246	Open ditches only.....	7,882,741	42,023,607	5.33	23,649,385	13,374,222
Tile drains only.....	3,098,495	17,961,089	5.80	17,740,952	220,137	Tile drains only.....	3,100	41,000	13.23	41,000	.....
Open ditches and tile drains	7,188,994	40,802,652	5.68	39,115,374	1,687,278	Open ditches and tile drains	38,356	293,000	7.64	256,000	87,000
<b>WEST NORTH CENTRAL.</b>					<b>MOUNTAIN.</b>						
Total or mean.....	19,217,367	133,194,663	6.93	121,562,077	11,632,586	Total or mean.....	810,078	12,508,817	15.44	7,839,941	4,668,876
Open ditches only.....	14,301,750	63,695,299	4.45	58,302,566	5,392,733	Open ditches only.....	242,028	4,356,347	18.00	2,725,123	1,631,224
Tile drains only.....	1,747,658	28,945,695	16.56	27,014,796	1,930,899	Tile drains only.....	105,525	1,837,577	17.41	1,487,944	349,633
Open ditches and tile drains	3,167,959	40,553,669	12.80	36,244,715	4,308,954	Open ditches and tile drains	462,523	6,314,893	13.65	3,626,874	2,688,019
<b>SOUTH ATLANTIC.</b>					<b>PACIFIC.</b>						
Total or mean.....	2,385,384	33,323,268	13.97	18,947,093	14,476,175	Total or mean.....	1,207,243	55,658,046	46.10	49,284,672	6,373,474
Open ditches only.....	2,376,184	32,913,268	13.85	18,584,093	14,329,175	Open ditches only.....	908,485	46,068,513	50.71	41,585,868	4,482,645
Tile drains only.....	.....	.....	.....	.....	.....	Tile drains only.....	10,566	452,315	42.81	452,315	.....
Open ditches and tile drains	19,200	1410,000	44.57	263,000	147,000	Open ditches and tile drains	288,192	9,137,218	31.71	7,246,389	1,890,829

<sup>1</sup> All individual ownership enterprises.

To investigate more minutely the cost of drainage for agricultural land, those enterprises in which the length of levees equaled or exceeded the length of drains, and those sanitary districts which evidently were not established primarily to improve land for agricultural uses, were deducted from the total acreages and costs stated in the tables. The costs per acre were then computed in the same way as those given in Table 13. The differences between the costs thus found and those given in the table were slight, exceeding approximately 5 per cent in only three instances: The cost of open ditches only in the East North Central states was computed as \$3.57 instead of \$3.98; in the Mountain states, \$15.91 instead of \$18; in the Pacific states, \$53.69 instead of \$50.71, being greater there than when all drainage enterprises were included.

Cost of pumping districts.—The capital invested when the works under construction have been completed, and the costs per acre, for those enterprises drained entirely by gravity are given in Table 10. It will be noted that the acreage costs vary but little from

those for all operating enterprises, except for Illinois, Louisiana, Arizona, and California, due to the comparatively small acreage in pumping districts in most states.

Table 14 shows the investment and the cost per acre for the pumping districts for the United States, and for each state having as much as 25,000 acres drained by pumping. Of those states not shown separately, Michigan has 10,100 acres served by pumps wholly or partly, and no other has so much as 8,000 acres. The capital invested to December 31, 1919, and the total estimated for the operating enterprises when they have completed construction of the works authorized, are more than six times as great per acre as for the gravity districts. In Iowa and North Carolina the estimated investment when construction has been completed is slightly less per acre than for the gravity districts; in the other states the cost of the pumping districts is greater by from \$2.07 per acre in Mississippi to \$42.07 in California and \$43.75 in Illinois.

## DRAINAGE.

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TABLE 14.—CAPITAL INVESTED AND COST PER ACRE FOR PUMPING DISTRICTS: 1920.

STATE.	ALL PUMPING DISTRICTS.					DRAINAGE BY PUMPING ONLY.			PART GRAVITY DRAINAGE.			
	Acreage in enterprises.	Cost when completed.		Cost to Dec. 31, 1919.		Acreage in enterprises. <sup>1</sup>	Cost when completed.		Acreage in enterprises.	Cost when completed.		Acreage served by pumps. <sup>2</sup>
		Total.	Per acre.	Total.	Per acre.		Total.	Per acre.		Total.	Per acre.	
United States.....	1,892,563	\$79,755,354	\$42.05	\$65,830,264	\$34.70	781,441	\$34,022,568	\$43.54	1,111,122	\$45,732,786	\$41.00	762,569
Illinois.....	225,843	17,351,077	53.25	12,061,591	37.02	157,360	6,809,372	43.27	168,483	10,541,705	62.57	134,456
Iowa.....	139,166	1,145,192	8.23	1,145,192	8.23	79,686	778,770	9.77	59,480	866,422	6.16	54,830
Missouri.....	77,306	2,280,830	29.50	2,280,830	29.25	77,306	77,306	29.50	77,306	2,280,830	29.50	70,308
North Carolina.....	100,000	735,374	7.35	735,374	7.35	100,000	735,374	7.35	97,400	710,100	7.29	44,000
Mississippi.....	97,400	710,100	7.29	365,100	3.95							
Arkansas.....	185,000	5,000,000	27.03	500,000	2.70				185,000	5,000,000	27.03	90,000
Louisiana.....	154,470	4,409,618	28.55	3,969,743	25.70	137,260	4,261,518	31.05	17,220	148,000	8.59	3,559
Arizona.....	30,000	925,000	30.83	313,000	10.43				30,000	925,000	30.83	25,000
California.....	707,330	45,244,231	63.96	42,626,402	60.26	300,422	21,237,606	70.89	406,908	23,946,625	58.85	304,024
Other states.....	76,048	1,954,032	24.32	1,833,032	22.81	6,723	139,928	20.81	69,325	1,814,104	24.64	36,292

<sup>1</sup> Drained entirely by pumping.

<sup>2</sup> An undetermined part of this acreage may at times be drained by gravity.

The cost of the pumping plants was not secured separately from the other costs of the enterprises, and it is not to be inferred that the difference between the cost of gravity districts and pumping districts, even for a state, represents only the cost of the plants. The condition is that those enterprises that require pumping generally are so situated that the other

drainage works also are more costly than the average, but an unusually high value of the land is believed to warrant the extraordinary expense. The real cost of drainage by pumping includes, of course, operating charges such as labor and fuel for which statistics were not obtained and no estimates are attempted.



# SUMMARY FOR THE UNITED STATES.

## INTRODUCTION.

This report presents a summary of the statistics of drainage for the United States collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for any previous year. The statistics relate to the artificial drainage of land in farms, and of other land that is expected to be used ultimately for agricultural purposes.

The drainage census divides naturally into two parts, one relating to improvement work undertaken by individual farm owners, the other to improvement or reclamation work of mutual benefit to a number of owners organized in accordance with the statutes. The former has been termed drainage on farms, and the latter termed drainage enterprises. These enterprises in some states include considerable areas of timber and other unimproved land not yet included in farms.

The statistics for drainage on farms were collected in the general census of agriculture, while those for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside a drainage enterprise, and since the drains that each owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

No census of drainage enterprises was taken in the states of the New England and Middle Atlantic divisions, or the other states north of Potomac River. No enterprises of a public nature in Alabama, Virginia, and West Virginia had begun actual construction on January 1, 1920, so those states have been omitted entirely from this part of the census. The figures for drainage on farms include all states.

TABLE 1.—SUMMARY: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the United States.....	6, 448, 343	100. 0
Farms reporting land having drainage.....	924, 810	14. 3
Farms reporting land needing drainage.....	956, 095	14. 8
All land in farms..... acres..	955, 883, 715	100. 0
Improved land in farms..... acres..	503, 073, 007	52. 6
Farm land reported as provided with drainage..... acres..	53, 024, 975	5. 5
Farm land reported as needing drainage..... acres..	39, 110, 357	4. 1
Needing drainage only..... acres..	10, 459, 181	1. 1
Needing drainage and clearing..... acres..	28, 651, 176	3. 0
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the states included..... acres..	1, 717, 932, 160	100. 0
All land in operating drainage enterprises..... acres..	65, 495, 038	3. 8
Improved land..... acres..	44, 288, 235	2. 6
Per cent of all improved land in farms.....	8. 8	-----
Timber and cut-over land..... acres..	11, 283, 532	0. 7
Other unimproved land..... acres..	9, 923, 271	0. 6
Swampy, subject to overflow, seeped, or alkali..... acres..	7, 224, 213	11. 0
Suffering a loss of crops from defective drainage..... acres..	3, 011, 407	4. 6
Improved land prior to drainage..... acres..	24, 536, 236	37. 5
Increase since drainage began..... acres..	19, 701, 999	30. 1
Land in nonoperating enterprises..... acres..	3, 924, 821	0. 2
Open ditches in operating enterprises..... miles..	111, 770. 0	100. 0
Completed..... miles..	107, 468. 2	96. 2
Additional under construction..... miles..	4, 301. 8	3. 8
Tile drains in operating enterprises..... miles..	45, 173. 8	100. 0
Completed..... miles..	42, 311. 7	93. 7
Additional under construction..... miles..	2, 862. 1	6. 3
Total capital invested in and required for completion of operating enterprises..	\$434, 594, 979	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	372, 273, 567	85. 7
Additional capital required to complete these enterprises.....	62, 321, 412	14. 3
Average cost per acre when completed.....	6. 64	-----



## DRAINAGE ON FARMS.

**Explanation of terms.**—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which were substantially as follows:

**Drainage of agricultural land** was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, includes the acreage actually benefited or made of more value for agricultural purposes, by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land that is not now suitable for crops, but which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, generally are not included in the enterprises for which data are given in this report (see definition of drainage enterprises below).

**Farms and farm land.**—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

## DRAINAGE ENTERPRISES.

**Explanation of terms.**—The more important terms used in connection with the census of drainage enterprises were defined as follows:

**Drainage enterprises** comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, any other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

**Operating enterprises**, as designated in this report, are those drainage enterprises that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

**Land in drainage enterprises** is the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering a loss of crops is intended to include only land devoted to planted crops, which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation or improvement several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include enterprises that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work; and also projects that had just been established by decree of the court or other designated authority and were still subject to considerable change in area, plan of drainage works, and cost. The figures are presented for the United States as a whole in Table 2, and for geographic divisions and states in State Tables II and III (pages 373 and 374).

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises..	69,419,859	100.0	\$373,397,025	100.0	\$97,259,090	
Operating enterprises.....	65,495,038	94.3	372,273,567	99.7	62,321,412	
With works completed.....	56,763,751	81.8	293,857,023	78.7		
With works under construction.....	8,731,287	12.6	78,416,544	21.0	62,321,412	
Nonoperating enterprises.....	3,924,821	5.7	1,123,458	0.3	34,937,678	

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Three-fourths of all the land in drainage enterprises in the United States (78 per cent of the area in operating enterprises and 75 per cent of that in all enterprises) is situated in those states north of the Ohio and Missouri Rivers and east of the Rocky Mountains, including Missouri and Kansas. The Southern states from the Potomac to the Rio Grande contain 19 per cent of the land in operating enterprises and 22 per cent of that in all drainage enterprises, and the western states have the remaining 3 per cent. The drainage water from three-fourths of the land in the enterprises in the United States ultimately reaches the Mississippi River. In the north-eastern states, omitted from these statistics, comparatively little drainage for agriculture has been undertaken.

Michigan has a greater area in drainage enterprises than any other state, 9,754,679 acres reported in all enterprises, and Indiana, Iowa, Minnesota, and Ohio reported areas ranging from 5,000,000 to 9,000,000 acres each. Indiana has the greatest portion of its area organized for drainage, more than 39 per cent of all

land in the state having been included in operating enterprises, and nearly 41 per cent in both operating and nonoperating enterprises. The distribution of the land in operating enterprises is shown by the map following page 346, and the figures for all enterprises, for each geographic division and state, are given in State Tables II, III, and IV (pages 373 to 375).

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises.....	69,419,859	100.0	\$373,397,025	100.0	\$97,259,090	
Operating enterprises.....	65,495,038	94.3	372,273,567	99.7	62,321,412	
Atlantic Ocean.....	2,053,788	3.0	17,004,954	4.6	13,900,175	
Gulf of Mexico, east <sup>1</sup> .....	807,712	1.2	4,776,673	1.3	748,904	
Lower Mississippi River <sup>2</sup> .....	8,072,564	11.6	47,516,434	12.7	21,683,482	
Ohio River.....	10,998,378	15.8	42,582,673	11.4	1,588,775	
Missouri River.....	2,510,150	3.6	21,350,055	5.7	2,466,268	
Upper Mississippi River <sup>3</sup> .....	10,850,408	15.6	105,159,705	28.2	8,893,447	
Gulf of Mexico, west <sup>1</sup> .....	3,324,860	4.8	10,950,007	2.9	899,293	
Rio Grande.....	766,670	1.1	3,508,703	0.9	1,835,500	
Great Basin.....	129,763	0.2	1,123,324	0.3	1,865,300	
Colorado River.....	136,280	0.2	814,864	0.2	1,699,195	
Pacific Ocean.....	80,401	0.1	1,363,986	0.4	150,000	
San Francisco Bay.....	986,118	1.4	46,184,577	12.4	5,194,474	
Columbia River.....	173,716	0.3	3,378,710	0.9	149,000	
Hudson Bay.....	7,992,846	11.5	16,223,414	4.3	480,500	
Great Lakes.....	16,611,386	23.9	50,335,438	13.5	717,099	
Nonoperating enterprises.....	3,924,821	5.7	1,123,458	0.3	34,937,678	
Atlantic Ocean.....	1,044,921	1.5	242,721	0.1	2,957,792	
Gulf of Mexico, east <sup>1</sup> .....	41,230	0.1	25,056	(*)	403,194	
Lower Mississippi River <sup>2</sup> .....	1,194,600	1.7	350,928	0.1	11,476,017	
Ohio River.....	158,932	0.2	69,475	(*)	1,591,407	
Missouri River.....	352,894	0.5	155,916	(*)	6,785,438	
Upper Mississippi River <sup>3</sup> .....	521,759	0.8	140,028	(*)	7,424,581	
Gulf of Mexico, west <sup>1</sup> .....	383,490	0.6	46,000	(*)	1,417,500	
Rio Grande.....	7,000	(*)			150,000	
Great Basin.....	20,731	(*)	9,500	(*)	647,500	
Colorado River.....	25,345	(*)	500	(*)	535,000	
Pacific Ocean.....	12,900	(*)	1,000	(*)	400,000	
Columbia River.....	18,955	(*)	54,725	(*)	205,000	
Hudson Bay.....	23,312	(*)	2,484	(*)	104,023	
Great Lakes.....	118,752	0.2	25,125	(*)	841,226	

<sup>1</sup> The eastern and western areas drained into the Gulf of Mexico are separated by the region tributary to Mississippi River, and do not include the land drained into either the Mississippi or the Rio Grande.

<sup>2</sup> The division between upper and lower Mississippi River is made at the Missouri.

<sup>3</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—The statistics secured show that of all the land in operating enterprises slightly more than two-thirds is improved, and somewhat more than one-tenth still is swampy or subject to overflow, including land too wet for cultivation and that injured by the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. The improved land is approximately 75 per cent of all land in the operating enterprises in the two north central geographic divisions of the United States, 45 per cent in the three southern divisions, and 87 per cent in the two western divisions. The portions swampy, wet, subject to overflow, or alkali are approximately 8 per cent, 24 per cent, and 12 per cent, respectively, in the northern, southern, and western groups of states. The condition of the land before drainage, in the operating enterprises, is shown in State Table V (pages 376 to 379).

In general, those drainage enterprises in the Atlantic Coastal Plain, from North Carolina to Texas and including the alluvial land of the lower Mississippi Valley,

have been organized for the reclamation of rather large areas of level swamp land. The swampy land in the North Central states, except in the northern parts of Minnesota, Wisconsin, and Michigan, is generally broken into smaller tracts by a slightly rolling topography. Those enterprises in the Piedmont section of the South Atlantic states and those bordering the streams of moderate size in the Mississippi River system are intended principally to protect against inundation by stream floods or to remove the overflow water promptly. Nearly all of the enterprises in the Mountain states and a large part of those in the Pacific states are for the drainage or protection of irrigated land injured or threatened with seepage and alkali.

In the Western states, irrigated land comprising 52,873 acres in drainage districts and 600,578 acres in irrigation districts and irrigation projects of the United States Reclamation Service is reported as not to have needed drainage or protection for itself, but to have been assessed for the cost of drainage merely on account of being responsible for injury to the other land. This acreage in the irrigation enterprises is not included in the tabulations in this report.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or that suffers damage to crops, does not show that the improvement works are inadequate for the purpose intended. Perhaps some of the supplemental drains that are properly the work of individual farm owners have not been constructed.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	65,495,038	100.0	56,763,751	8,731,287	3,924,821
Improved land.....	44,288,235	67.6	40,828,982	3,459,253	1,376,495
Timber and cut-over land.....	11,283,532	17.2	8,209,432	3,074,040	1,294,018
Other unimproved land.....	9,923,271	15.2	7,725,277	2,197,994	1,254,308
Swampy, subject to overflow, seeped, or alkali.....	7,224,213	11.0	4,496,922	2,727,291	2,299,562
Suffering a loss of crops.....	3,011,407	4.6	2,340,065	671,342	239,192

Size of enterprises.—To show the statistics by counties, as has been done in the reports on drainage for separate states, required that an enterprise located in more than one county be divided, and the part in each county be considered as a separate enterprise. In this way 56,949 operating drainage enterprises are counted in the United States, with an average area of

1,680 acres assessed. The number of enterprises includes both those organized for original construction, and those for reconstruction undertaken by petition and hearings in the same manner as prescribed for establishing new drains, which has been the customary method for maintaining or renewing public ditches in some states; it includes also those organized for extending drains constructed previously, or for uniting two or more such drains into a single system.

The assessed acreage exceeds the land in operating enterprises by 30,134,253 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises.

There are 543 nonoperating enterprises, which have a total assessed area of 5,245,428 acres and an average area of 9,660 acres. Of this total, 1,282,107 acres are a duplication of land assessed in earlier enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	65,495,038	96,629,291	100.0
Less than 200 acres.....	791,506	1,155,395	1.2
200 to 499 acres.....	2,263,873	5,285,772	5.5
500 to 999 acres.....	5,456,072	9,202,602	9.6
1,000 to 4,999 acres.....	18,637,501	30,153,424	31.5
5,000 to 9,999 acres.....	9,176,406	13,848,393	14.5
10,000 to 49,999 acres.....	17,737,764	23,412,104	24.5
50,000 to 99,999 acres.....	6,508,673	7,840,623	8.2
100,000 to 499,999 acres.....	3,923,243	4,730,978	4.9

Character of enterprises.—Most of the drainage enterprises, comprising 92.4 per cent of all the land in the operating enterprises, are public corporations or local improvement districts organized in accordance with general state laws specially framed to permit or to encourage the reclamation and improvement of land that is swampy, wet, or subject to overflow. Such enterprises have been classified here as drainage districts and county drains, according to whether the executive authority is vested in officers specially chosen for each district, or in regular county officials serving in the same capacity for all the county drains in their respective counties. This classification is not recognized in all states, however, and the term district is used in several states for enterprises here designated as county drains. The district form of organization has been used altogether in Colorado, Georgia, Idaho, Louisiana, Tennessee, Texas, Utah, and Wyoming, and the county form entirely in Iowa,<sup>1</sup> Michigan, Minnesota, Montana, North Dakota, Ohio, and South Dakota, for public enterprises established primarily for drainage. Both forms have been used in the

<sup>1</sup> Excepting those pumping districts governed by elected trustees.

other states where organized drainage is important, but in Arkansas, Florida, Illinois, and North Carolina the area served by county drains is less than 5 per cent of the total in enterprises. A few laws prescribe for each enterprise a governing board comprising both regular county officials and members specially appointed or elected for the enterprise.

A considerable number of drainage districts have been established by special acts of the state legislatures, which determined more or less specifically for each district what land should be included, the manner of selecting the officers, their duties and powers, and the various steps in securing construction of the improvement works, in financing the project, and in apportioning and collecting the assessments to pay the expenses incurred. Rather more than one-third, in acreage, of the operating drainage districts in Arkansas, and practically one-fourth in Florida, have been created by such special legislation.

In general, drainage districts and county drains are established by order of the administrative board of the county or by decree of a court designated in the drainage law, after petition, investigation, and public hearings to determine the necessity and public utility of the project. The statutes provide the basis for apportioning the cost against the property to be benefited by the proposed work, and most of the states authorize the issue of drainage bonds by the districts or by the counties.

Township drains are similar to county drains, but the officers of the townships, instead of the county boards, determine whether the enterprise shall be established and afterwards control construction of the works authorized.

The state drainage projects are located in Florida and Minnesota. Those in the former state are drainage districts organized under special acts of the legislature; those in the latter state have the character of enterprises classified here as county drains, with state instead of county officials in control after the decree of establishment has been issued.

Irrigation districts included as drainage enterprises are those public corporations formed to construct and operate irrigation works, which have undertaken the construction of works to drain or protect land in the district injured or threatened with seepage or alkali as a result of the irrigation. In character they are not unlike drainage districts. The area of the drainage enterprise is the area to be drained or protected, not the area of the irrigation district.

The United States Reclamation Service irrigation projects are included as drainage enterprises under the same circumstances as irrigation districts, the area of the drainage enterprise being the area to be benefited by the drainage works.

Commercial developments are principally enterprises formed under ordinary business corporation laws for the primary purpose of reclaiming unimproved land to be sold at a profit.

Individual ownership enterprises are private undertakings by single farm owners, or occasionally by a few owners cooperating without formal organization, for improving land already in farms. Only those individual enterprises designed to benefit 500 acres or more have been included in the statistics for drainage enterprises. They are included also with the smaller undertakings in the figures for drainage on farms.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises...	69,419,859	100.0	\$373,397,025	100.0	\$97,259,090	
Operating enterprises.....	65,495,039	94.3	372,273,507	99.7	62,321,412	
Drainage districts <sup>1</sup> .....	22,069,597	31.8	172,013,972	46.1	39,136,568	
General state laws.....	20,239,956	29.2	147,511,259	39.5	24,593,523	
Special acts.....	1,529,641	2.6	24,502,713	6.6	14,545,045	
County drains.....	37,570,303	54.6	169,743,093	45.5	9,682,477	
Township drains.....	195,133	0.3	574,983	0.2	4,500	
State drainage projects.....	1,422,844	2.0	6,845,429	1.8	6,434,440	
U. S. Reclamation Service.....	237,899	0.4	3,912,370	1.0	2,530,243	
Irrigation districts.....	175,200	0.3	1,459,714	0.4	2,553,529	
Commercial developments.....	212,421	0.3	3,279,829	0.9	1,128,000	
Individual ownerships.....	432,397	0.6	6,449,252	1.7	841,750	
Not reported <sup>2</sup> .....	2,828,744	4.1	7,994,945	2.1	9,605	
Nonoperating enterprises.....	3,924,821	5.7	1,123,453	0.3	34,937,678	
Drainage districts.....	3,250,104	4.7	772,834	0.2	26,339,970	
General state laws.....	2,667,056	3.8	752,830	0.2	25,073,970	
Special acts.....	593,048	0.9	20,004	(*)	1,266,000	
County drains.....	596,694	0.9	302,224	0.1	3,139,808	
Township drains.....	423	(*)			2,400	
U. S. Reclamation Service.....	7,000	(*)			150,000	
Commercial developments.....	50,000	0.1	45,000	(*)	150,000	
Individual ownerships.....	10,600	(*)	3,400	(*)	155,500	

<sup>1</sup> All of the statistics for which character of enterprises was not reported, except 35,082 acres and \$213,951 invested to Dec. 31, 1919, relate to either drainage districts or county drains in Indiana.

<sup>2</sup> Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 107,468.2 miles of open ditches, 42,311.7 miles of tile drains, and 3,519.8 miles of accessory levees; the additional lengths under construction were 4,301.8 miles of open ditches, 2,862.1 miles of tile drains, and 810.2 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are 212 pumping districts among the operating drainage enterprises in the United States.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the United States and the maximum in each state are shown in line 15 of State Table V. The maximum length, width, and depth of outlet shown in that table for any state may not refer to the same enterprise.

In State Table V, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the

depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted, because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those enterprises. To include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the United States 5.5 instead of 5.4 feet.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	65,495,038	100.0	\$372,273,567	100.0	\$62,321,412
Open ditches only.....	43,658,485	66.7	155,943,040	41.9	21,798,959
Open ditches and levees.....	5,658,000	8.6	32,263,934	22.1	27,114,634
Tile drains only.....	4,951,152	7.6	46,537,986	12.5	2,516,169
Tile drains and levees.....	23,109	( <sup>1</sup> )	264,000	0.1	
Open ditches and tile drains.....	10,731,279	16.4	73,457,209	19.7	9,888,175
Open ditches, tile drains, and levees.....	475,013	0.7	13,807,398	3.7	1,003,475

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	65,495,038	100.0	\$372,273,567	100.0	\$62,321,412
Gravity drainage only.....	63,602,475	97.1	306,443,303	82.3	48,398,323
All drainage by pumping.....	781,441	1.2	32,020,807	8.6	2,001,781
Part gravity and part pumping.....	1,111,122	1.7	33,809,457	9.1	11,923,399
Total area served by pumps.....	1,544,010	2.4			

TABLE 9.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horse-power.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	67,189	100.0	15,949,166	100.0	1,544,010	100.0
Steam.....	17,311	25.8	7,125,848	44.7	496,426	32.0
Electric.....	36,472	54.3	5,733,756	36.0	706,794	45.6
Internal combustion.....	6,691	10.0	1,844,662	11.6	250,452	16.2
Steam and electric.....	15,485	22.8	974,200	6.1	67,466	4.4
Electric and internal combustion.....	890	1.3	180,500	1.2	14,728	1.0
Steam and internal combustion.....	215	0.3	77,600	0.5	5,800	0.4
Not reported.....	125	0.2	3,600	( <sup>1</sup> )	2,349	0.2

<sup>1</sup> Includes 2,450 steam, 1,330 electric, and 1,705 not divided.  
<sup>2</sup> Includes 230 electric, 245 internal combustion, and 415 not divided.  
<sup>3</sup> Includes 75 steam and 140 internal combustion.  
<sup>4</sup> Less than one-tenth of 1 per cent.  
<sup>5</sup> Includes 594 acres served by 1 water-wheel.

TABLE 10.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF PUMP: 1920.

KIND OF PUMP.	Number of pumps.	PUMP CAPACITY.		ENGINE CAPACITY.		AREA SERVED.	
		Gallons per minute.	Per cent of total.	Horse-power.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	453	15,949,166	100.0	67,189	100.0	1,544,010	100.0
Centrifugal.....	423	14,500,308	90.9	62,509	93.0	1,371,447	88.8
Rotary.....	7	53,348	0.3	360	0.5	4,341	0.3
Rotary and centrifugal.....	3	75,000	0.5	200	0.3	2,600	0.2
Screw.....	11	1,223,660	7.7	3,845	5.7	126,804	8.4
Centrifugal and screw.....	3	84,000	0.5	125	0.2	4,200	0.3
Not reported.....	6	12,850	0.1	150	0.2	131,618	2.0

<sup>1</sup> Includes 594 acres served by 1 water-wheel.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	65,495,038	100.0
Less than 3 feet.....	1,295,633	2.0
3.0 to 3.9 feet.....	4,100,380	6.3
4.0 to 4.9 feet.....	6,840,135	10.1
5.0 to 5.9 feet.....	5,402,497	8.2
6.0 to 6.9 feet.....	5,737,251	8.8
7.0 to 7.9 feet.....	3,488,588	5.3
8.0 to 8.9 feet.....	4,019,691	6.1
9.0 to 9.9 feet.....	496,596	0.8
10 feet and more.....	1,511,584	2.3
Not reporting branches.....	32,802,684	50.1

Maintenance of works.—Most of the laws governing drainage enterprises provide that the executive boards of those enterprises classified herein as drainage districts may maintain and repair the drainage works of their districts, and that the county boards or other designated public officials may keep the county drains in proper condition. In states having two or more drainage laws, a different method of maintenance may be provided for the enterprises established under each statute. Inspection of the public drainage works at least once each year is required in Iowa, and twice each season in those counties of Minnesota in which the cost of the enterprises has reached \$50,000. Annual estimates of funds necessary for maintenance work are now required by law for part or all of the public drainage enterprises in nearly every state in which public drainage organization is authorized. All public drains in Michigan and all dredged ditches in Indiana are repaired or reconstructed only upon petition and after proceedings similar to those required for establishing a new drain. In some other states also this has been the usual method of obtaining repairs until very recently.

The greater part of the laws provide that the costs for maintenance and repairs shall be assessed against the land that was assessed for original construction of the works, and in the same proportion as the construction cost. Maintenance costs for all the drainage enterprises in Texas and for those established under certain laws in other states are apportioned according to the assessed value of the property in the enterprises. In Louisiana

the costs are assessed in proportion to property valuation or at a uniform rate per acre. Some statutes have authorized or required that the ditches be divided into sections and allotted to the landowners for keeping in repair.

TABLE 12.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises...	65,426,088	100.0	\$372,273,567	100.0	\$62,321,412
By district forces.....	14,184,281	21.7	132,883,309	35.7	23,717,025
By contract.....	12,687,978	19.4	83,422,369	22.4	5,474,587
By method not specified.....	533,058	0.8	6,317,532	1.7	313,776
By landowners.....	3,530,148	5.4	16,082,606	4.3	1,663,543
No maintenance provided.....	30,512,636	46.6	113,343,700	30.4	8,852,656
Not reporting.....	4,006,987	6.1	20,224,001	5.4	22,294,524

Further information than is given in the above table was not secured regarding maintenance provided for the drainage works. It is probable that the amount of systematic maintenance is actually much less than the table would seem to indicate; that only an inconsiderable number of landowners clean out the public drains of their own initiative; and that much of the contract work, and even some of that reported as done by district forces, is really reconstruction of drains that have been more or less neglected.

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the orders of establishment were issued, since there may be a period of one or more years between the order of establishment and the beginning of actual construction, and since the work of construction may occupy several years for a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. For such enterprises as irrigation districts, the date is approximately that when the drainage, rather than the irrigation, was undertaken.

Owing to the incompleteness of the records of drainage work in Michigan before 1897, when the county drain law was enacted, no attempt was made to secure information regarding the enterprises established previous to that year. In some counties in other states, more particularly in Indiana and Ohio, the records of the earlier drainage enterprises were incomplete or, in some cases, entirely missing.

TABLE 13.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSURED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	65,426,088	100.0	65,426,088	100.0
Before 1890.....	97,319	0.1	98,119	0.1
1890 to 1899.....	793,357	1.2	822,385	1.0
1870 to 1879.....	2,077,717	3.2	3,413,277	3.6
1880 to 1889.....	5,424,294	8.3	5,543,654	8.2
1890 to 1899.....	6,026,987	9.2	11,575,924	12.1
1900 to 1904.....	7,606,753	11.6	12,200,468	12.8
1905 to 1909.....	14,530,397	22.2	20,228,636	21.2
1910 to 1914.....	17,344,086	26.5	22,245,530	23.3
1915 to 1919.....	11,374,619	17.4	15,828,501	16.6
Not reported.....	226,547	0.4	282,608	0.3

TABLE 14.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	Amount.	Per cent of total.	Additional required to complete.
All operating enterprises.....	\$372,273,567	100.0	\$62,321,412
Before 1890.....	182,716	( <sup>1</sup> )	.....
1890 to 1899.....	1,689,852	0.5	.....
1870 to 1879.....	4,128,391	2.2	.....
1880 to 1889.....	23,884,430	6.4	1,540,529
1890 to 1899.....	24,468,861	6.6	521,310
1900 to 1904.....	28,708,464	7.7	709,063
1905 to 1909.....	78,672,320	21.4	7,612,491
1910 to 1914.....	120,266,506	32.3	14,455,410
1915 to 1919.....	87,379,632	23.5	36,771,650
Not reported.....	3,414,065	0.9	410,450

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 15.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DRAINS.		DITCHES.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees...	111,770.0	100.0	45,172.8	100.0	4,330.0	100.0
Before 1890.....	172.7	0.2	4.2	( <sup>1</sup> )	.....	.....
1890 to 1899.....	2,295.5	2.1	47.5	0.1	21.0	6.5
1870 to 1879.....	6,671.9	6.0	372.5	0.8	64.2	1.5
1880 to 1889.....	14,783.2	13.2	2,552.0	5.7	218.7	5.0
1890 to 1899.....	12,747.3	11.4	4,305.0	9.5	378.1	8.7
1900 to 1904.....	12,308.3	11.0	5,735.4	12.7	438.5	10.1
1905 to 1909.....	20,538.9	18.4	7,677.8	17.4	801.1	18.5
1910 to 1914.....	24,875.7	22.3	11,812.3	26.1	1,231.1	28.4
1915 to 1919.....	16,897.5	15.1	14,237.7	31.5	885.3	20.4
Not reported.....	498.0	0.4	198.4	0.4	198.5	4.5

<sup>1</sup> Less than one-tenth of 1 per cent.

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, wheat, cotton, hay, and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in State Table V. No data were secured at the general census of agriculture which would make it possible to separate the crops grown upon land drained artificially from those produced upon land drained naturally.



STATE TABLE I.—DRAINAGE ON FARMS, BY GEOGRAPHIC DIVISIONS AND STATES: 1920.

DIVISION AND STATE.	NUMBER OF FARMS.				Area of all land (acres).	LAND IN FARMS.							
	All farms.	Having drainage.	Needing drainage.	In drainage and levee districts.		Total (acres).	Improved (acres).	Woodland (acres).	Other unimproved (acres).	Provided with drainage (acres).	Needing drainage.		
											Total (acres).	Drainage only (acres).	Drainage and clearing (acres).
<b>United States.....</b>	<b>6,448,343</b>	<b>924,615</b>	<b>956,095</b>	<b>172,793</b>	<b>1,903,215,360</b>	<b>955,533,715</b>	<b>503,073,007</b>	<b>167,738,794</b>	<b>285,079,914</b>	<b>53,024,975</b>	<b>29,189,639</b>	<b>10,459,151</b>	<b>24,710,438</b>
<b>GEOGRAPHIC DIVISIONS:</b>													
New England.....	156,564	9,083	17,571	252	39,664,640	16,990,642	6,114,601	7,020,311	3,855,730	129,799	397,267	86,991	310,276
Middle Atlantic.....	425,147	61,549	69,216	1,583	64,000,000	40,572,901	26,562,107	8,659,237	5,351,557	1,673,638	1,412,038	505,910	906,128
East North Central...	1,094,744	429,584	302,008	63,789	157,160,960	117,735,179	87,894,835	18,061,460	11,778,884	30,737,056	8,870,356	3,243,427	5,626,929
West North Central...	1,096,951	163,714	169,593	47,883	328,914,560	250,973,229	171,394,439	18,761,832	66,816,959	11,758,939	7,200,539	4,187,385	3,073,154
South Atlantic.....	1,158,976	114,983	156,780	6,979	172,205,440	97,775,243	48,509,886	41,802,263	7,463,094	2,865,072	7,511,230	696,687	6,814,543
East South Central...	1,051,600	69,597	106,972	17,290	114,885,760	78,997,463	44,380,132	28,414,524	6,102,807	1,720,517	4,279,968	462,040	3,817,928
West South Central...	996,038	44,835	91,595	25,010	275,037,440	173,449,127	64,189,606	29,749,152	79,510,369	2,365,701	7,134,572	734,306	6,400,267
Mountain.....	244,109	9,754	14,988	3,551	549,765,760	117,337,226	30,105,868	6,887,071	80,244,287	456,015	909,948	329,359	640,589
Pacific.....	234,164	21,716	27,372	6,456	203,580,800	56,152,705	23,921,533	8,374,944	23,856,228	1,318,238	1,333,721	213,077	1,120,644
<b>NEW ENGLAND:</b>													
Maine.....	48,227	2,068	5,425	25	19,132,800	5,425,968	1,977,329	2,447,597	1,001,042	26,302	142,053	19,930	122,123
New Hampshire.....	20,523	1,013	1,794	16	5,779,840	2,603,806	702,902	1,299,838	601,066	11,777	40,783	9,914	30,869
Vermont.....	29,075	1,728	3,042	35	5,839,360	4,235,811	1,691,595	1,428,309	1,115,907	35,649	68,912	19,265	49,647
Massachusetts.....	32,001	2,955	4,112	138	5,144,960	2,494,477	908,834	1,030,386	555,257	39,022	80,883	21,212	59,671
Rhode Island.....	4,083	116	359	2	682,880	331,600	132,855	130,462	68,283	2,403	8,174	2,240	5,934
Connecticut.....	22,655	1,203	2,839	36	3,084,800	1,898,980	701,066	683,719	514,175	14,646	56,462	14,430	42,032
<b>MIDDLE ATLANTIC:</b>													
New York.....	193,195	33,896	38,523	1,447	30,498,560	20,632,803	13,158,781	4,160,567	3,313,455	1,180,423	779,467	318,865	460,602
New Jersey.....	29,702	4,903	3,428	136	4,808,960	2,282,585	1,555,607	454,768	272,210	174,260	77,881	29,193	48,688
Pennsylvania.....	202,250	22,750	27,265	238	28,662,490	17,657,613	11,847,719	4,043,902	1,765,892	318,955	554,690	157,852	396,838
<b>EAST NORTH CENTRAL:</b>													
Ohio.....	256,695	130,117	85,226	7,315	26,073,600	23,516,883	18,542,353	3,198,929	1,774,606	7,365,532	2,014,889	866,567	1,128,329
Indiana.....	205,126	111,435	66,413	14,839	23,068,800	21,063,382	16,680,212	3,141,042	1,242,078	8,308,844	1,717,068	673,952	1,043,116
Illinois.....	237,181	99,246	33,731	14,586	35,867,520	31,974,775	27,294,833	3,102,579	1,577,663	11,247,637	1,228,739	641,493	587,246
Michigan.....	196,447	66,948	64,310	23,356	36,787,200	19,032,961	12,925,521	3,217,000	2,890,440	3,156,632	2,070,387	579,813	1,490,574
Wisconsin.....	199,295	21,838	52,228	3,693	35,363,840	22,148,223	12,452,216	5,401,910	4,294,097	658,411	1,839,273	461,612	1,377,661
<b>WEST NORTH CENTRAL:</b>													
Minnesota.....	178,478	53,011	73,905	16,421	51,749,120	30,221,758	21,481,710	4,482,656	4,257,392	2,993,034	3,504,574	1,801,457	1,703,117
Iowa.....	213,439	83,865	56,083	20,658	35,575,040	33,474,896	28,606,951	2,296,274	2,572,671	7,334,404	2,052,942	1,661,744	391,198
Missouri.....	263,004	11,917	19,572	7,743	43,985,280	34,774,679	24,332,966	3,553,857	1,387,856	859,603	830,963	163,778	667,615
North Dakota.....	77,690	682	2,669	341	44,917,120	36,214,751	24,563,178	679,836	10,971,737	89,054	211,305	53,161	158,144
South Dakota.....	74,637	4,077	11,828	1,028	49,195,620	34,636,491	18,199,250	536,183	15,901,058	161,371	446,915	356,049	90,866
Nebraska.....	124,417	2,356	2,963	1,064	49,157,120	42,225,475	23,109,624	900,933	18,214,918	214,426	146,818	115,425	30,393
Kansas.....	165,286	2,806	2,573	628	52,335,360	45,425,179	30,600,760	1,313,033	13,511,326	106,985	68,292	36,371	31,921
<b>SOUTH ATLANTIC:</b>													
Delaware.....	10,140	4,246	2,488	1,321	1,257,600	944,511	663,052	222,658	63,801	185,831	68,969	7,967	61,003
Maryland.....	47,908	6,911	6,658	272	6,362,240	4,757,999	3,136,728	1,327,221	294,050	249,799	184,820	33,267	151,553
District of Columbia..	204	21	12	.....	38,400	5,668	4,258	828	582	197	115	58	57
Virginia.....	186,242	9,899	27,740	140	25,767,680	18,561,112	9,480,492	7,907,352	1,193,288	225,068	1,172,580	77,192	1,095,388
West Virginia.....	87,289	1,949	10,304	33	15,374,080	9,599,790	5,520,308	3,409,444	580,038	38,464	310,868	32,253	278,615
North Carolina.....	269,763	45,246	42,247	1,831	31,193,600	30,021,736	8,198,409	10,299,547	1,523,780	1,068,933	1,925,343	189,401	1,735,942
South Carolina.....	193,693	26,993	24,598	1,071	19,616,800	12,426,675	6,184,159	5,302,575	939,941	676,152	1,341,903	125,548	1,216,355
Georgia.....	310,732	15,121	24,337	995	37,584,000	25,441,061	13,055,209	10,491,848	1,894,004	274,688	1,819,611	143,187	1,676,424
Florida.....	84,006	4,597	8,486	1,266	35,111,040	6,048,691	2,297,271	2,780,790	963,630	147,940	687,021	87,814	599,207
<b>EAST SOUTH CENTRAL:</b>													
Kentucky.....	370,626	5,817	19,592	773	25,715,840	21,612,772	13,975,746	6,018,280	1,618,746	225,228	573,299	84,159	489,140
Tennessee.....	262,774	8,887	20,997	2,669	26,679,680	19,510,950	11,185,302	7,080,169	1,245,385	254,118	640,479	76,644	563,835
Alabama.....	256,099	19,967	36,511	352	32,818,600	19,578,856	9,893,407	8,301,177	1,382,272	415,293	1,610,656	150,028	1,460,628
Mississippi.....	272,101	84,626	29,872	13,499	29,671,680	18,196,979	9,325,677	7,014,898	1,856,404	825,878	1,455,534	151,179	1,304,355
<b>WEST SOUTH CENTRAL:</b>													
Arkansas.....	232,604	13,426	33,437	10,832	33,616,000	17,456,750	9,210,556	7,396,028	850,166	497,459	1,642,403	129,967	1,512,436
Louisiana.....	185,463	21,371	14,985	10,516	29,061,760	19,019,822	5,696,296	3,614,040	779,566	1,004,935	1,065,769	179,305	916,464
Oklahoma.....	191,983	2,032	8,065	834	44,424,960	31,951,934	18,125,321	4,206,171	9,620,442	107,014	268,786	39,788	228,998
Texas.....	436,033	8,106	35,108	2,778	167,934,720	114,020,021	31,227,563	14,532,913	68,260,205	756,263	4,130,614	385,225	3,745,389
<b>MOUNTAIN:</b>													
Montana.....	87,677	756	1,728	336	69,523,840	35,070,656	11,007,378	1,646,462	23,416,916	51,146	113,293	36,342	76,951
Idaho.....	42,106	1,167	2,865	647	53,346,560	8,375,873	4,511,689	820,876	3,043,317	64,648	199,874	37,566	162,308
Wyoming.....	15,748	433	1,127	237	62,430,720	11,806,361	2,102,005	421,806	9,285,540	35,654	69,066	23,837	45,229
Colorado.....	59,934	2,749	4,399	696	66,341,120	24,462,014	7,744,757	1,415,420	15,301,637	127,057	270,997	80,121	190,876
New Mexico.....	29,844	1,994	996	484	78,401,920	24,409,633	7,717,224	1,817,480	20,374,949	47,311	49,102	29,016	20,086
Arizona.....	9,975	341	435	28	72,838,400	5,802,126	712,803	533,648	4,565,675	9,651	41,951	9,596	32,355
Utah.....	25,662	2,729	3,085	791	52,597,760	5,050,410	1,715,380	212,762	3,122,263	74,316	165,926	74,798	91,140
Nevada.....	3,163	385	321	232	70,285,440	2,357,163	594,741	28,637	1,733,785	46,252	59,739	38,085	21,644
<b>PACIFIC:</b>													
Washington.....	66,388	10,020	14,323	2,630	42,775,040	13,244,720	7,126,343	1,813,051	4,302,316	274,696	576,005	45,206	530,799
Oregon.....	80,206	6,618	9,862	673	61,188,480	13,542,318	4,913,851	2,309,596	6,318,971	269,582	471,396	75,063	396,333
California.....													

DRAINAGE.

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STATE TABLE II.—LAND IN ALL DRAINAGE ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES, BY GEOGRAPHIC DIVISIONS AND STATES: 1920.

DIVISION AND STATE.	Approximate land area of states included (acres).	ALL ENTERPRISES.		OPERATING ENTERPRISES.				NONOPERATING ENTERPRISES.	
		Acreage.	Per cent of total.	All operating enterprises.		Works completed (acres).	Works under construction (acres).	Acreage.	Per cent of total.
				Acreage.	Per cent of total.				
States included.....	1,717,932,160	69,419,859	100.0	65,495,038	100.0	56,783,751	8,731,287	8,924,831	100.0
<b>GEOGRAPHIC DIVISIONS:</b>									
East North Central.....	157,160,980	32,073,734	46.2	31,627,176	48.3	30,475,905	1,151,271	448,558	11.4
West North Central.....	326,914,500	19,936,111	28.7	19,217,367	29.3	16,959,103	2,258,264	718,744	18.3
South Atlantic.....	123,405,440	3,436,687	5.0	2,365,384	3.6	861,312	1,524,072	1,061,503	26.8
East South Central.....	82,067,200	2,796,830	4.0	2,323,595	3.5	1,732,536	591,059	473,235	12.1
West South Central.....	275,037,440	9,062,480	13.1	7,924,197	12.1	5,750,958	2,173,239	1,138,283	29.0
Mountain.....	549,765,760	888,809	1.3	810,076	1.2	236,872	573,204	78,733	2.0
Pacific.....	203,580,800	1,225,008	1.8	1,207,243	1.8	747,015	460,228	17,765	0.5
<b>EAST NORTH CENTRAL:</b>									
Ohio.....	26,073,600	8,147,546	11.7	8,107,204	12.4	8,093,094	13,210	40,342	1.0
Indiana.....	23,068,800	9,375,907	13.5	9,087,183	13.9	8,867,674	219,509	288,724	7.4
Illinois.....	35,867,520	3,982,033	5.7	3,909,049	6.0	3,430,474	478,575	72,984	1.9
Michigan.....	36,787,200	9,754,679	14.1	9,729,171	14.9	9,511,555	217,616	25,508	0.6
Wisconsin.....	35,363,840	813,569	1.2	794,569	1.2	572,208	222,361	19,000	0.5
<b>WEST NORTH CENTRAL:</b>									
Minnesota.....	51,749,120	9,362,944	13.5	9,232,709	14.1	8,552,900	679,809	130,235	3.3
Iowa.....	35,575,040	5,383,012	7.8	5,224,478	8.0	4,685,030	539,398	158,534	4.0
Missouri.....	43,985,280	2,980,265	4.3	2,596,204	4.0	1,858,045	737,259	384,061	9.8
North Dakota.....	44,917,120	1,248,328	1.8	1,240,326	1.9	1,100,044	140,284	8,000	0.2
South Dakota.....	49,196,520	222,062	0.3	222,062	0.3	124,132	97,930	.....	.....
Nebraska.....	49,157,120	633,566	0.9	607,730	0.9	565,222	42,508	25,836	0.7
Kansas.....	52,335,360	105,634	0.2	93,856	0.1	72,780	21,076	12,078	0.3
<b>SOUTH ATLANTIC:</b>									
North Carolina.....	31,193,600	542,828	0.8	542,828	0.8	449,657	102,171	.....	.....
South Carolina.....	19,516,800	144,237	0.2	140,031	0.2	24,864	115,167	4,206	0.1
Georgia.....	37,584,000	104,006	0.1	65,452	0.1	43,723	21,729	38,554	1.0
Florida.....	35,111,040	2,645,816	3.8	1,637,073	2.5	352,068	1,285,005	1,008,743	25.7
<b>EAST SOUTH CENTRAL:</b>									
Kentucky.....	25,715,840	471,874	0.7	358,480	0.5	288,143	70,337	113,394	2.9
Tennessee.....	26,679,680	445,955	0.6	363,671	0.6	268,667	95,004	82,284	2.1
Mississippi.....	29,671,680	1,879,001	2.7	1,601,444	2.4	1,175,776	425,668	277,557	7.1
<b>WEST SOUTH CENTRAL:</b>									
Arkansas.....	33,616,000	4,151,834	6.0	3,479,591	5.3	2,124,446	1,355,145	672,243	17.1
Louisiana.....	29,061,760	2,732,368	3.9	2,268,328	3.5	1,534,634	731,694	466,040	11.9
Oklahoma.....	44,424,960	12,150	( <sup>1</sup> )	12,150	( <sup>1</sup> )	11,750	400	.....	.....
Texas.....	187,634,720	2,166,128	3.1	2,166,128	3.3	2,080,128	86,000	.....	.....
<b>MOUNTAIN:</b>									
Montana.....	93,623,840	168,682	0.2	168,682	0.3	44,682	124,000	.....	.....
Idaho.....	53,346,560	78,732	0.1	64,642	0.1	43,892	20,750	14,090	0.4
Wyoming.....	62,430,720	107,041	0.2	95,474	0.1	11,740	83,734	11,567	0.3
Colorado.....	66,341,120	171,656	0.2	171,656	0.3	66,816	104,840	.....	.....
New Mexico.....	78,401,920	147,219	0.2	140,219	0.2	20,169	120,050	7,000	0.2
Arizona.....	72,838,400	64,985	0.1	39,840	0.1	9,840	30,000	25,345	0.6
Utah.....	52,597,760	134,554	0.2	113,823	0.2	23,993	89,830	20,731	0.5
Nevada.....	70,285,440	15,940	( <sup>1</sup> )	15,940	( <sup>1</sup> )	15,940	.....	.....	.....
<b>PACIFIC:</b>									
Washington.....	42,775,040	99,789	0.1	94,924	0.1	90,084	4,840	4,855	0.1
Oregon.....	61,188,480	4,000	( <sup>1</sup> )	4,000	( <sup>1</sup> )	4,000	.....	.....	.....
California.....	99,017,280	1,121,219	1.6	1,108,319	1.7	652,631	455,388	12,900	0.3

<sup>1</sup> Less than one-tenth of 1 per cent.



## AGRICULTURE.

STATE TABLE III.—CAPITAL INVESTED IN ALL DRAINAGE ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES, BY GEOGRAPHIC DIVISIONS AND STATES: 1920.

DIVISION AND STATE.	INVESTED TO DEC. 31, 1919.								ADDITIONAL REQUIRED TO COMPLETE.			
	Total.		Operating enterprises.				Nonoperating enterprises.		Total.		All operating enterprises.	Non-operating enterprises.
			All operating enterprises.		Works completed.	Works under construction.						
	Amount.	Per cent.	Amount.	Per cent.	Amount.	Amount.	Amount.	Per cent.	Amount.	Per cent.	Amount.	Amount.
States included.....	\$373,397,025	100.0	\$373,273,567	100.0	\$293,857,023	\$78,416,544	\$1,123,458	100.0	\$97,259,090	100.0	\$68,321,418	\$34,937,678
<b>GEOGRAPHIC DIVISIONS:</b>												
East North Central.....	134,359,233	36.0	134,269,066	36.1	119,525,193	14,744,473	80,567	8.0	13,376,507	13.8	9,452,661	3,923,846
West North Central.....	121,824,200	32.6	121,562,077	32.7	102,365,306	19,196,771	262,123	23.3	23,743,744	24.4	11,632,586	12,111,158
South Atlantic.....	19,096,139	5.1	18,847,093	5.1	6,805,285	12,041,808	249,046	22.2	17,512,611	18.0	14,476,175	3,036,436
East South Central.....	11,806,449	3.2	11,523,833	3.1	9,085,234	2,438,599	284,616	25.3	7,333,076	7.5	2,306,418	5,026,658
West South Central.....	29,112,366	7.8	28,946,385	7.8	20,473,933	8,472,452	165,981	14.8	21,902,834	22.5	13,411,222	8,491,612
Mountain.....	7,866,066	2.1	7,839,941	2.1	3,248,713	4,591,228	26,125	2.3	6,541,844	6.7	4,668,876	1,872,968
Pacific.....	49,330,572	13.2	49,284,572	13.2	32,353,359	16,931,213	46,000	4.1	6,848,474	7.0	6,873,474	475,000
<b>EAST NORTH CENTRAL:</b>												
Ohio.....	30,707,863	8.2	30,680,145	8.2	30,636,857	43,288	27,718	2.5	397,396	0.4	91,475	305,921
Indiana.....	31,201,517	8.4	31,147,632	8.4	30,154,296	993,336	53,835	4.8	2,729,055	2.8	796,176	1,932,879
Illinois.....	43,595,069	11.7	43,595,069	11.7	31,424,167	12,170,902	.....	.....	9,199,841	9.5	7,798,175	1,401,666
Michigan.....	24,686,729	6.6	24,683,715	6.6	24,100,929	582,786	3,014	0.3	537,645	0.6	365,265	172,380
Wisconsin.....	4,168,055	1.1	4,163,055	1.1	3,208,944	954,111	5,000	0.4	512,570	0.5	401,570	111,000
<b>WEST NORTH CENTRAL:</b>												
Minnesota.....	42,069,304	11.3	42,017,447	11.3	36,784,850	5,232,597	71,857	6.4	5,095,002	5.2	2,166,391	2,928,611
Iowa.....	49,649,775	13.3	49,627,304	13.3	44,630,537	4,996,767	22,471	2.0	6,858,477	7.1	4,542,574	2,315,903
Missouri.....	20,839,328	5.6	20,723,128	5.6	13,294,035	7,429,093	166,200	14.8	10,178,401	10.5	4,026,607	6,151,794
North Dakota.....	2,208,049	0.6	2,208,049	0.6	1,863,788	344,261	.....	.....	77,723	0.1	53,400	24,323
South Dakota.....	1,461,063	0.4	1,461,063	0.4	942,757	518,306	.....	.....	271,666	0.3	271,666	.....
Nebraska.....	4,588,578	1.2	4,588,578	1.2	4,121,486	467,092	.....	.....	821,841	0.8	298,108	523,738
Kansas.....	938,103	0.3	936,508	0.3	747,853	188,655	1,595	0.1	440,634	0.5	273,845	166,780
<b>SOUTH ATLANTIC:</b>												
North Carolina.....	3,623,518	1.0	3,623,518	1.0	3,075,018	548,500	.....	.....	902,500	0.9	902,500	.....
South Carolina.....	583,083	0.2	582,183	0.2	198,370	383,813	900	0.1	445,845	0.5	354,331	91,514
Georgia.....	828,681	0.2	794,585	0.2	614,636	179,949	34,086	3.0	1,231,176	1.3	303,654	927,522
Florida.....	14,060,857	3.8	13,846,807	3.7	2,917,261	10,929,546	214,060	19.1	14,933,090	15.4	12,915,690	2,017,400
<b>EAST SOUTH CENTRAL:</b>												
Kentucky.....	1,620,027	0.4	1,621,725	0.4	1,278,701	243,024	98,302	8.7	1,825,513	1.9	299,271	1,526,242
Tennessee.....	2,996,515	0.8	2,925,944	0.8	2,283,589	642,355	69,571	6.2	1,447,230	1.5	522,047	925,183
Mississippi.....	7,192,907	1.9	7,076,164	1.9	5,522,944	1,553,220	116,743	10.4	4,060,333	4.2	1,485,100	2,575,233
<b>WEST SOUTH CENTRAL:</b>												
Arkansas.....	14,217,155	3.8	14,147,174	3.8	9,385,025	4,762,149	69,981	6.2	18,637,337	19.2	11,741,425	6,895,912
Louisiana.....	9,117,991	2.4	9,021,991	2.4	5,966,938	3,055,053	96,000	8.5	2,564,497	2.6	968,797	1,595,700
Oklahoma.....	76,415	( <sup>1</sup> )	76,415	( <sup>1</sup> )	76,165	250	.....	.....	1,000	( <sup>1</sup> )	1,000	.....
Texas.....	5,700,805	1.5	5,700,805	1.5	5,055,805	645,000	.....	.....	700,000	0.7	700,000	.....
<b>MOUNTAIN:</b>												
Montana.....	664,990	0.2	664,990	0.2	393,969	271,021	.....	.....	181,476	0.2	181,476	.....
Idaho.....	1,678,294	0.4	1,668,569	0.4	1,237,578	430,991	9,725	0.9	250,000	0.3	120,000	130,000
Wyoming.....	1,182,362	0.3	1,175,902	0.3	82,231	1,143,731	6,400	0.6	901,873	0.9	491,406	410,468
Colorado.....	1,081,875	0.3	1,081,875	0.3	508,663	573,212	.....	.....	203,195	0.2	203,195	.....
New Mexico.....	1,710,796	0.5	1,710,796	0.5	361,980	1,348,807	.....	.....	1,345,880	1.4	1,195,500	150,000
Arizona.....	414,925	0.1	414,425	0.1	101,425	313,000	500	( <sup>1</sup> )	1,147,000	1.2	612,000	535,000
Utah.....	1,014,978	0.3	1,005,478	0.3	466,007	510,466	9,500	0.8	2,512,800	2.6	1,865,300	647,500
Nevada.....	117,851	( <sup>1</sup> )	117,851	( <sup>1</sup> )	117,851	.....	.....	.....	.....	.....	.....	.....
<b>PACIFIC:</b>												
Washington.....	1,442,419	0.4	1,397,419	0.4	1,376,809	20,610	45,000	4.0	114,000	0.1	39,000	75,000
Oregon.....	300,000	0.1	300,000	0.1	200,000	.....	.....	.....	.....	.....	.....	.....
California.....	47,688,183	12.8	47,687,183	12.8	30,776,550	16,910,633	1,000	0.1	6,734,474	6.9	6,334,474	400,000

<sup>1</sup> Less than one-tenth of 1 per cent.

DRAINAGE.

STATE TABLE IV.—LAND IN ALL DRAINAGE ENTERPRISES, CLASSIFIED BY CONDITION; BY GEOGRAPHIC DIVISIONS AND STATES: 1920.

DIVISION AND STATE	Land in all enterprises (acres).	Per cent of all land in state.	OPERATING ENTERPRISES.						NONOPERATING ENTERPRISES.					
			Total (acres).	Improved land (acres).	Timber and cut-over land (acres).	Other unimproved land (acres).	Swampy or subject to overflow (acres).	Suffering a loss of crops (acres).	Total (acres).	Improved land (acres).	Timber and cut-over land (acres).	Other unimproved land (acres).	Swampy or subject to overflow (acres).	Suffering a loss of crops (acres).
States included...	69,419,859	8.6	85,495,038	44,288,235	11,283,532	9,923,271	7,224,212	3,011,407	3,924,821	1,378,495	1,294,018	1,254,308	2,269,562	239,192
<b>GEOGRAPHIC DIVISIONS:</b>														
East North Central...	32,073,734	20.4	31,627,176	25,282,065	4,457,151	1,887,990	2,012,248	1,283,296	446,558	270,083	77,653	98,822	144,363	61,024
West North Central...	19,936,111	6.1	19,217,367	11,630,279	2,530,012	5,057,076	2,007,511	901,857	718,744	406,744	89,443	222,557	441,137	28,656
South Atlantic...	3,436,887	2.0	2,385,384	388,345	862,334	1,134,705	849,342	58,194	1,051,503	86,900	314,640	700,063	719,579	38,280
East South Central...	2,796,830	2.4	2,323,595	1,349,791	914,404	59,400	434,602	78,909	473,235	198,494	223,185	51,556	239,554	19,359
West South Central...	9,062,490	3.3	7,924,197	3,877,166	2,506,431	1,540,600	1,670,037	483,495	1,138,293	393,471	587,147	152,665	709,355	68,150
Mountain...	888,809	0.2	810,076	635,868	87	174,121	194,437	164,551	78,733	56,739	1,960	20,054	31,258	23,722
Pacific...	1,225,008	0.6	1,207,243	1,124,721	13,113	69,409	56,036	51,205	17,785	9,174		8,591	14,316	
<b>EAST NORTH CENTRAL:</b>														
Ohio.....	8,147,546	31.2	8,107,204	6,707,328	956,894	442,982	247,273	141,481	40,342	24,375	4,363	11,604	19,778	7,603
Indiana.....	9,375,907	40.6	9,067,183	7,605,565	942,378	539,240	388,530	210,678	288,724	192,190	51,212	45,322	64,677	33,456
Illinois.....	3,982,033	11.1	3,909,049	3,532,316	184,673	192,160	228,337	229,065	72,984	44,993	3,714	24,277	29,294	13,507
Michigan.....	9,754,679	26.5	9,729,171	7,182,352	2,195,562	351,257	1,020,207	692,224	25,508	8,245	15,039	2,224	12,316	1,458
Wisconsin.....	813,569	2.3	794,599	254,504	177,744	362,321	130,111	9,848	19,000	280	3,325	15,395	18,300	
<b>WEST NORTH CENTRAL:</b>														
Minnesota.....	9,362,944	18.1	9,232,799	3,818,490	1,370,023	4,044,196	1,193,136	471,094	130,235	34,494	7,158	88,583	78,922	981
Iowa.....	5,383,012	15.1	5,224,478	4,493,407	74,652	656,419	320,893	157,542	158,534	84,722	4,350	69,462	68,197	5,058
Missouri.....	2,980,265	6.8	2,596,204	1,474,302	1,074,860	47,042	454,360	242,258	384,061	265,063	77,268	41,730	270,382	17,917
North Dakota.....	1,248,328	2.8	1,240,328	1,026,574		213,754	12,332	4,819	8,000	5,334		2,666	2,000	
South Dakota.....	222,062	0.5	222,062	178,540		43,522	6,067	481						
Nebraska.....	633,566	1.3	607,730	551,517	6,342	49,871	14,019	19,575	25,836	5,853	267	19,716	21,636	4,700
Kansas.....	105,934	0.2	98,856	87,449	4,135	2,272	6,704	6,088	12,078	11,378	400	400		
<b>SOUTH ATLANTIC:</b>														
North Carolina.....	542,828	1.7	542,828	204,928	244,576	93,324	77,494	12,771						
South Carolina.....	144,237	0.7	140,081	89,075	64,965	16,001	12,206	3,093	4,206	976	1,548	1,689	4,106	
Georgia.....	104,006	0.3	95,453	29,763	10,155	25,544	21,951	1,832	38,564	9,622	9,426	19,506	23,232	6,862
Florida.....	2,645,816	7.5	1,637,073	94,589	542,648	999,836	731,691	40,498	1,008,743	26,202	303,666	678,876	692,241	31,413
<b>EAST SOUTH CENTRAL:</b>														
Kentucky.....	471,874	1.8	358,489	245,334	92,496	20,651	69,413	36,723	113,394	67,526	28,539	17,329	55,339	875
Tennessee.....	445,955	1.7	303,671	163,218	189,945	10,508	104,063	29,879	82,284	23,116	57,150	2,018	76,004	17,636
Mississippi.....	1,879,001	6.3	1,601,444	941,239	631,964	28,241	261,126	12,207	277,557	107,863	137,496	32,209	108,211	948
<b>WEST SOUTH CENTRAL:</b>														
Arkansas.....	4,151,834	12.4	3,479,591	1,491,777	1,923,382	64,432	897,547	153,957	672,243	217,491	414,707	40,045	496,573	20,774
Louisiana.....	2,732,368	9.4	2,266,328	1,299,391	467,622	529,115	569,189	198,935	466,040	180,980	172,440	112,620	212,782	47,376
Oklahoma.....	12,150	( <sup>1</sup> )	12,150	8,845	3,305		3,250	1,838						
Texas.....	2,166,128	1.3	2,166,128	1,107,153	111,923	947,053	201,051	128,785						
<b>MOUNTAIN:</b>														
Montana.....	188,682	0.2	168,682	141,282		27,400	19,630	21,964						
Idaho.....	78,732	0.1	64,642	82,098	87	12,457	11,402	164	14,060	7,514	1,960	4,626	3,826	3,101
Wyoming.....	107,041	0.2	95,474	84,846		10,628	20,785	6,595	11,567	7,513		4,054	6,554	1,000
Colorado.....	171,656	0.3	171,656	128,031		43,625	26,446	15,282						
New Mexico.....	147,219	0.2	140,219	92,477		47,742	20,572	24,420	7,000	1,750		5,250		1,155
Arizona.....	64,985	0.1	39,640	26,880		2,760	2,160	2,160	25,345	22,276		3,069	1,069	1,069
Utah.....	134,554	0.8	113,823	97,314		16,509	88,181	76,803	20,731	17,676		2,055	20,309	17,268
Nevada.....	15,940	( <sup>1</sup> )	15,940	7,970		7,970	5,261	7,163						
<b>PACIFIC:</b>														
Washington.....	99,789	0.3	94,924	81,886	850	12,188	10,873	8,996	4,865	3,174		1,661	1,416	
Oregon.....	4,000	( <sup>1</sup> )	4,000	4,000										
California.....	1,121,219	1.1	1,108,319	1,088,835	12,263	57,221	45,163	42,209	12,900	6,000		6,900	12,900	

<sup>1</sup> Less than one-tenth of 1 per cent.

STATE TABLE V.—OPERATING DRAINAGE ENTERPRISES.

	STATES INCLUDED.	GEOGRAPHIC DIVISIONS.								
		East North Central.	West North Central.	South Atlantic.	East South Central.	West South Central.	Mountain.	Pacific.		
<b>LAND AREA.</b>										
1	Approximate land area of the division or state.....	acres.	1,717,932,160	157,160,960	326,914,560	123,405,440	52,067,200	275,037,440	549,785,760	203,580,800
2	All land in operating drainage enterprises.....	acres.	65,405,038	31,627,176	19,217,367	2,385,384	2,323,595	7,924,197	810,076	1,207,243
3	Improved land.....	acres.	44,288,235	25,282,065	11,630,279	388,345	1,349,791	3,877,166	635,868	1,124,721
4	Per cent of all improved land in farms.....		8.8	28.8	6.8	6.0	3.0	6.0	2.1	4.7
5	Timber and cut-over land.....	acres.	11,283,532	4,457,151	2,530,012	862,334	914,404	2,506,431	87	13,113
6	Other unimproved land.....	acres.	9,923,271	1,887,960	5,057,076	1,134,705	59,400	1,540,600	174,121	69,409
7	Swampy or subject to overflow, in enterprises.....	acres.	7,224,213	2,012,248	2,007,511	849,342	434,602	1,670,037	194,437	56,036
8	Suffering a loss of crops from defective drainage.....	acres.	3,011,407	1,283,296	901,857	58,194	78,809	483,495	154,551	51,205
9	Assessed acreage.....	acres.	95,629,291	59,131,679	21,262,129	2,517,852	2,326,635	8,363,124	810,076	1,217,796
10	Excess over all land in operating enterprises.....	acres.	30,134,253	27,504,503	2,044,762	132,468	3,040	438,927	.....	10,553
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed.....	miles.	107,468.2	64,924.3	23,912.7	3,701.6	3,258.9	7,672.8	827.7	3,172.2
13	Additional under construction.....	miles.	4,301.8	408.9	745.6	1,229.4	436.0	1,234.0	36.1	211.8
14	Maximum completed in any enterprise.....	miles.	324.0	144.5	216.0	166.0	121.0	305.0	108.0	824.0
15	Maximum width at bottom of ditch <sup>1</sup> .....	feet.	400	125	125	90	120	200	25	400
14	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet.	42.0	42.0	30.0	22.0	20.0	30.0	16.0	20.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet.	5.4	4.7	5.5	5.1	6.8	5.6	6.7	4.6
17	Tile drains:									
18	Completed.....	miles.	42,311.7	23,325.2	17,109.3	101.5	325.2	20.6	1,248.2	181.6
19	Additional under construction.....	miles.	2,869.1	369.6	1,265.0	161.0	55.3	2.0	955.5	23.7
20	Maximum completed in any enterprise.....	miles.	210.0	200.0	210.0	64.0	80.0	10.0	200.0	47.0
21	Maximum size of tile.....	inches.	60	60	52	24	36	40	38	36
22	Accessory levees and dikes:									
23	Completed.....	miles.	3,519.8	868.4	668.6	111.7	49.2	625.3	37.6	1,181.1
24	Additional under construction.....	miles.	810.2	112.8	35.8	136.5	47.0	306.7	.....	121.4
25	Pumping plants:									
26	Engine capacity.....	horsepower.	87,189	20,190	6,003	1,275	250	10,465	480	28,526
27	Pump capacity.....	gallons per minute.	15,949,166	2,964,014	1,086,800	1,083,600	78,000	5,965,150	72,560	4,690,042
28	Area served by pumps.....	acres.	1,544,010	315,879	207,124	107,440	44,000	230,809	34,312	604,446
29	Area drained by open ditches only <sup>1</sup> .....	acres.	43,658,485	20,579,653	13,191,826	1,724,706	1,952,386	5,805,234	210,616	194,064
30	Length of these ditches.....	miles.	84,628.5	51,005.9	19,304.1	3,787.9	3,234.4	6,409.4	422.9	483.9
31	Average length per acre.....	feet.	10.2	13.1	7.7	11.6	8.7	5.8	10.6	12.6
32	Area having open ditches and levees <sup>1</sup> .....	acres.	5,656,000	760,034	1,109,924	651,478	311,224	2,077,507	31,412	714,421
33	Length of these ditches.....	miles.	8,615.8	954.0	1,582.2	1,028.1	313.9	2,399.8	28.1	2,309.7
34	Average length per acre.....	feet.	8.0	6.6	7.5	8.3	5.3	6.1	4.7	17.1
35	Length of the accessory levees.....	miles.	3,746.7	670.3	683.0	206.2	96.2	931.0	32.0	1,128.0
36	Area drained by tile only <sup>1</sup> .....	acres.	4,951,152	3,068,386	1,734,658	.....	8,917	3,100	105,525	10,566
37	Length of these tile.....	miles.	23,193.4	12,522.0	10,087.3	.....	115.0	20.0	402.8	48.3
38	Average length per acre.....	feet.	24.7	21.4	30.7	.....	68.1	84.1	20.2	23.1
39	Area having tile drains and levees <sup>1</sup> .....	acres.	23,109	10,109	13,000	.....	.....	.....	.....	.....
40	Length of these tile.....	miles.	11.0	2.0	9.0	.....	.....	.....	.....	.....
41	Average length per acre.....	feet.	2.5	1.0	3.7	.....	.....	.....	.....	.....
42	Length of the accessory levees.....	miles.	26.5	16.0	10.5	.....	.....	.....	.....	.....
43	Area drained by open ditches and tile <sup>1</sup> .....	acres.	10,731,279	6,941,175	3,071,610	.....	51,068	28,850	450,323	179,247
44	Length of these drains.....	miles.	37,678.9	22,977.2	11,624.8	.....	410.2	85.0	2,157.7	423.9
45	Average length per acre.....	feet.	15.5	17.5	20.0	.....	42.4	15.6	24.8	12.5
46	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres.	475,013	247,819	96,349	9,200	.....	9,500	3,200	108,945
47	Length of these drains.....	miles.	2,816.2	1,566.8	446.2	377.5	.....	15.2	66.0	345.5
48	Average length per acre.....	feet.	31.3	33.4	24.4	216.7	.....	8.4	106.9	16.7
49	Length of the accessory levees.....	miles.	556.8	292.9	90.9	42.0	.....	1.0	5.5	124.9
<b>DEVELOPMENT OF LAND.</b>										
48	Improved land in operating enterprises, 1920.....	acres.	44,288,235	25,282,065	11,630,279	388,345	1,349,791	3,877,166	635,868	1,124,721
49	Improved land prior to drainage.....	acres.	24,586,239	13,510,812	6,850,589	173,633	774,771	2,394,636	477,899	403,896
50	Increase since drainage.....	acres.	19,701,999	11,771,253	4,779,690	214,712	575,020	1,482,530	157,969	720,825
51	Per cent of increase.....		80.1	87.1	69.8	123.7	74.2	61.9	33.1	178.5
52	Timber and cut-over land, 1920.....	acres.	11,283,532	4,457,151	2,530,012	862,334	914,404	2,506,431	87	13,113
53	Timber and cut-over land prior to drainage.....	acres.	21,753,774	12,924,601	3,229,756	971,139	1,420,474	3,164,160	97	43,547
54	Decrease since drainage.....	acres.	10,470,242	8,467,450	690,744	108,805	506,070	657,729	10	30,434
55	Per cent of decrease.....		48.1	65.5	21.7	11.2	35.6	20.8	10.3	69.9
56	Other unimproved land, 1920.....	acres.	9,923,271	1,887,960	5,057,076	1,134,705	59,400	1,540,600	174,121	69,409
57	Other unimproved land prior to drainage.....	acres.	19,155,028	5,191,763	9,137,022	1,240,612	128,350	2,365,401	332,080	759,800
58	Decrease since drainage.....	acres.	9,231,757	3,303,803	4,079,946	105,907	68,950	824,801	157,969	690,391
59	Per cent of decrease.....		48.2	63.6	44.7	8.5	53.7	34.9	47.6	90.9
60	Swampy or subject to overflow, 1920.....	acres.	7,224,213	2,012,248	2,007,511	849,342	434,602	1,670,037	194,437	56,036
61	Swampy or subject to overflow, prior to drainage.....	acres.	31,096,513	13,702,611	9,388,660	1,784,869	1,179,603	4,351,751	427,502	861,577
62	Decrease since drainage.....	acres.	24,472,300	11,690,363	7,381,149	935,527	745,001	2,681,714	233,065	805,481
63	Per cent of decrease.....		77.2	85.3	78.6	52.4	63.2	61.6	54.5	93.5
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required to complete enterprises.....	dollars.	434,584,979	143,722,327	133,194,663	33,323,268	13,830,251	42,357,607	12,508,817	55,658,046
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.	372,273,567	134,299,666	121,562,077	18,847,093	11,523,833	26,946,385	7,839,941	49,234,572
66	Additional capital required to complete these enterprises.....	dollars.	62,311,412	9,452,661	11,632,586	14,476,175	2,306,418	13,411,222	4,668,876	6,373,474
67	Average cost per acre when completed.....	dollars.	6.64	4.54	6.93	13.97	5.95	5.35	15.44	46.10
68	Enterprises constructing open ditches only.....	dollars.	177,741,999	64,064,791	52,342,663	21,024,626	11,475,140	21,492,022	3,351,347	3,901,410
69	Average cost per acre when completed.....	dollars.	4.07	3.11	3.97	12.19	6.86	3.70	15.91	20.57
70	Enterprises constructing open ditches and levees.....	dollars.	109,378,568	20,889,257	11,352,630	11,888,642	1,634,345	20,531,585	1,005,000	42,077,103
71	Average cost per acre when completed.....	dollars.	19.34	27.48	10.23	18.25	6.25	9.88	31.99	58.90
72	Enterprises constructing tile drains only.....	dollars.	49,054,155	17,801,089	28,841,695	.....	80,479	41,000	1,837,577	452,315
73	Average cost per acre when completed.....	dollars.	6.91	5.78	16.63	.....	9.03	13.23	17.41	42.81
74	Enterprises constructing tile drains and levees.....	dollars.	264,000	160,000	104,000	.....	.....	.....	.....	.....
75	Average cost per acre when completed.....	dollars.	11.42	15.83	6.00	.....	.....	.....	.....	.....
76	Enterprises constructing open ditches and tile drains.....	dollars.	83,345,384	34,100,397	38,456,628	.....	640,287	253,000	6,174,893	3,630,179
77	Average cost per acre when completed.....	dollars.	7.77	4.93	12.52	.....	12.64	8.77	13.44	20.25
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars.	14,810,873	6,616,793	2,097,041	410,000	.....	40,000	140,000	5,507,039
79	Average cost per acre when completed.....	dollars.	31.18	26.70	21.77	44.57	.....	4.21	43.75	50.55
<b>CROPS.</b>										
80	Improved land in enterprises reporting—									
81	Corn as principal crop on drained land.....	acres.	27,089,387	18,280,046	6,951,913	215,984	486,124	1,057,601	1,130	96,589
82	Wheat as principal crop on drained land.....	acres.	6,936,078	3,398,947	3,118,868	.....	750	138,006	.....	279,507
83	Cotton as principal crop on drained land.....	acres.	2,763,213	.....	250,681	70,966	857,587	1,505,619	36,240	42,800
84	Hay as principal crop on drained land.....	acres.	1,941,236	802,990	1,067,258	.....	1,080	4,315	17,006	48,585
85	Sugar beets as principal crop on drained land.....	acres.	1,207,244	1,140,580	16,284	.....	.....	35,255	.....	14,823
86	Peas and beans (dried) as principal crop on drained land.....	acres.	643,339	616,142	.....	.....	.....	.....	.....	27,197
87	Alfalfa as principal crop on drained land.....	acres.	538,866	.....	3,230	.....	.....	28,500	373,459	153,677
88	Vegetables as principal crop on drained land.....	acres.	570,218	297,810	7,339	32,737	.....	152,044	.....	80,288
89	Rice as principal crop on drained land.....	acres.	623,167	.....	.....	.....	.....	446,130	.....	77,037
90	Sugar cane as principal crop on drained land.....	acres.	453,890	.....	.....	17,623	.....	466,273	.....	.....
91	Potatoes as principal crop on drained land.....	acres								

# DRAINAGE.

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BY GEOGRAPHIC DIVISIONS AND STATES: 1920.

EAST NORTH CENTRAL.					WEST NORTH CENTRAL.							
Ohio.	Indiana.	Illinois.	Michigan.	Wisconsin.	Minnesota.	Iowa.	Missouri.	North Dakota.	South Dakota.	Nebraska.	Kansas.	
26,073,600	23,063,800	35,867,520	36,787,200	35,363,840	51,749,120	35,575,040	43,985,280	44,917,120	49,195,520	49,157,120	52,335,360	1
8,107,204	9,087,183	3,908,049	9,729,171	794,569	9,232,709	5,224,478	2,596,204	1,240,328	222,062	607,730	93,856	2
6,707,828	7,606,565	3,532,316	7,182,352	254,504	8,818,490	4,493,407	1,474,302	1,026,574	178,540	551,517	87,449	3
36.2	46.6	12.9	55.6	2.0	17.8	15.7	5.9	4.2	1.0	6.3	0.3	4
956,894	942,378	184,573	2,195,562	177,744	1,370,023	74,652	1,074,860	213,754	43,522	49,871	4,135	5
442,982	539,240	192,180	351,257	362,321	4,044,196	656,419	47,042	12,332	6,067	14,019	2,272	6
247,273	386,320	228,337	1,020,207	130,111	1,193,188	320,893	454,360	4,819	481	19,575	6,704	7
141,481	210,678	229,065	692,224	9,848	471,094	157,542	242,288	1,240,328	234,201	708,450	93,856	8
23,464,812	15,015,221	4,090,599	15,766,478	794,569	9,974,662	5,905,743	3,104,839	1,240,328	234,201	708,450	93,856	9
15,357,608	5,928,038	181,550	6,037,307	.....	741,953	681,265	508,685	.....	12,139	100,720	.....	10
24,984.0	17,470.7	4,754.5	16,023.8	1,661.3	14,657.0	3,998.0	3,438.7	708.3	237.8	734.5	138.4	11
12.4	12.4	65.7	118.4	88.0	186.1	81.1	460.4	4.0	8.1	18.7	7.2	12
44.1	100.0	80.0	75.0	144.5	216.0	82.3	179.3	45.1	28.6	80.0	14.4	13
125	125	100	70	60	72	90	125	80	100	100	54	14
18.0	27.5	42.0	13.0	13.0	24.0	25.0	22.0	14.0	10.5	18.0	30.0	15
3.9	5.1	4.8	4.3	6.5	4.8	6.6	7.0	3.7	4.8	6.1	4.3	16
9,208.3	8,227.6	3,507.1	2,178.9	211.3	5,924.6	10,384.9	38.8	9.3	179.3	359.4	213.0	17
8.3	185.7	127.1	8.4	40.1	482.7	783.6	5.9	.....	33.6	14.2	.....	18
80.0	100.0	200.0	10.5	43.0	153.0	127.0	15.0	4.5	25.9	100.0	210.0	19
60	48	48	48	30	48	52	30	22	36	48	30	20
9.6	165.8	650.2	83.1	7.7	0.1	45.2	458.9	2.1	2.4	28.8	165.1	21
4.0	9.2	97.1	.....	2.5	0.3	.....	74.9	.....	2.8	.....	7.8	22
125	625	18,225	1,085	150	.....	3,153	2,785	.....	.....	.....	.....	23
3,600	55,343	2,843,068	62,000	.....	.....	530,800	552,000	.....	.....	.....	4,000	24
1,755	5,611	291,816	10,100	6,597	.....	134,616	70,308	.....	.....	.....	2,200	25
4,738,114	5,183,620	1,508,695	8,541,556	657,683	8,440,167	1,294,243	1,612,085	1,217,028	145,534	445,431	37,033	26
19,924.4	12,487.2	2,406.7	14,725.0	1,462.6	13,432.0	1,934.7	2,483.3	706.0	168.9	528.9	83.3	27
22.2	12.8	8.4	9.1	11.7	8.4	7.9	8.1	3.1	6.1	6.3	7.6	28
7,078	270,784	452,588	2,000	27,584	.....	26,228	883,432	9,600	4,120	138,551	47,993	29
11.1	210.5	559.7	83.6	79.1	.....	45.4	1,278.3	4.0	8.3	177.9	68.3	30
8.3	4.1	6.5	247.1	15.1	.....	9.1	7.6	2.2	10.6	6.8	7.5	31
6.8	153.6	469.1	33.1	7.7	.....	29.1	481.7	2.1	1.8	28.6	138.7	32
1,189,856	1,234,320	392,733	818,514	2,954	271,118	1,415,176	780	10,820	30,764	6,020	.....	33
5,274.7	4,638.5	1,208.9	1,303.7	97.2	2,816.1	6,785.7	4.0	9.0	116.0	356.5	.....	34
24.4	18.8	16.2	21.6	173.5	54.8	25.3	27.8	4.4	19.9	312.7	.....	35
.....	.....	10,109	.....	.....	.....	6,000	7,000	.....	.....	.....	.....	36
.....	.....	2.0	.....	.....	.....	6.0	8.0	.....	.....	.....	.....	37
.....	.....	1.0	.....	.....	.....	5.3	2.3	.....	.....	.....	.....	38
.....	.....	16.0	.....	.....	.....	8.0	2.5	.....	.....	.....	.....	39
2,219,770	2,423,949	1,327,996	887,101	102,359	516,782	2,444,906	49,240	2,890	40,664	17,728	2,410	40
8,933.4	8,481.7	3,012.4	2,202.2	347.0	4,907.3	6,392.2	88.9	2.6	164.5	63.5	5.8	41
21.2	15.5	12.0	13.4	17.9	60.1	13.8	10.2	4.8	21.4	18.9	12.7	42
2,350	24,510	216,923	.....	4,000	4,642	37,925	46,687	.....	680	.....	6,415	43
67.4	183.5	1,266.7	.....	44.2	55.0	68.6	89.3	.....	1.1	.....	231.2	44
149.2	40.6	30.8	.....	58.3	62.6	9.6	10.1	.....	8.5	.....	190.3	45
6.9	21.4	262.2	.....	2.5	0.4	8.1	47.6	.....	0.6	.....	34.2	46
6,707,828	7,606,565	3,532,316	7,182,352	254,504	3,818,490	4,493,407	1,474,302	1,026,574	178,540	551,517	87,449	47
3,955,220	5,396,387	2,062,621	2,046,613	50,071	1,722,876	3,210,496	760,796	691,005	98,724	292,621	74,072	48
2,752,108	2,209,178	1,469,795	5,135,739	204,433	2,095,615	1,282,911	713,508	335,569	79,816	268,806	18,377	49
69.0	40.9	71.3	250.9	408.3	121.6	40.0	68.8	48.6	80.8	88.5	18.1	50
14.8	13.2	5.4	39.7	1.6	9.8	4.5	2.9	1.4	0.4	1.1	.....	51
956,894	942,378	184,573	2,195,562	177,744	1,370,023	74,652	1,074,860	.....	.....	6,342	4,135	52
3,079,180	2,324,978	479,498	6,809,213	231,732	1,473,820	93,994	1,646,297	.....	.....	8,797	6,848	53
2,122,288	1,382,600	294,925	4,613,651	53,989	103,797	19,342	671,437	.....	.....	2,455	2,713	54
68.9	59.5	61.5	67.8	23.3	7.0	30.6	34.7	.....	.....	27.9	59.6	55
442,982	539,240	192,180	351,257	362,321	4,044,196	656,419	47,042	213,754	43,522	49,871	2,272	56
1,072,804	1,365,818	1,367,030	873,345	512,766	6,036,014	1,919,988	189,111	549,328	123,338	306,312	12,936	57
629,822	826,578	1,174,870	522,088	150,445	1,991,318	1,263,568	142,669	335,569	79,816	256,441	10,664	58
58.7	60.5	85.9	69.8	29.3	33.0	65.8	75.1	61.1	64.7	83.7	82.4	59
247,273	386,320	228,337	1,020,207	130,111	1,193,188	320,893	454,360	12,332	6,067	14,019	6,704	60
3,126,852	3,247,205	1,864,138	4,763,016	701,307	4,634,641	1,567,960	2,013,704	619,159	141,491	395,253	16,452	61
2,879,612	2,860,945	1,635,801	3,742,893	571,196	3,441,505	1,247,067	1,569,344	608,827	135,424	331,234	9,748	62
92.1	83.1	87.8	78.6	81.4	74.3	76.5	77.4	98.0	95.7	96.5	99.3	63
80,771,620	81,943,853	81,393,244	25,048,980	4,564,625	44,183,838	54,169,878	24,749,785	2,261,449	1,732,729	4,896,681	1,210,833	64
30,680,145	31,147,682	43,595,069	24,683,715	4,163,055	1,722,447	49,627,304	20,723,128	2,208,049	1,461,063	4,688,578	936,508	65
91,473	796,176	7,798,176	385,265	401,570	2,166,391	4,542,574	4,026,607	53,400	271,666	293,193	273,845	66
3.80	3.52	13.15	2.57	5.74	4.79	10.37	9.53	1.62	7.80	8.04	12.90	67
15,960,631	14,565,990	11,874,658	19,041,495	3,222,017	23,288,989	8,856,170	13,442,666	2,200,158	891,770	3,034,949	677,961	68
3.24	2.81	7.87	2.23	4.90	2.75	8.84	8.34	1.81	6.11	6.81	18.30	69
50,900	920,976	19,459,251	178,284	282,666	673,770	9,215,065	12,368	12,368	9,447	1,010,524	481,482	70
7.08	3.40	43.00	83.14	10.25	25.69	25.69	10.43	1.29	2.29	7.29	8.99	71
5,997,998	6,276,168	3,181,397	2,287,056	59,770	7,391,548	20,896,478	17,500	42,908	360,263	143,000	.....	72
8.26	5.08	8.10	7.18	20.21	27.26	14.76	23.03	3.97	11.71	23.75	.....	73
.....	.....	160,000	.....	.....	.....	90,000	14,000	.....	.....	.....	.....	74
.....	.....	15.83	.....	.....	.....	15.00	2.00	.....	.....	.....	.....	75
9,285,211	9,811,999	10,641,870	3,544,145	907,172	13,860,171	23,424,200	485,230	6,015	468,539	698,208	14,265	76
4.18	4.03	8.01	4.09	8.96	25.85	9.58	10.49	2.09	11.52	39.38	5.92	77
78,000	369,725	6,076,089	.....	93,000	193,130	239,262	1,575,274	2,710	2,710	.....	86,665	78
32.69	15.08	28.01	.....	23.25	41.60	33.74	.....	.....	3.99	.....	13.51	79
6,309,143	6,943,654	3,404,489	1,525,655	97,075	927,801	4,365,787	980,387	.....	148,804	495,683	33,451	80
24												

STATE TABLE V.—OPERATING DRAINAGE ENTERPRISES,

	SOUTH ATLANTIC.				EAST SOUTH CENTRAL.			WEST SOUTH CENTRAL.			
	North Carolina.	South Carolina.	Georgia.	Florida.	Kentucky.	Tennessee.	Mississippi.	Arkansas.	Louisiana.		
<b>LAND AREA.</b>											
1	Approximate land area of the state.....	acres	31,193,600	19,518,800	37,584,000	35,111,040	25,715,840	26,679,680	29,671,680	33,616,000	29,061,760
2	All land in operating drainage enterprises.....	acres	542,828	140,031	65,452	1,637,073	358,480	363,671	1,601,444	3,479,591	2,268,328
3	Improved land.....	acres	204,928	59,075	29,753	94,589	245,334	163,218	941,239	1,491,777	1,269,391
4	Per cent of all improved land in farms.....		2.5	1.0	0.2	4.1	1.8	1.5	10.1	16.2	22.6
5	Timber and cut-over land.....	acres	244,576	64,955	10,155	542,648	92,495	189,945	631,964	1,923,382	467,822
6	Other unimproved land.....	acres	93,324	16,001	25,544	999,836	20,651	10,508	28,241	64,432	529,115
7	Swampy or subject to overflow, in enterprises.....	acres	77,494	18,206	21,951	731,691	69,413	104,063	261,126	897,547	569,189
8	Suffering a loss of crops from defective drainage.....	acres	12,771	3,093	1,832	40,499	36,723	29,879	12,207	153,957	198,935
9	Assessed acreage.....	acres	552,428	140,031	65,452	1,759,941	358,480	363,671	1,604,484	3,842,812	2,342,034
10	Excess over all land in operating enterprises.....	acres	9,600			122,868			3,040	383,221	75,706
<b>DRAINAGE WORKS.</b>											
<b>Open ditches:</b>											
11	Completed.....	miles	1,171.3	262.7	276.8	1,990.8	664.5	777.3	1,815.1	3,154.1	1,771.6
12	Additional under construction.....	miles	367.8	87.7	79.9	694.0	77.0	135.4	223.6	974.1	162.7
13	Maximum completed in any enterprise.....	miles	110.0	100.0	21.5	166.0	21.3	55.0	121.0	305.0	100.0
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet	70	29	46	90	34	80	120	100	100
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet	14.0	10.0	10.0	22.0	20.0	16.0	20.0	18.0	30.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet	6.7	5.2	5.1	4.3	5.1	6.8	6.8	6.9	5.1
<b>Tile drains:</b>											
17	Completed.....	miles		101.5			86.2	0.3	228.8	20.4	0.2
18	Additional under construction.....	miles		161.0			1.0	0.1	54.2	2.0	
19	Maximum completed in any enterprise.....	miles		64.0			32.0	0.3	80.0	10.0	0.2
20	Maximum size of tile <sup>1</sup> .....	inches		24			24	10	36	20	40
<b>Accessory levees and dikes:</b>											
21	Completed.....	miles	33.5	12.0		66.2	0.2	42.3	6.7	119.8	440.7
22	Additional under construction.....	miles		30.0		106.5		10.2	86.8	240.8	65.9
<b>Pumping plants:</b>											
23	Engine capacity.....	horsepower	1,000	155		120			250	2,800	7,665
24	Pump capacity.....	gallons per minute	1,000,000	44,600		39,000			78,000	720,000	5,245,150
25	Area served by pumps.....	acres	100,600	2,940		4,000			44,000	90,000	140,809
26	Area drained by open ditches only <sup>1</sup> .....	acres	435,295	130,831	65,452	1,093,128	345,605	332,317	1,274,464	2,267,281	1,913,570
27	Length of these ditches.....	miles	1,404.6	235.4	356.7	1,791.2	687.1	862.2	1,685.1	2,454.3	1,366.4
28	Average length per acre.....	feet	17.0	9.5	28.8	8.7	10.5	13.7	7.0	5.7	3.8
29	Area having open ditches and levees <sup>1</sup> .....	acres	107,533			543,945	1,140	30,854	279,230	1,171,354	351,958
30	Length of these ditches.....	miles	134.5			893.6	4.3	50.5	259.1	1,566.8	567.4
31	Average length per acre.....	feet	6.6			8.7	19.9	8.6	4.9	7.1	8.5
32	Length of the accessory levees.....	miles	33.5			172.7	0.2	52.5	43.5	359.6	506.6
33	Area drained by tile only <sup>1</sup> .....	acres					117	500	8,300	3,100	
34	Length of these tile.....	miles					2.6	0.4	112.0	20.0	
35	Average length per acre.....	feet					117.3	4.2	71.2	34.1	
36	Area having tile drains and levees <sup>1</sup> .....	acres									
37	Length of these tile.....	miles									
38	Average length per acre.....	feet									
39	Length of the accessory levees.....	miles									
40	Area drained by open ditches and tile <sup>1</sup> .....	acres					11,618		39,450	28,356	500
41	Length of these drains.....	miles					134.7		275.5	84.3	0.7
42	Average length per acre.....	feet					61.2		36.9	15.7	7.4
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres		9,200						9,500	
44	Length of these drains.....	miles		377.5						15.2	
45	Average length per acre.....	feet		216.7						8.4	
46	Length of the accessory levees.....	miles		42.0						1.0	
<b>DEVELOPMENT OF LAND.</b>											
47	Improved land in operating enterprises, 1920.....	acres	204,928	59,075	29,753	94,589	245,334	163,218	941,239	1,491,777	1,269,391
48	Improved land prior to drainage.....	acres	84,714	51,349	7,229	30,341	181,915	85,028	506,828	887,864	936,902
49	Increase since drainage.....	acres	120,214	7,726	22,524	64,248	63,419	77,190	434,411	603,913	332,489
50	Per cent of increase.....		141.9	15.0	311.6	211.8	34.9	89.7	85.7	68.0	35.5
51	Per cent increase is of all improved land in farms, 1920.....		1.5	0.1	0.2	2.8	0.5	0.7	4.7	6.6	5.9
52	Timber and cut-over land, 1920.....	acres	244,576	64,955	10,155	542,648	92,495	189,945	631,964	1,923,382	467,822
53	Timber and cut-over land prior to drainage.....	acres	311,626	68,691	25,081	585,741	146,096	262,163	1,012,215	2,460,170	580,418
54	Decrease since drainage.....	acres	67,050	3,736	14,926	23,093	63,601	72,218	360,251	536,788	112,596
55	Per cent of decrease.....		21.5	5.4	59.5	4.1	36.7	27.5	37.6	21.8	19.4
56	Other unimproved land, 1920.....	acres	93,324	16,001	25,544	999,836	20,651	10,508	28,241	64,432	529,115
57	Other unimproved land prior to drainage.....	acres	146,488	19,991	33,142	1,040,991	30,469	15,480	82,401	131,557	749,008
58	Decrease since drainage.....	acres	53,164	3,990	7,598	41,155	9,818	4,972	54,160	67,125	219,893
59	Per cent of decrease.....		36.3	20.0	22.9	4.0	32.2	32.1	85.7	61.0	29.4
60	Swampy or subject to overflow, 1920.....	acres	77,494	18,206	21,951	731,691	69,413	104,063	261,126	897,547	569,189
61	Swampy or subject to overflow, prior to drainage.....	acres	311,110	91,354	64,092	1,328,313	199,161	358,027	627,415	2,065,264	1,278,985
62	Decrease since drainage.....	acres	233,616	73,148	32,141	596,622	129,748	248,964	366,289	1,167,717	709,808
63	Per cent of decrease.....		75.1	80.1	59.4	44.9	65.1	70.5	59.4	56.5	55.5
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
64	Total capital invested in and required to complete enterprises, dollars.....		4,526,018	936,514	1,068,239	26,762,497	1,820,996	3,447,991	8,561,264	25,888,599	9,990,788
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	3,623,518	582,183	794,585	13,846,807	1,521,725	2,925,944	7,076,164	14,147,174	9,021,991
66	Additional capital required to complete these enterprises, dollars.....		902,500	354,331	303,654	12,915,690	299,271	522,047	1,485,100	11,741,425	968,797
67	Average cost per acre when completed.....	dollars	8.34	6.60	16.78	16.35	5.08	9.48	5.35	7.44	4.41
68	Enterprises constructing open ditches only.....	dollars	3,729,644	526,514	1,068,239	15,670,229	1,702,397	2,951,791	6,820,952	11,001,651	4,868,251
69	Average cost per acre when completed.....	dollars	8.57	4.02	16.78	14.34	4.93	8.88	5.35	4.85	2.54
70	Enterprises constructing open ditches and levees.....	dollars	796,374			11,092,268	8,333	498,700	1,137,312	14,555,948	5,119,537
71	Average cost per acre when completed.....	dollars	7.41			20.39	7.31	15.84	4.07	12.43	14.55
72	Enterprises constructing tile drains only.....	dollars					1,979	7,500	71,000	41,000	
73	Average cost per acre when completed.....	dollars					18.91	15.00	8.55	13.23	
74	Enterprises constructing tile drains and levees.....	dollars									
75	Average cost per acre when completed.....	dollars									
76	Enterprises constructing open ditches and tile drains.....	dollars					108,287		532,000	250,000	3,000
77	Average cost per acre when completed.....	dollars					9.32		13.49	8.82	8.00
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars		410,000						40,000	
79	Average cost per acre when completed.....	dollars		44.57						4.21	
<b>CROPS.</b>											
<b>Improved land in enterprises reporting—</b>											
80	Corn as principal crop on drained land.....	acres	188,658	3,036	20,291		239,254	110,022	136,848	461,230	103,608
81	Wheat as principal crop on drained land.....	acres									
82	Cotton as principal crop on drained land.....	acres	19,678	61,308				53,196	804,391	909,973	241,430
83	Hay as principal crop on drained land.....	acres					1,060			2,320	
84	Sugar beets as principal crop on drained land.....	acres									
85	Peas and beans (dried) as principal crop on drained land.....	acres									
86	Alfalfa as principal crop on drained land.....	acres									
87	Vegetables as principal crop on drained land.....	acres		1,232		31,505					6,341
88	Rice as principal crop on drained land.....	acres									446,130
89	Sugar cane as principal crop on drained land.....	acres				17,623					466,273
90	Potatoes as principal crop on drained land.....	acres		1,120		18,784					
91	Oats as principal crop on drained land.....	acres									
92	Barley as principal crop on drained land.....	acres									
93	Fruit as principal crop on drained land.....	acres									
94	Citrus fruit as principal crop on drained land.....	acres				10,820					
95	Other crops as principal ones on drained land.....	acres	1,350	2,390		13,781				116,254	8,608
96	Not reporting principal crop on drained land.....	acres	242		462	2,098	5,000				

<sup>1</sup> Less than one-tenth of 1 per cent.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Includes 1,000 acres reported as grain.



## ARKANSAS.

The following pages present the statistics of drainage for Arkansas collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet in farms.

The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

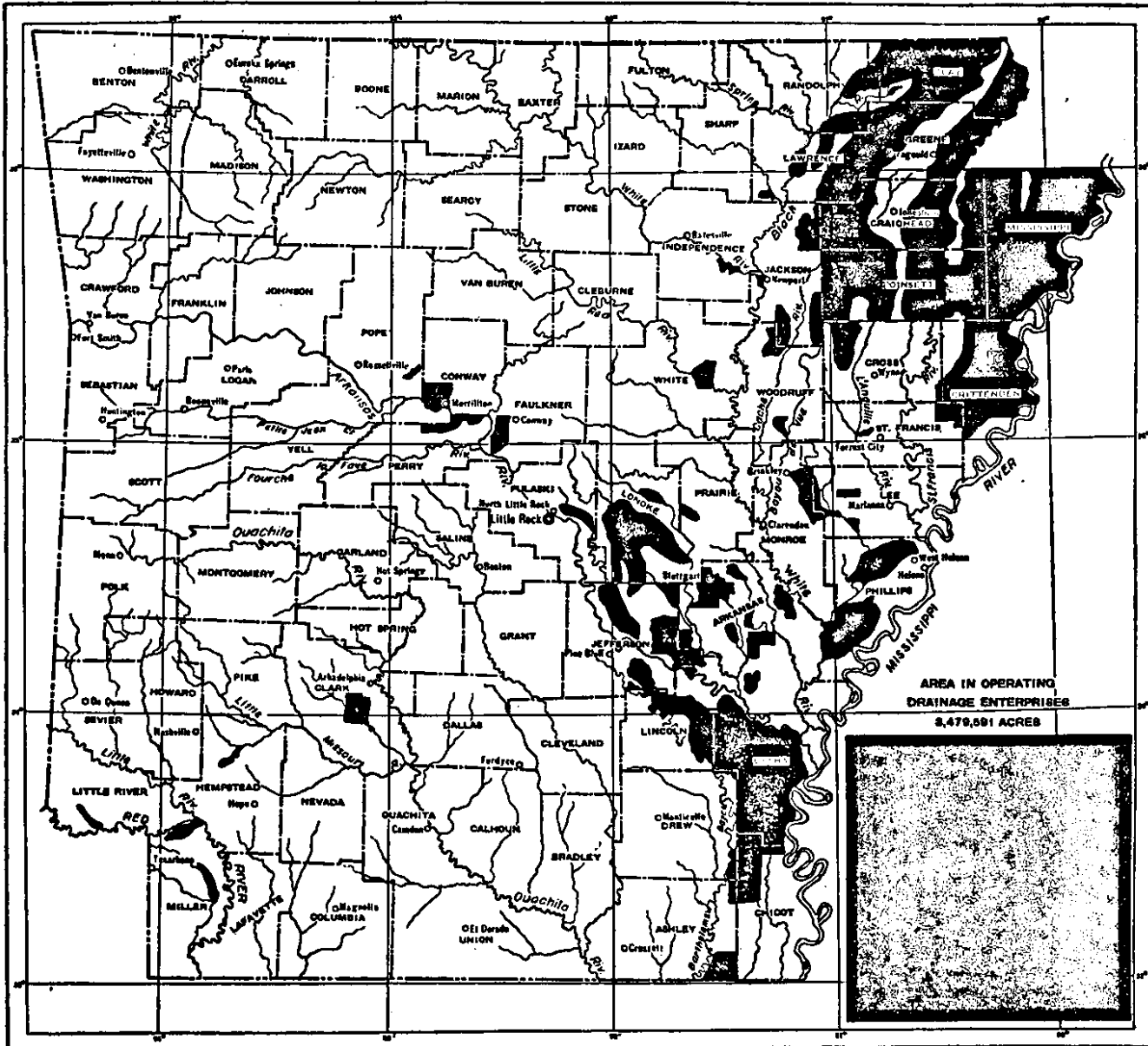
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	232, 604	100. 0
Farms reporting land having drainage.....	13, 426	5. 8
Farms reporting land needing drainage.....	33, 437	14. 4
All land in farms.....acres..	17, 456, 750	100. 0
Improved land in farms.....acres..	9, 210, 556	52. 8
Farm land reported as provided with drainage.....acres..	497, 489	2. 8
Farm land reported as needing drainage.....acres..	1, 642, 403	9. 4
Needing drainage only.....acres..	129, 987	0. 7
Needing drainage and clearing.....acres..	1, 512, 416	8. 7
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state.....acres..	33, 616, 000	100. 0
All land in operating drainage enterprises.....acres..	3, 479, 591	10. 4
Improved land.....acres..	1, 491, 777	4. 4
Per cent of all improved land in farms.....	16. 2	-----
Timber and cut-over land.....acres..	1, 923, 382	5. 7
Other unimproved land.....acres..	64, 432	0. 2
Swampy, subject to overflow, seeped, or alkali.....acres..	897, 547	2. 7
Suffering a loss of crops from defective drainage.....acres..	153, 957	0. 5
Improved land prior to drainage.....acres..	887, 864	2. 6
Increase since drainage began.....acres..	603, 913	1. 8
Land in nonoperating enterprises.....acres..	672, 243	2. 0
Open ditches in operating enterprises.....miles..	4, 128. 2	100. 0
Completed.....miles..	3, 154. 1	76. 4
Additional under construction.....miles..	974. 1	23. 6
Tile drains in operating enterprises.....miles..	22. 4	100. 0
Completed.....miles..	20. 4	91. 1
Additional under construction.....miles..	2. 0	8. 9
Total capital invested in and required for completion of operating enterprises..	\$25, 888, 599	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	14, 147, 174	54. 6
Additional capital required to complete these enterprises.....	11, 741, 425	45. 4
Average cost per acre when completed.....	7. 44	-----



# ARKANSAS

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts for which the orders of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

**TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.**

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	4,151,834	100.0	\$14,217,155	100.0	\$18,637,337
Operating enterprises.....	3,479,591	83.8	14,147,174	99.5	11,741,425
With works completed.....	2,124,446	51.2	9,385,025	66.0	.....
With works under construction.	1,355,145	32.6	4,762,149	33.5	11,741,425
Nonoperating enterprises.....	672,243	16.2	69,981	0.5	6,895,912

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

**Location of enterprises.**—Most of the drainage enterprises in Arkansas are in the eastern part of the state. Large portions of the areas of several counties in the northeast corner and in the southeastern section are embraced in drainage districts. There are a few enterprises in the central part of the state, northwest of Little Rock, and in the southwestern part, as shown by the map on page 2.

**TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.**

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	4,151,834	100.0	\$14,217,155	100.0	\$18,637,337
Operating enterprises.....	3,479,591	83.8	14,147,174	99.5	11,741,425
St. Francis River.....	1,526,474	35.8	6,995,231	49.2	9,133,400
White River.....	886,928	21.4	3,084,530	21.7	1,032,025
Arkansas River.....	412,008	10.6	1,040,760	11.5	404,000
Black River (in Louisiana) <sup>1</sup> ..	220,336	5.3	689,000	4.8	142,000
Red River.....	33,501	0.8	163,800	1.2	.....
Mississippi River.....	370,344	8.9	1,568,833	11.0	1,030,000
Nonoperating enterprises.....	672,243	16.2	69,981	0.5	6,895,912
St. Francis River.....	132,000	3.2	54,500	0.4	1,598,000
White River.....	477,580	11.5	14,481	0.1	4,790,541
Arkansas River.....	23,240	0.6	1,000	( <sup>2</sup> )	106,420
Black River (in Louisiana) <sup>1</sup> ..	7,275	0.2	.....	.....	155,951
Red River.....	32,148	0.8	.....	.....	275,000

<sup>1</sup> Includes Ouachita River, Bartholomew Bayou, Boeuff River, and Mason Bayou.  
<sup>2</sup> Less than one-tenth of 1 per cent.

**Condition of land in enterprises.**—Most of the drainage enterprises in this state are for the reclamation and improvement of so-called swamp land in the alluvial plain of Mississippi River. Much of the land in the enterprises receives also protection against overflow by the levees along the Mississippi and some of its principal tributaries that have been built by the Federal Government and by local levee districts which are not drainage enterprises according to the definition adopted by the Census Bureau. Originally the swamp land was generally timbered. Some of it was logged off before drainage was undertaken, but there is a considerable amount of merchantable timber still standing in operating drainage enterprises.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

**TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.**

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	3,479,591	100.0	2,124,446	1,355,145	672,243
Improved land.....	1,491,777	42.9	1,051,442	440,335	217,491
Timber and cut-over land..	1,923,382	55.3	1,016,887	905,495	414,707
Other unimproved land....	64,432	1.9	56,117	8,315	40,045
Swampy or subject to overflow.	897,547	25.8	330,630	566,917	496,573
Suffering a loss of crops.....	153,957	4.4	69,133	64,769	20,774

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 174 operating drainage enterprises are counted in Arkansas, with an average area of 22,085 acres assessed. There are 20 of these enterprises embracing 50,000 acres or more each, 68 others of 10,000 acres or more, and only 8 enterprises of less than 1,000 acres each.

The assessed acreage exceeds the land in enterprises by 363,221 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acres.	Per cent of total.
All operating enterprises.....	3,479,591	3,842,812	100.0
200 to 499 acres.....	240	1,140	( <sup>1</sup> ) 0.1
500 to 999 acres.....	1,949	3,669	0.1
1,000 to 4,999 acres.....	80,780	103,001	2.7
5,000 to 9,999 acres.....	248,047	274,227	7.1
10,000 to 49,999 acres.....	1,380,711	1,473,301	38.3
50,000 to 99,999 acres.....	964,000	1,162,120	30.2
100,000 to 499,999 acres.....	825,264	825,264	21.5

<sup>1</sup> Less than one-tenth of 1 per cent.

**Character of enterprises.**—The drainage enterprises in Arkansas are county drains or drainage districts organized under general, special, or local laws of the state, and a few undertakings by individual farm owners. A distinction between county drains and drainage districts is not universally recognized, and is not made in the following pages for this state.

The statute of April 23, 1891 (act 161), was the first general drainage law of the state. It provided for the establishment of ditches by the county courts, upon petition from one or more landowners affected. Three viewers appointed by the court made report regarding the location of the proposed ditch, the probable benefits to be secured from it, and the apportionment of the work of construction to the landowners in proportion to the benefits they would receive. Order of establishment was issued only after public hearing upon the viewers' report and, if any remonstrance was filed, upon further report from reviewers appointed by the court. For work not performed by the landowners, contracts were let by the county court and the cost collected from the owners. For a ditch in more than one county, viewers were appointed by each county court, to act jointly with the viewers from the other counties affected.

The law of April 23, 1903 (act 159), supersedes that of 1891, to which it is generally similar. For an improvement to be more than 5 miles long, at least five landowners must sign the petition. If the petition is denied, the cost of the proceedings is charged to the petitioners. After the viewers have submitted a preliminary report and the order of establishment has been issued by the county court, the complete plan of drainage is prepared and the viewers assess the benefits and the damages that will accrue to the land, and apportion the work of construction to the owners in proportion to the benefits. After public hearing, the final report of the viewers is confirmed with such modifications as the court finds equitable. Appeals may be taken to the district court. Contracts for construction not performed by the landowners are let by the engineer whom the court appoints to superintend the construction. The cost of the enterprise is paid by the

landowners in proportion to the benefits, and is collected like taxes. Bonds may be issued, to run from 10 to 30 years. For a district in more than one county, each county court appoints one viewer for making the preliminary report, and two additional for preparing the plan of drainage and assessment of damages and benefits.

The drainage district law of May 27, 1909 (act 279), does not repeal the law of 1903, but has virtually superseded it in practice. As amended, the 1909 law authorizes the county courts to establish drainage districts upon petition from three or more owners of real property within the proposed district. The circuit courts have jurisdiction over districts embracing land in more than one county, the petition being filed with that court for any county in which a part of the district is located. After a plan of drainage is formulated and the district boundaries are defined by an engineer appointed by the court, public hearing is held and the district is established if the court finds the project will be of benefit to the property owners; the district must be established if petition for it is made at the hearing by a majority of the landowners in number, acreage, or value. The officers of the district are three commissioners appointed by the court; the selection may be determined by petition from a majority in value of the landowners. The final plan of improvement works, estimate of cost, and assessments of damages and benefits are made by the commissioners, subject to review by the court at public hearing. Awards of damages may be appealed by any aggrieved owner for jury trial. The cost of the enterprise is apportioned according to the benefits, and collected like taxes. Supplemental levies for cost may be made, but the total cost must not exceed the confirmed benefits. Bonds may be issued by the district, to mature within 30 years. Subdistricts within a drainage district may be established by the same method as main districts, the commissioners of the main district serving also for the subdistricts.

Local drainage laws have been enacted by the legislature, each applying in only one or a few counties. Also, many special acts have been passed, each creating one drainage district, defining its boundaries, naming the initial members of its board of commissioners, and prescribing its powers and method of procedure. The cost of these special districts generally has been apportioned according to the anticipated benefits, and the issuance of bonds nearly always has been authorized.

A law effective February 24, 1905 (act 53), provides for condemnation of right of way by drainage districts, damages to be determined by appraisers appointed by the circuit judge, the awards to be confirmed by the circuit court and subject to appeal to the supreme court of the state.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	4,151,834	100.0	\$14,217,155	100.0	\$18,637,337
Operating enterprises.....	3,479,591	83.8	14,147,174	99.5	11,741,425
Drainage districts.....	3,452,691	83.2	14,084,174	99.1	11,721,425
Laws of 1891, act 161.....	26,100	0.6	100,000	0.7	.....
Laws of 1903, act 159 <sup>1</sup> .....	1,339,111	8.2	981,072	6.9	.....
Laws of 1909, act 279.....	1,825,915	44.0	8,374,659	58.9	1,986,025
Special acts <sup>2</sup> .....	1,261,565	30.4	4,628,443	32.6	9,735,400
Individual ownerships.....	26,900	0.6	63,000	0.4	20,000
Nonoperating enterprises.....	672,243	16.2	69,981	0.5	6,895,912
Drainage districts.....	672,243	16.2	69,981	0.5	6,895,912
Laws of 1909, act 279.....	559,995	13.5	51,981	0.4	5,754,912
Special acts.....	112,248	2.7	18,000	0.1	1,141,000

<sup>1</sup> Includes 4,080 acres organized under act 27 of 1903, applicable only in Randolph, Lawrence, and Jackson Counties.

<sup>2</sup> Includes 5,861 acres organized under act 144 of 1909, applicable only in Little River County.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 3,154.1 miles of open ditches, 20.4 miles of tile drains, and 119.8 miles of accessory levees; the additional lengths under construction were 974.1 miles of ditches, 2.0 miles of tile drains, and 240.8 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one pumping district for land drainage among the enterprises under construction in Arkansas, in which part of the drainage water from 90,000 acres is to be removed by pumping. The anticipated capacity of the pumps is 720,000 gallons per minute, and that of the engine 2,800 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	3,479,591	100.0	\$14,147,174	100.0	\$11,741,425
Open ditches only.....	2,267,281	65.2	9,038,226	63.9	1,968,425
Open ditches and levees.....	1,171,354	33.7	4,819,948	34.1	9,736,000
Tile drains only.....	8,100	0.1	41,000	0.3	.....
Open ditches and tile drains.....	28,366	0.8	213,000	1.5	37,000
Open ditches, tile drains, and levees.....	9,500	0.3	40,000	0.3	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown on line 15 of County Table II.

The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths of 10 feet and greater were omitted, as it seemed they did not represent so well the average depths of outlet provided for all the farms in those districts; to include this group, computed as 10 feet, would change the mean depth for the state, 6.9 feet, less than 0.1 foot.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Percent of total.
All operating enterprises.....	3,479,591	100.0
3.0 to 3.9 feet.....	46,986	1.4
4.0 to 4.9 feet.....	165,213	4.7
5.0 to 5.9 feet.....	213,578	6.1
6.0 to 6.9 feet.....	517,802	14.9
7.0 to 7.9 feet.....	810,607	23.3
8.0 to 8.9 feet.....	1,138,863	32.7
9.0 to 9.9 feet.....	76,119	2.2
10 and more.....	41,000	1.2
Not reporting branches.....	469,423	13.5

Maintenance of works.—The drainage law of 1903 provides that ditches constructed under that act shall be cleaned by the road commissioners of the county. A statute of May 13, 1907, (act 314), provides that the county judge, county clerk, and county sheriff shall constitute a board to ascertain the amount of money necessary each year to clean the public ditches of the county, this amount to be certified to the quorum court of the county for the purpose of levying a tax against the property affected.

The drainage district law of 1909 provides that the district organization shall continue after completion of the drainage system, for the purpose of preserving the system, keeping the ditches clear of obstruction, and extending or enlarging the drains as may be advantageous to the district. The levy of taxes for such maintenance or extension work is determined by the county court upon petition from the district commissioners and after public hearing, the findings of the court being subject to appeal.

Most of the special acts creating individual drainage districts authorize the maintenance of the works of those districts by the district commissioners, taxes for the annual cost being levied by the commissioners in proportion to the benefits.

DRAINAGE—ARKANSAS.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	3,478,591	100.0	\$14,147,174	100.0	\$11,741,425
By district forces.....	580,292	16.7	2,683,513	19.0	1,440,000
By contract.....	643,795	18.5	3,621,997	25.6	337,000
By method not specified.....	18,000	0.5	129,000	0.9	
By landowners.....	92,490	2.7	11,500	0.1	
No maintenance provided.....	1,358,508	39.0	5,636,764	40.2	1,566,425
Not reporting.....	788,506	22.7	2,014,400	14.2	8,393,000

**Date of organization.**—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	3,478,591	100.0	3,842,812	100.0
1905 to 1909.....	869,641	25.0	960,641	25.0
1910 to 1914.....	1,563,456	44.9	1,733,237	45.1
1915 to 1919.....	998,494	28.7	1,100,934	28.6
Not reported.....	48,000	1.4	48,000	1.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$14,147,174	100.0	\$11,741,425
1905 to 1909.....	2,877,390	20.3	
1910 to 1914.....	7,811,962	55.2	1,425,400
1915 to 1919.....	3,357,822	23.7	10,216,025
Not reported.....	100,000	0.7	100,000

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1905 to 1909.....	663.2	16.1			65.0	18.0
1910 to 1914.....	2,029.4	49.2	21.7	96.9	18.1	4.5
1915 to 1919.....	1,377.7	33.4	0.7	3.1	279.5	77.5
Not reported.....	57.9	1.4				

**Crops.**—The principal crops grown upon the drained land in the drainage enterprises are cotton and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—ARKANSAS.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Arkansas.	Ashley.	Bradley.	Chicot.	Clark.	Clay.	Cleburne.
1	Number of all farms in the state or county.....	232,604	2,121	3,216	1,595	3,663	3,292	3,335	1,941
2	Farms reporting land having drainage.....	13,420	97	106	42	359	285	840	37
3	Farms reporting land needing drainage.....	33,437	361	575	698	208	295	1,125	576
4	Farms in drainage and levee districts.....	10,882	82	57	1	435	47	1,089	.....
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	33,616,000	640,000	601,600	421,760	388,480	564,490	418,560	381,440
6	All land in farms..... acres.....	17,456,750	282,097	211,890	144,433	171,706	265,460	215,298	185,633
7	Improved land in farms..... acres.....	9,210,558	195,910	109,700	64,789	104,472	125,816	156,989	72,083
8	Woodland in farms..... acres.....	7,396,028	65,094	93,501	77,944	65,914	114,554	54,632	107,856
9	Other unimproved land in farms..... acres.....	850,166	21,093	8,689	1,701	1,320	25,090	3,677	5,694
10	Farm land reported as provided with drainage..... acres..	497,489	16,771	3,534	660	14,557	6,030	38,438	767
11	Farm land reported as needing drainage..... acres.....	1,642,493	19,665	46,349	34,855	27,954	16,732	34,208	23,450
12	Drainage only..... acres.....	120,987	1,075	5,280	783	2,362	1,005	8,745	228
13	Drainage and clearing..... acres.....	1,512,416	18,590	41,069	34,072	25,592	15,727	25,463	23,222

		Colum- bla.	Conway.	Craig- head.	Crawford.	Critten- den.	Gross.	Desha.	Drew.	Faulk- ner.	Grant.
1	Number of all farms in the county.....	4,555	3,594	3,549	3,326	5,495	2,507	3,344	3,344	4,457	1,428
2	Farms reporting land having drainage.....	40	46	873	16	112	60	170	31	72	113
3	Farms reporting land needing drainage.....	783	251	694	272	144	263	368	610	653	994
4	Farms in drainage and levee districts.....	.....	27	943	23	176	77	399	4	16	18
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	502,400	360,320	439,680	379,520	372,480	396,160	478,080	542,080	416,640	407,680
6	All land in farms..... acres.....	347,650	248,600	204,899	234,462	203,227	144,134	124,856	251,466	307,003	129,468
7	Improved land in farms..... acres.....	178,341	154,626	141,459	131,676	151,215	82,529	79,215	121,476	175,466	51,668
8	Woodland in farms..... acres.....	162,688	89,153	59,607	79,851	50,298	57,178	38,472	119,949	113,912	75,292
9	Other unimproved land in farms..... acres.....	6,641	4,912	8,833	22,975	1,714	4,427	7,169	10,041	17,625	1,508
10	Farm land reported as provided with drainage..... acres..	916	1,202	34,255	688	8,523	7,524	4,988	728	1,724	1,629
11	Farm land reported as needing drainage..... acres.....	44,712	5,964	25,132	5,120	18,681	24,686	12,760	48,615	67,649	60,390
12	Drainage only..... acres.....	634	165	5,571	191	8,973	2,579	3,777	2,874	1,417	619
13	Drainage and clearing..... acres.....	44,078	5,799	19,561	4,935	14,908	22,087	12,383	40,741	66,232	59,771

		Greene.	Hemp- stead.	Howard.	Independ- ence.	Jackson.	Jefferson.	Law- rence.	Lee.	Lincoln.	Little River.
1	Number of all farms in the county.....	3,291	5,031	2,693	3,287	3,227	6,900	2,759	4,895	3,660	2,490
2	Farms reporting land having drainage.....	356	190	220	8	380	2,515	285	334	1,105	17
3	Farms reporting land needing drainage.....	790	417	469	204	646	575	717	852	863	484
4	Farms in drainage and levee districts.....	424	56	1	2	431	2,291	161	65	819	4
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	859,040	465,280	385,280	487,680	405,760	577,020	378,880	384,640	365,440	349,440
6	All land in farms..... acres.....	211,481	334,767	184,420	278,668	221,310	290,286	220,054	213,452	223,194	178,142
7	Improved land in farms..... acres.....	137,065	206,038	99,968	139,694	129,382	198,314	126,953	147,154	127,790	104,777
8	Woodland in farms..... acres.....	71,785	116,532	72,990	128,024	79,035	85,203	84,738	68,167	91,034	69,371
9	Other unimproved land in farms..... acres.....	2,651	12,197	11,462	10,940	12,893	6,779	8,363	3,131	4,370	3,394
10	Farm land reported as provided with drainage..... acres..	18,550	4,680	3,368	952	17,457	83,017	8,601	10,129	37,958	3,071
11	Farm land reported as needing drainage..... acres.....	32,659	19,645	19,197	7,622	33,922	34,368	28,022	26,036	49,095	29,790
12	Drainage only..... acres.....	4,049	1,565	263	487	2,370	6,672	3,425	2,635	7,364	1,032
13	Drainage and clearing..... acres.....	28,610	18,080	18,934	7,135	31,552	27,696	24,597	23,401	41,781	28,758

DRAINAGE—ARKANSAS.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Logan.	Lanoke.	Miller.	Mississippi.	Monroe.	Montgomery.	Nevada.	Onachita.	Perry.	Phillips.
1	3,911	5,596	2,618	6,511	3,305	1,742	3,682	2,326	1,265	5,774
2	137	338	23	1,498	36	54	36	35	114	145
3	462	536	225	541	343	612	856	215	266	509
4	15	459	16	1,664	10		2		3	149
<b>LAND AND FARM AREA.</b>										
5	464,640	516,480	398,720	506,880	385,920	501,760	396,800	469,120	353,280	442,880
6	311,463	320,088	207,568	277,670	150,029	185,775	279,682	222,802	86,763	237,939
7	179,355	217,981	105,728	231,694	101,215	71,242	146,552	99,609	44,702	177,756
8	119,988	95,571	98,910	32,821	45,367	106,685	128,582	117,781	31,803	55,944
9	12,122	6,536	2,930	13,265	3,447	7,848	6,568	5,412	10,268	4,239
10	2,461	14,253	3,220	65,471	1,243	648	649	654	1,870	3,744
11	8,947	21,870	8,194	27,622	13,803	26,333	45,645	10,810	7,942	21,442
12	490	1,532	737	11,033	1,130	220	220	890	163	2,750
13	8,457	20,138	7,457	16,589	12,673	26,112	45,425	9,920	7,779	18,092
	Pike.	Poinsett.	Polk.	Pope.	Prairie.	Pulaski.	Randolph.	St. Francis.	Saline.	Scott.
1	1,762	2,257	2,272	3,936	2,413	4,496	2,838	4,586	1,918	2,321
2	56	102	59	99	132	162	120	53	92	107
3	520	75	277	152	544	615	375	528	715	224
4		105		16	98	69	152	192	30	
<b>LAND AND FARM AREA.</b>										
5	384,640	461,440	541,440	529,920	423,680	498,560	418,560	401,920	475,320	620,800
6	145,799	127,124	213,025	282,104	238,994	241,970	277,843	190,175	161,645	197,273
7	69,691	78,191	77,905	161,896	153,830	150,395	145,272	133,540	67,946	87,369
8	71,637	44,739	122,489	114,927	72,803	88,535	95,551	45,635	80,284	102,935
9	4,471	4,194	12,631	5,281	12,361	5,040	37,020	11,000	13,415	6,969
10	1,055	10,997	725	2,562	3,918	5,559	6,773	5,160	2,118	2,728
11	21,097	6,345	5,970	3,618	32,969	28,712	17,997	38,684	26,301	6,439
12	537	1,203	241	252	702	7,764	4,172	6,330	832	1,014
13	20,560	5,142	5,729	3,366	32,267	20,948	13,225	32,354	25,469	5,425
	Sebastian.	Sevier.	Union.	Washington.	White.	Woodruff.	Yell.	All other counties. <sup>1</sup>		
1	3,150	2,282	3,736	4,803	4,821	2,853	3,917	48,117		
2	158	136	104	194	61	98	311	156		
3	520	570	785	147	818	321	416	6,583		
4	4	6		9	24	142	8	61		
<b>LAND AND FARM AREA.</b>										
5	339,840	366,080	670,720	611,200	663,680	369,280	611,200	8,920,320		
6	222,567	188,123	354,437	481,183	353,062	163,305	267,014	5,043,185		
7	134,459	88,148	145,075	242,456	187,064	104,356	153,885	2,138,793		
8	71,912	93,966	202,472	213,021	152,163	55,279	100,304	2,549,212		
9	16,196	6,008	6,890	25,706	13,835	3,640	12,825	355,180		
10	4,073	2,164	696	5,726	3,300	2,296	9,024	2,595		
11	8,950	29,078	60,751	3,511	31,723	24,272	13,945	297,719		
12	431	7,803	362	1,234	696	938	2,320	6,200		
13	8,519	21,275	60,389	2,277	31,027	23,334	11,625	291,519		

<sup>1</sup> No drainage on farms reported in Boone, Carroll, and Newton Counties.



# DRAINAGE—ARKANSAS.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Arkansas.	Ashley.	Chicot.	Clark.	Clay.	Conway.	Craighead.	Crittenden.	
<b>LAND AREA.</b>											
1	Approximate land area of the state or county.....	acres..	33,616,000	640,000	601,600	388,480	564,480	418,560	360,320	439,680	372,480
2	All land in operating drainage enterprises.....	acres..	3,479,591	91,840	38,319	68,920	25,000	278,480	31,650	265,920	261,860
3	Improved land.....	acres..	1,491,777	32,461	26,660	32,204	12,500	147,907	15,825	89,379	132,892
4	Per cent of all improved land in farms.....	.....	16.2	42.1	24.3	30.8	9.9	64.2	10.2	63.2	87.9
5	Timber and cut-over land.....	acres..	1,923,382	8,653	11,659	36,716	12,500	180,573	15,825	176,541	114,266
6	Other unimproved land.....	acres..	64,432	725							14,672
7	Swampy or subject to overflow, in enterprises.....	acres..	897,547		3,000	6,016	6,250	65	13,325	76,682	32,445
8	Suffering a loss of crops from defective drainage.....	acres..	153,957								
9	Assessed acreage.....	.....	3,842,812	91,840	38,319	68,920	25,000	366,225	31,650	265,920	261,860
10	Excess over all land in operating enterprises.....	acres..	363,221				87,745				
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....	miles..	3,154.1	139.3	17.0	42.5	10.2	403.1	8.5	154.6	385.1
12	Additional under construction.....	miles..	974.1			1.0	5.8	12.8	0.2	76.6	92.3
13	Maximum completed in any enterprise.....	miles..	305.0	30.0	16.0	41.5	10.2	149.0	6.2	50.0	140.0
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet..	100	24	55	88	20	80	20	60	70
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet..	18.0	6.5	15.0	14.0	10.0	8.0	9.0	10.0	18.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet..	6.9	2.7	9.0	8.9		6.2	7.6	6.7	7.3
Tile drains:											
17	Completed.....	miles..	20.4					0.2		10.2	
18	Additional under construction.....	miles..	2.0								
19	Maximum completed in any enterprise.....	miles..	10.0					0.2		10.0	
20	Maximum size of tile <sup>1</sup> .....	inches..	20					6		10	
Accessory levees and dikes:											
21	Completed.....	miles..	119.8					60.7		2.7	0.8
22	Additional under construction.....	miles..	240.8				16.0	25.0	0.1	6.5	
23	Area drained by open ditches only <sup>1</sup> .....	acres..	2,267,281	91,840	38,319	68,920		1,300	25,000	238,120	248,676
24	Length of these ditches.....	miles..	2,464.3	139.3	17.0	43.5		45.1	6.2	186.2	431.5
25	Average length per acre.....	feet..	5.7	8.0	2.3	3.3		183.2	1.3	4.2	9.4
26	Area having open ditches and levees <sup>1</sup> .....	acres..	1,171,354				25,000	277,180	6,650	16,500	18,284
27	Length of these ditches.....	miles..	1,566.8				16.0	356.8	2.5	27.0	45.9
28	Average length per acre.....	feet..	7.1				3.4	6.8	2.0	8.6	13.3
29	Length of the accessory levees.....	miles..	359.6				16.0	87.7	0.1	8.2	0.6
30	Area drained by tile only <sup>1</sup> .....	acres..	3,100							1,800	
31	Length of these tile.....	miles..	20.0							10.0	
32	Average length per acre.....	feet..	34.1							28.3	
33	Area drained by open ditches and tile <sup>1</sup> .....	acres..	28,366					(*)			
34	Length of these drains.....	miles..	34.3					14.2			
35	Average length per acre.....	feet..	15.7								
36	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres..	9,500							9,500	
37	Length of these drains.....	miles..	15.2							15.2	
38	Average length per acre.....	feet..	8.4							8.4	
39	Length of the accessory levees.....	miles..	1.0							1.0	
<b>DEVELOPMENT OF LAND.</b>											
40	Improved land in operating enterprises, 1920.....	acres..	1,491,777	32,461	26,660	32,204	12,500	147,907	15,825	89,379	132,892
41	Improved land prior to drainage.....	acres..	837,884	37,747	26,748	9,982	6,250	48,083	5,825	55,979	88,117
42	Increase since drainage.....	acres..	653,913	44,714	5,912	22,242	6,250	99,824	10,000	33,400	44,775
43	Per cent of increase.....	.....	68.0	118.5	28.5	223.2	100.0	207.6	171.7	59.7	50.8
44	Per cent increase is of all improved land in farms, 1920.....	.....	6.6	22.8	5.4	21.3	5.0	63.6	6.5	23.6	29.6
45	Timber and cut-over land, 1920.....	acres..	1,923,382	8,653	11,659	36,716	12,500	180,573	15,825	176,541	114,266
46	Timber and cut-over land prior to drainage.....	acres..	2,460,170	13,988	17,571	58,958	18,750	230,397	25,825	209,941	158,399
47	Decrease since drainage.....	acres..	536,788	5,335	5,912	22,242	6,250	99,824	10,000	33,400	44,103
48	Per cent of decrease.....	.....	21.8	38.1	33.6	37.7	33.3	43.3	38.7	15.9	27.8
49	Other unimproved land, 1920.....	acres..	64,432	725							14,672
50	Other unimproved land prior to drainage.....	acres..	131,557	40,105							15,344
51	Decrease since drainage.....	acres..	67,125	39,379							672
52	Per cent of decrease.....	.....	51.0	88.2							4.4
53	Swampy or subject to overflow, 1920.....	acres..	897,547		3,000	6,016	6,250	65	13,325	76,682	32,445
54	Swampy or subject to overflow prior to drainage.....	acres..	2,065,264	38,804	16,739	52,066	12,500	159,180	22,075	228,332	104,425
55	Decrease since drainage.....	acres..	1,167,717	38,804	13,739	46,050	6,250	159,115	8,750	151,650	71,980
56	Per cent of decrease.....	.....	56.5	100.0	82.1	88.4	50.0	100.0	39.6	66.4	68.9
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
57	Total capital invested in and required for completion of operating enterprises.....	dollars..	25,888,599	378,988	77,000	168,182	210,000	1,772,998	65,000	1,385,000	1,696,827
58	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	14,147,174	378,988	77,000	157,656	68,000	1,707,798	63,000	798,800	1,461,827
59	Additional capital required to complete these enterprises.....	dollars..	11,741,425			10,526	142,000	65,200	2,000	586,200	235,000
60	Average cost per acre when completed.....	dollars..	7.44	4.13	2.01	2.44	8.40	6.37	2.05	5.02	6.48
61	Enterprises constructing open ditches only.....	dollars..	11,001,651	378,988	77,000	168,182		234,946	50,000	954,000	1,566,567
62	Average cost per acre when completed.....	dollars..	4.55	4.13	2.01	2.44		2.00	2.00	4.01	6.43
63	Enterprises constructing open ditches and levees.....	dollars..	14,555,948				210,000	1,508,052	15,000	325,000	130,280
64	Average cost per acre when completed.....	dollars..	12.43				8.40	5.44	2.26	19.70	7.12
65	Enterprises constructing tile drains only.....	dollars..	41,000							16,000	
66	Average cost per acre when completed.....	dollars..	13.23							8.89	
67	Enterprises constructing open ditches and tile drains.....	dollars..	250,000					30,000			
68	Average cost per acre when completed.....	dollars..	8.82								
69	Enterprises constructing open ditches, tile drains, and levees.....	dollars..	40,000							40,000	
70	Average cost per acre when completed.....	dollars..	4.21							4.21	
<b>CROPS.</b>											
Improved land in enterprises reporting—											
71	Cotton as principal crop on drained land.....	acres..	909,973		26,660	32,204	12,500			33,600	108,892
72	Corn as principal crop on drained land.....	acres..	461,230					147,907		55,779	24,000
73	Hay as principal crop on drained land.....	acres..	2,320								
74	Other crops as principal ones on drained land.....	acres..	118,254	32,461							

<sup>1</sup> When works under construction have been completed.

\* Acreage reported under open ditches and levees.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Cross.	Desha.	Drew.	Faulkner.	Greene.	Hempstead.	Independence.	Jackson.	Jefferson.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres.	396,160	478,080	542,080	416,640	350,040	485,280	487,680	405,760	577,920
2	All land in operating drainage enterprises.....acres.	43,364	317,264	6,400	20,000	182,180	9,400	5,520	61,083	162,660
3	Improved land.....acres.	11,807	69,453	3,200	10,000	73,300	8,652	3,368	25,097	94,352
4	Per cent of all improved land in farms.....	14.3	87.7	2.6	5.7	53.5	4.2	2.4	19.4	47.6
5	Timber and cut-over land.....acres.	29,625	247,811	3,200	10,000	105,265	700	1,891	35,986	68,308
6	Other unimproved land.....acres.	1,932				3,615	48	261		
7	Swampy or subject to overflow, in enterprises.....acres.	6,715	235,811			123,834	48	5,026	20,629	21,214
8	Suffering a loss of crops from defective drainage.....acres.					43,033		861		5,414
9	Assessed acreage.....acres.	43,364	399,424	6,400	20,000	270,330	9,400	5,520	61,083	189,840
10	Excess over all land in operating enterprises.....acres.		82,160			88,150				27,180
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....miles.	28.9	138.0	3.5	10.0	151.1	14.9	10.5	75.2	150.6
12	Additional under construction.....miles.	5.6	94.0			38.6			30.0	13.2
13	Maximum completed in any enterprise.....miles.	22.4	94.0	3.5	10.0	48.1	11.2	5.9	13.5	24.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet.	60	88	55	20	80	20	25	30	45
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet.	13.0	14.0	12.0	6.0	11.0	8.0	10.0	7.0	12.0
16	Mean depth of branch ditches <sup>1</sup> .....feet.	7.1	8.0	9.0		7.0	7.0	5.1	4.9	6.8
<b>Tile drains:</b>										
17	Completed.....miles.									
18	Additional under construction.....miles.								0.5	
19	Maximum completed in any enterprise.....miles.									
20	Maximum size of tile <sup>1</sup> .....inches.									
<b>Accessory levees and dikes:</b>										
21	Completed.....miles.					4.4	5.0			
22	Additional under construction.....miles.					36.7				
23	Area drained by open ditches only <sup>1</sup> .....acres.	43,364	317,264	6,400	20,000	94,880	2,400	5,520	50,325	162,660
24	Length of these ditches.....miles.	34.5	232.0	3.5	10.0	97.6	3.7	10.5	77.1	163.8
25	Average length per acre.....feet.	4.2	3.9	2.9	2.6	5.4	8.1	10.0	8.1	6.3
26	Area having open ditches and levees <sup>1</sup> .....acres.					87,300	7,000			
27	Length of these ditches.....miles.					92.1	11.2			
28	Average length per acre.....feet.					5.6	8.4			
29	Length of the accessory levees.....miles.					41.1	5.0			
30	Area drained by tile only <sup>1</sup> .....acres.									
31	Length of these tile.....miles.									
32	Average length per acre.....feet.									
33	Area drained by open ditches and tile <sup>1</sup> .....acres.								10,758	
34	Length of these drains.....miles.								28.6	
35	Average length per acre.....feet.								14.0	
36	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres.									
37	Length of these drains.....miles.									
38	Average length per acre.....feet.									
39	Length of the accessory levees.....miles.									
<b>DEVELOPMENT OF LAND.</b>										
40	Improved land in operating enterprises, 1920.....acres.	11,807	69,453	3,200	10,000	73,300	8,652	3,368	25,097	94,352
41	Improved land prior to drainage.....acres.	6,660	29,326	960		40,848	7,520	2,961	16,227	63,513
42	Increase since drainage.....acres.	5,147	40,127	2,240	10,000	32,452	1,132	407	8,870	30,839
43	Per cent of increase.....	77.3	136.8	233.3		79.4	15.1	13.7	54.7	48.6
44	Per cent increase is of all improved land in farms, 1920.....	6.2	50.7	1.8	5.7	23.7	0.5	0.3	6.9	15.6
45	Timber and cut-over land, 1920.....acres.	29,625	247,811	3,200	10,000	105,265	700	1,891	35,986	68,308
46	Timber and cut-over land prior to drainage.....acres.	31,870	287,938	5,440	20,000	135,292	1,400	2,298	44,856	99,147
47	Decrease since drainage.....acres.	2,245	40,127	2,240	10,000	30,027	700	407	8,870	30,839
48	Per cent of decrease.....	7.0	13.9	41.2	50.0	22.2	50.0	17.7	19.3	31.1
49	Other unimproved land, 1920.....acres.	1,932				3,615	48	261		
50	Other unimproved land prior to drainage.....acres.	4,834				6,040	480	261		
51	Decrease since drainage.....acres.	2,902				2,425	432			
52	Per cent of decrease.....	60.0				40.1	90.0			
53	Swampy or subject to overflow, 1920.....acres.	6,715	235,811			123,834	48	5,026	20,629	21,214
54	Swampy or subject to overflow prior to drainage.....acres.	23,575	256,811	4,800	4,000	132,286	480	5,375	50,163	72,331
55	Decrease since drainage.....acres.	29,860	21,000	4,800	4,000	8,452	432	349	29,534	51,117
56	Per cent of decrease.....	80.0	8.2	100.0	100.0	6.4	90.0	6.5	58.9	70.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
57	Total capital invested in and required for completion of operating enterprises.....dollars.	136,000	2,463,171	8,500	30,000	2,871,418	65,000	32,500	300,000	882,318
58	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	118,000	1,463,697	8,500	30,000	1,032,418	65,000	32,500	268,000	829,318
59	Additional capital required to complete these enterprises.....dollars.	18,000	999,474			1,839,000			32,000	53,000
60	Average cost per acre when completed.....dollars.	3.14	7.76	1.33	1.50	15.76	6.91	5.89	4.91	5.42
61	Enterprises constructing open ditches only.....dollars.	136,000	2,463,171	8,500	30,000	427,751	14,000	32,500	230,000	882,318
62	Average cost per acre when completed.....dollars.	3.14	7.76	1.33	1.50	4.51	5.83	5.89	4.57	5.42
63	Enterprises constructing open ditches and levees.....dollars.					2,443,667	51,000			
64	Average cost per acre when completed.....dollars.					27.99	7.29			
65	Enterprises constructing tile drains only.....dollars.									
66	Average cost per acre when completed.....dollars.									
67	Enterprises constructing open ditches and tile drains.....dollars.								70,000	
68	Average cost per acre when completed.....dollars.								6.51	
69	Enterprises constructing open ditches, tile drains, and levees.....dollars.									
70	Average cost per acre when completed.....dollars.									
<b>CROPS.</b>										
71	Improved land in enterprises reporting—									
72	Cotton as principal crop on drained land.....acres.	1,932	69,453	3,200	10,000	31,470	6,300	1,048	25,097	94,352
73	Corn as principal crop on drained land.....acres.					41,630	2,352			
74	Hay as principal crop on drained land.....acres.							2,320		
74	Other crops as principal ones on drained land.....acres.	9,875								

<sup>1</sup> When works under construction have been completed.

DRAINAGE—ARKANSAS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Lawrence.	Lee.	Lincoln.	Little River.	Lonoka.	Miller.	Mississippi.	Monroe.	Perry.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres	378,880	394,640	365,440	349,440	516,480	398,720	506,880	385,920	353,280
2	All land in operating drainage enterprises.....acres	117,520	20,576	92,937	5,861	172,007	27,640	478,687	33,136	12,350
3	Improved land.....acres	37,190	12,466	47,807	5,275	91,067	14,512	207,743	14,911	6,175
4	Per cent of all improved land in farms.....	29.3	8.5	37.4	5.0	41.8	13.7	89.7	14.7	13.8
5	Timber and cut-over land.....acres	75,430	8,110	42,930	586	80,940	10,058	257,111	18,225	6,175
6	Other unimproved land.....acres	4,900		2,200			3,070	13,833		
7	Swampy or subject to overflow, in enterprises.....acres	39,050	4,611	6,756		56,387	795	5,319	6,627	6,175
8	Suffering a loss of crops from defective drainage.....acres	209	3,662	1,760		1,688	156		298	
9	Assessed acreage.....	117,520	20,576	92,937	5,861	172,007	27,640	478,687	33,136	12,350
10	Excess over all land in operating enterprises.....acres			680		7,306		70,000		
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....miles	127.1	15.5	88.0	14.4	93.8	35.9	575.4	20.0	10.8
12	Additional under construction.....miles	11.9	6.0	7.5		72.3		282.0		1.2
13	Maximum completed in any enterprise.....miles	40.0	7.0	28.0	14.4	28.5	17.4	305.0	20.0	10.8
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	80	16	45	17	70	20	70	16	20
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	10.0	7.5	6.0	4.0	12.0	10.0	13.5	6.0	9.0
16	Mean depth of branch ditches <sup>1</sup> .....feet	7.5	5.6	5.2	4.0	5.8	8.0	7.5	6.0	6.0
Tile drains:										
17	Completed.....miles									
18	Additional under construction.....miles									
19	Maximum completed in any enterprise.....miles									
20	Maximum size of tile <sup>1</sup> .....inches									
Accessory levees and dikes:										
21	Completed.....miles					0.2		48.0		
22	Additional under construction.....miles					3.5		55.0		
23	Area drained by open ditches only <sup>1</sup> .....acres	117,520	20,576	92,937	5,861	86,567	27,640	65,687	33,136	12,350
24	Length of these ditches.....miles	139.0	21.5	85.5	14.4	82.8	35.9	204.4	20.0	12.0
25	Average length per acre.....feet	6.2	5.5	5.4	13.0	5.1	6.9	16.4	3.2	5.1
26	Area having open ditches and levees <sup>1</sup> .....acres					85,440		413,000		
27	Length of these ditches.....miles					83.3		653.0		
28	Average length per acre.....feet					5.1		8.3		
29	Length of the accessory levees.....miles					3.7		103.0		
30	Area drained by tile only <sup>1</sup> .....acres									
31	Length of these tile.....miles									
32	Average length per acre.....feet									
33	Area drained by open ditches and tile <sup>1</sup> .....acres									
34	Length of these drains.....miles									
35	Average length per acre.....feet									
36	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres									
37	Length of these drains.....miles									
38	Average length per acre.....feet									
39	Length of the accessory levees.....miles									
<b>DEVELOPMENT OF LAND.</b>										
40	Improved land in operating enterprises, 1920.....acres	37,190	12,466	47,807	5,275	91,067	14,512	207,743	14,911	6,175
41	Improved land prior to drainage.....acres	25,506	10,305	33,436	2,931	62,621	7,945	140,932	11,588	6,175
42	Increase since drainage.....acres	11,684	2,161	14,371	2,344	28,446	6,567	66,811	3,323	
43	Per cent of increase.....	45.8	21.0	43.0	80.0	45.4	52.7	47.4	28.6	
44	Per cent increase is of all improved land in farms, 1920.....	9.2	1.5	11.2	2.2	13.0	6.2	28.8	3.3	
45	Timber and cut-over land, 1920.....acres	75,430	8,110	42,930	586	80,940	10,058	257,111	18,225	6,175
46	Timber and cut-over land prior to drainage.....acres	86,614	10,271	57,301	1,465	109,386	16,490	318,405	21,538	6,175
47	Decrease since drainage.....acres	11,184	2,161	14,371	879	28,446	5,432	61,294	3,313	
48	Per cent of decrease.....	12.9	21.0	25.1	60.0	28.0	35.1	19.3	15.4	
49	Other unimproved land, 1920.....acres	4,900		2,200			3,070	13,833		
50	Other unimproved land prior to drainage.....acres	5,400		2,200	1,465		4,205	19,350		
51	Decrease since drainage.....acres	500			1,465		1,135	5,517		
52	Per cent of decrease.....	9.3			100.0		27.0			
53	Swampy or subject to overflow, 1920.....acres	39,050	4,611	6,756		56,387	795	5,319	6,627	6,175
54	Swampy or subject to overflow prior to drainage.....acres	99,930	6,045	46,300	5,861	107,514	16,938	199,315	8,284	6,175
55	Decrease since drainage.....acres	60,880	1,434	39,544	5,861	51,127	16,143	193,996	1,657	
56	Per cent of decrease.....	60.9	23.7	85.4	100.0	47.6	95.3	97.3	20.0	
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
57	Total capital invested in and required for completion of operating enterprises.....dollars	369,050	118,600	319,000	52,800	730,034	116,000	4,940,636	16,900	60,000
58	Capital invested in these enterprises to Dec. 31, 1919.....dollars	333,025	94,600	299,000	52,800	405,034	116,000	2,090,636	16,900	52,000
59	Additional capital required to complete these enterprises.....dollars	36,025	24,000	20,000		325,000		2,850,000		8,000
60	Average cost per acre when completed.....dollars	3.14	5.76	3.43	9.01	4.24	4.20	10.32	0.51	4.85
61	Enterprises constructing open ditches only.....dollars	369,050	118,600	319,000	52,800	330,034	116,000	567,000	16,900	60,000
62	Average cost per acre when completed.....dollars	3.14	5.76	3.43	9.01	3.81	4.20	6.63	0.51	4.85
63	Enterprises constructing open ditches and levees.....dollars					400,000		4,373,636		
64	Average cost per acre when completed.....dollars					4.68		10.59		
65	Enterprises constructing tile drains only.....dollars									
66	Average cost per acre when completed.....dollars									
67	Enterprises constructing open ditches and tile drains.....dollars									
68	Average cost per acre when completed.....dollars									
69	Enterprises constructing open ditches, tile drains, and levees.....dollars									
70	Average cost per acre when completed.....dollars									
<b>CROPS.</b>										
71	Improved land in enterprises reporting— Cotton as principal crop on drained land.....acres	18,800	12,466	47,807	5,275	84,317	9,315	111,243	14,911	6,175
72	Corn as principal crop on drained land.....acres	15,390					5,197	96,500		
73	Hay as principal crop on drained land.....acres									
74	Other crops as principal ones on drained land.....acres	3,000				6,750				

<sup>1</sup> When works under construction have been completed.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Phillips.	Poinsett.	Pope.	Prairie.	Pulaski.	Randolph.	St. Francis.	White.	Woodruff.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres..	442,880	461,440	529,920	423,680	498,560	418,560	401,920	668,680	369,280
2	All land in operating drainage enterprises.....acres..	119,800	394,800	2,500	7,256	16,000	48,320	29,563	17,598	13,180
3	Improved land.....acres..	59,110	71,510	1,250	6,168	16,000	31,860	13,853	5,279	10,544
4	Per cent of all improved land in farms.....	33.3	91.5	0.8	4.0	10.6	21.9	10.4	2.8	10.1
5	Timber and cut-over land.....acres..	60,690	315,725	1,250	1,088	16,460	16,460	5,188	12,319	2,636
6	Other unimproved land.....acres..		7,565					10,522		
7	Swampy or subject to overflow, in enterprises.....acres..	63,036	144,540	1,000			5,010	5,245	1,936	
8	Suffering a loss of crops from defective drainage.....acres..	89,882					1,484	510		
9	Assessed acreage.....acres..	119,800	394,800	2,500	7,256	16,000	48,320	29,563	17,598	13,180
10	Excess over all land in operating enterprises.....acres..									
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....miles..	75.0	176.0	2.2	9.0	12.0	58.2	45.4	37.4	15.0
12	Additional under construction.....miles..		217.0	8.5					2.6	
13	Maximum completed in any enterprise.....miles..	39.0	57.0	2.2	9.0	12.0	22.0	24.5	37.4	10.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	40	100	14	40	24	20	60	20	30
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	6.0	10.0	7.1	5.0		8.0	13.0	12.0	7.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	4.0	7.1		3.0	8.0	4.3	8.0	5.0	5.0
Tile drains:										
17	Completed.....miles..		10.0							
18	Additional under construction.....miles..								1.5	
19	Maximum completed in any enterprise.....miles..		10.0							
20	Maximum size of tile <sup>1</sup> .....inches..		20							
Accessory levees and dikes:										
21	Completed.....miles..									
22	Additional under construction.....miles..		98.0							
23	Area drained by open ditches only <sup>1</sup> .....acres..	119,800	208,500	2,500	7,256	16,000	48,320	29,563		13,180
24	Length of these ditches.....miles..	75.0	141.0	5.7	9.0	12.0	58.2	45.4		15.0
25	Average length per acre.....feet..	3.3	3.6	12.0	6.5	4.0	6.4	8.1		6.0
26	Area having open ditches and levees <sup>1</sup> .....acres..		185,000							
27	Length of these ditches.....miles..		252.0							
28	Average length per acre.....feet..		7.2							
29	Length of the accessory levees.....miles..		98.0							
30	Area drained by tile only <sup>1</sup> .....acres..		1,300							
31	Length of these tile.....miles..		10.0							
32	Average length per acre.....feet..		40.6							
33	Area drained by open ditches and tile <sup>1</sup> .....acres..								17,598	
34	Length of these drains.....miles..								41.5	
35	Average length per acre.....feet..								12.5	
36	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres..									
37	Length of these drains.....miles..									
38	Average length per acre.....feet..									
39	Length of the accessory levees.....miles..									
<b>DEVELOPMENT OF LAND.</b>										
40	Improved land in operating enterprises, 1920.....acres..	59,110	71,510	1,250	6,168	16,000	31,860	13,853	5,279	10,544
41	Improved land prior to drainage.....acres..	30,820	67,817	1,250	1,088	10,667	18,348	7,129	880	7,690
42	Increase since drainage.....acres..	28,290	3,693		5,080	5,333	13,512	6,724	4,399	2,854
43	Per cent of increase.....	91.8	5.4		82.6	50.0	73.6	94.3	499.9	37.1
44	Per cent increase is of all improved land in farms, 1920.....	15.9	4.7		3.3	3.5	9.3	5.0	2.4	2.7
45	Timber and cut-over land, 1920.....acres..	60,690	315,725	1,250			16,460	5,188	12,319	2,636
46	Timber and cut-over land prior to drainage.....acres..	88,980	316,125	1,250	726	5,333	29,972	6,961	10,718	5,490
47	Decrease since drainage.....acres..	28,290	400		726	5,333	13,512	1,673	4,399	2,854
48	Per cent of decrease.....	31.8	0.1		100.0	100.0	45.1	24.4	26.3	52.0
49	Other unimproved land, 1920.....acres..		7,565		1,088			10,522		
50	Other unimproved land prior to drainage.....acres..		10,858		5,442			15,573		
51	Decrease since drainage.....acres..		3,293		4,354			5,051		
52	Per cent of decrease.....		30.3		80.0			32.4		
53	Swampy or subject to overflow, 1920.....acres..	63,036	144,540	1,000			5,010	5,245	1,936	
54	Swampy or subject to overflow prior to drainage.....acres..	91,170	184,233	1,000	6,168	16,000	48,320	7,951	14,078	6,040
55	Decrease since drainage.....acres..	28,134	89,693		6,168	16,000	43,310	2,706	12,142	6,040
56	Per cent of decrease.....	30.9	21.5		100.0	100.0	89.6	34.0	86.2	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
57	Total capital invested in and required for completion of operating enterprises.....dollars..	230,000	5,691,125	28,000	24,000	125,000	149,925	206,627	150,000	68,000
58	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	230,000	1,191,125	12,000	24,000	125,000	149,925	206,627	120,000	68,000
59	Additional capital required to complete these enterprises.....dollars..		4,500,000	16,000					30,000	
60	Average cost per acre when completed.....dollars..	1.92	14.42	11.20	3.31	7.81	3.10	6.99	8.52	5.16
61	Enterprises constructing open ditches only.....dollars..	230,000	666,125	28,000	24,000	125,000	149,925	206,627		68,000
62	Average cost per acre when completed.....dollars..	1.92	3.19	11.20	3.31	7.81	3.10	6.99		5.16
63	Enterprises constructing open ditches and levees.....dollars..		5,000,000							
64	Average cost per acre when completed.....dollars..		27.03							
65	Enterprises constructing tile drains only.....dollars..		25,000							
66	Average cost per acre when completed.....dollars..		19.23							
67	Enterprises constructing open ditches and tile drains.....dollars..								150,000	
68	Average cost per acre when completed.....dollars..								8.52	
69	Enterprises constructing open ditches, tile drains, and levees.....dollars..									
70	Average cost per acre when completed.....dollars..									
<b>CROPS.</b>										
71	Improved land in enterprises reporting—									
72	Cotton as principal crop on drained land.....acres..	59,110	7,285	1,250		16,000	13,860	13,853	5,279	10,544
73	Corn as principal crop on drained land.....acres..		54,275				18,000			
74	Hay as principal crop on drained land.....acres..									
74	Other crops as principal ones on drained land.....acres..		10,000		6,168					

<sup>1</sup> When works under construction have been completed.

# CALIFORNIA.

The following pages present the statistics of drainage for California collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	117, 670	100. 0
Farms reporting land having drainage.....	5, 078	4. 3
Farms reporting land needing drainage.....	3, 187	2. 7
All land in farms..... acres..	29, 365, 667	100. 0
Improved land in farms..... acres..	11, 878, 339	40. 4
Farm land reported as provided with drainage..... acres..	813, 960	2. 8
Farm land reported as needing drainage..... acres..	286, 320	1. 0
Needing drainage only..... acres..	92, 808	0. 3
Needing drainage and clearing..... acres..	193, 512	0. 7
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	99, 617, 280	100. 0
All land in operating drainage enterprises..... acres..	1, 108, 319	1. 1
Improved land..... acres..	1, 038, 835	1. 0
Per cent of all improved land in farms.....	8. 7	.....
Timber and cut-over land..... acres..	12, 263	(1)
Other unimproved land..... acres..	57, 221	0. 1
Swampy, subject to overflow, seeped, or alkali..... acres..	45, 163	(1)
Suffering a loss of crops from defective drainage..... acres..	42, 209	(1)
Improved land prior to drainage..... acres..	350, 148	0. 4
Increase since drainage began..... acres..	688, 687	0. 7
Land in nonoperating enterprises..... acres..	12, 900	(1)
Open ditches in operating enterprises..... miles..	3, 214. 2	100. 0
Completed..... miles..	3, 009. 8	93. 6
Additional under construction..... miles..	204. 4	6. 4
Tile drains in operating enterprises..... miles..	108. 6	100. 0
Completed..... miles..	85. 6	78. 8
Additional under construction..... miles..	23. 0	21. 2
Total capital invested in and required for completion of operating enterprises.....	\$54, 021, 627	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	47, 687, 153	88. 3
Additional capital required to complete these enterprises.....	6, 334, 474	11. 7
Average cost per acre when completed.....	48. 74	.....

(1) Less than one-tenth of 1 per cent.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings and let contracts for the construction work, and also districts that had just been established by order of the county supervisors and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	1,121,219	100.0	\$47,688,153	100.0	\$6,734,474
Operating enterprises.....	1,108,319	98.8	47,687,153	100.0	6,334,474
With works completed.....	652,931	58.2	30,776,550	64.5	.....
With works under construction	455,388	40.6	16,910,603	35.5	6,334,474
Nonoperating enterprises.....	12,900	1.2	1,000	(?)	400,000

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

<sup>2</sup> Less than one-tenth of 1 per cent.

Location of enterprises.—Most of the land in drainage enterprises in California lies in the valleys of the lower San Joaquin and Sacramento Rivers, within 75 miles of their confluence. There are several small tracts in drainage enterprises between this large area and the coast, a few areas in the north end of the state, and several, including some of considerable size, in the extreme southern and southeastern parts of the state.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	1,121,219	100.0	\$47,688,153	100.0	\$6,734,474
Operating enterprises.....	1,108,319	98.8	47,687,153	100.0	6,334,474
Colorado River.....	40,000	4.1	175,634	0.4	1,000,000
Sacramento River.....	641,836	57.2	34,859,856	72.7	3,206,645
San Joaquin River.....	344,282	30.7	11,524,721	24.2	1,987,829
Pacific Ocean.....	70,201	6.8	1,326,942	2.8	140,000
Nonoperating enterprises.....	12,900	1.2	1,000	(?)	400,000
Pacific Ocean.....	12,900	1.2	1,000	(?)	400,000

<sup>1</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—The drainage enterprises in California are for draining and protecting land generally swampy, subject to inundation by

stream floods and tidal overflow, and injured or threatened with seepage and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. A considerable part of the total area in enterprises is swamp land that first was protected against overflow, then was more completely drained, and later was brought also under irrigation.

In the state, 19,872 acres in drainage and reclamation districts and 223,606 acres in irrigation districts and irrigation projects of the United States Reclamation Service are reported as not having needed drainage or protection, but as having been assessed for drainage merely on account of being responsible for damage to the other land. This acreage for the irrigation districts is not included in the statistics for drainage enterprises given in this bulletin.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	1,108,319	100.0	652,931	455,388	12,900
Improved land.....	1,038,835	93.7	630,912	407,923	6,000
Timber and cut-over land.....	12,263	1.1	11,263	1,000	.....
Other unimproved land.....	57,221	5.2	10,756	46,465	6,900
Swampy, subject to overflow, seeped, or alkali.....	45,163	4.1	3,698	41,465	12,900
Suffering a loss of crops.....	42,209	3.8	4,696	37,513	.....

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 145 operating drainage enterprises are counted in California, with an average area of 7,644 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	1,108,319	1,108,319	100.0
Less than 200 acres.....	341	341	( <sup>1</sup> )
200 to 499 acres.....	1,336	1,336	0.1
500 to 999 acres.....	10,059	10,059	0.9
1,000 to 4,999 acres.....	155,747	155,747	14.1
5,000 to 9,999 acres.....	203,655	203,655	18.4
10,000 to 49,999 acres.....	672,181	672,181	60.6
50,000 to 99,999 acres.....	65,000	65,000	5.9

<sup>1</sup> Less than one-tenth of 1 per cent.

**Character of enterprises.**—The drainage enterprises in California comprise reclamation districts organized under the Political Code of the state and by special acts of the legislature, drainage districts established according to the general drainage laws and special acts, irrigation districts providing drainage for land within those districts, commercial companies developing land to be sold or leased for farming purposes, and drainage undertakings by individual landowners in tracts of more than 500 acres each. Many of the present reclamation districts have been organized merely for the maintenance of drainage and protection works that were constructed by commercial land-development companies.

The tabulations in this bulletin include statistics for only those reclamation districts and other projects that have undertaken the construction of open ditch or tile drains, in accordance with the census definition of drainage enterprises (see p. 3). In some reclamation districts, however, it is apparent that the greater part of the cost has been for the construction of the levees rather than of the drains, so a special tabulation has been made in County Table II, under the heading "Flood-protection enterprises," for those drainage enterprises in which the length of levees is equal to or greater than the length of drains.

The Sacramento and San Joaquin Drainage District was organized in 1911-1913 by special acts of the legislature, to carry into effect the plans of the California Débris Commission. It embraces lowland along Sacramento, Feather, and San Joaquin Rivers from Butte and Glenn Counties on the north to Fresno and Madera Counties on the south. It is governed by a board of reclamation of seven men appointed by the governor of the state. This board has large powers for the construction of levee and other flood-protection works, the cost to be apportioned according to benefits to the land, and approval of this board must be obtained by any other enterprise for the construction of any new plan of reclamation, drainage, or protection that will affect the land or works of the Sacramento and San Joaquin Drainage District.

Reclamation districts are established by the boards of county supervisors, in accordance with sections 3446 to 3493 of the Political Code of 1872 as amended, upon petition from the holders of title representing one-half or more of any body of swamp, marsh, or tidal land, or land subject to overflow. This part of the code was based on the statute of March 28, 1868 (ch. 415). The supervisors hold public hearing upon the petition before approving it, and may change the boundaries of the district as they find necessary in order that just the area benefited will be included. A district situated in more than one county is established by the supervisors of the county containing the greater part of the land. The officers of each

district are three trustees, elected by the landowners voting in proportion to the value of their real estate in the district. Plans for the drainage improvement works are determined by the trustees. The improvements may include drains, levees, sluices, pumping plants, and all other works necessary for the reclamation of the land in the district. The cost of the works is apportioned against the land in proportion to the benefits that will accrue, these benefits being assessed by three disinterested commissioners specially appointed by the board of county supervisors. Public hearing upon this assessment is held by the supervisors, and from their findings appeal may be taken to the superior court. Bonds to pay the cost of reclamation may be issued by the trustees if authorized by a special election of the landowners of the district. Owners of all the area included may petition for the establishment of a reclamation district to be managed by themselves without the intervention of trustees, and the owners then may be given all the powers ordinarily granted to trustees.

Many reclamation districts have been established by special acts of the legislature that defined the boundaries of each district, sometimes named the trustees of the district, and usually prescribed that the powers of the trustees and the method of procedure should be as provided in the Political Code.

Drainage districts for the improvement of agricultural land other than swamp and overflowed land may be formed under a law of March 20, 1903 (ch. 238). A petition for establishment must be signed by 50 or by a majority of the holders of title or evidence of title to the land that will be affected, and must be submitted to the board of supervisors of the county in which all or the greater portion of the land is situated. After public hearing upon the petition, the landowners vote upon the question of establishment and for three or five directors to be the officers of the district. Two-thirds of the votes must be favorable in order that the enterprise be organized. The plan of drainage improvements is determined by the directors. The cost of drainage is assessed against the real estate in the district in proportion to its assessed value; the money that will be needed is assessed by the supervisors each year according to estimates prepared by the directors. Bonds may be issued by the directors after approval by a two-thirds vote of the landowners.

Drainage districts for the improvement of wet, swamp, or overflowed land have been formed under a law of March 21, 1903 (ch. 258), which has been repealed by an act approved May 18, 1919 (ch. 354), prescribing a similar form of organization. The board of county supervisors is the executive authority of the district. Petition for establishing the drains must be made to the supervisors by 20 or more property owners (the earlier law required only 10 or more)



or by the owners of a major portion of the land in the proposed district. The county surveyor prepares the plan of drainage works and makes the assessments of damages and of benefits. The supervisors hold public hearings upon the petition for establishment and upon the surveyor's assessments; their determinations of damages and benefits are final. The cost is assessed against the land in proportion to the benefits. The supervisors let contracts for constructing the works, and after these are completed public hearing is held to determine whether the work is acceptable and the amount of bonds that shall be issued. The law of 1903 provided that the supervisors apportion the work of construction to the various landowners, the supervisors to perform the work not completed within the time that had been specified and to assess the cost against the delinquent owners. Districts in more than one county are under the jurisdiction of the supervisors of the county containing the greater portion of the district.

A number of drainage districts have been established by special acts of the legislature, defining each separate district and prescribing its mode of operation, which usually has been somewhat similar to that prescribed for reclamation districts by the Political Code of the state.

Drainage districts may be established by the board of county supervisors under a law of March 18, 1885, upon petition from the owners of two-thirds of any body of land susceptible to one mode of drainage. This law in amended form is still in effect, but no enterprises are reported as organized under it. By-laws must be adopted by the petitioners and signed by the owners of two-thirds of the acreage in the district. The officers are three trustees selected by the landowners. The costs are assessed in proportion to benefits determined by three commissioners appointed by the supervisors. Land for district uses is obtained by condemnation proceedings according to the civil code of the state.

The first drainage law of California was that of May 13, 1861, creating a state board of swamp-land commissioners to reclaim swamp, tidal, and overflowed land granted to the state by Congress in 1850, upon petition from holders of patents or certificates of purchase of such lands. The cost of reclamation was paid from the swamp-land funds, consisting of the proceeds of the sale of those lands, supplemented by contributions from individuals or by special tax levies upon the land benefited. By an act of April 2, 1866, the board of swamp-land commissioners was abolished and its powers were transferred to the

boards of county supervisors. That act was repealed March 28, 1868 (ch. 415), by a law authorizing the formation of reclamation districts much like that provided by the Political Code of 1872, which, as amended, still is the statute most generally used in the formation of drainage enterprises.

A great many amendments have been made to the drainage laws as originally enacted, but the character of the enterprises as just described is in most instances the same as was first provided. Several drainage laws have been enacted and repealed or declared unconstitutional, including one of April 23, 1880 (ch. 117), creating a state board of drainage commissioners, and one of March 3, 1881 (ch. 21), authorizing the establishment of drains by the county supervisors.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	1,121,219	100.0	\$47,688,163	100.0	\$6,734,474
Operating enterprises.....	1,108,319	98.8	47,687,153	100.0	6,334,474
Reclamation districts.....	619,837	55.3	40,477,951	84.9	3,400,645
Political Code, sect. 3446 to 3493.....	360,480	32.2	21,942,881	46.0	544,000
Special acts.....	259,357	23.1	18,535,070	38.9	2,856,645
Drainage districts.....	175,604	15.7	2,543,712	5.3	60,000
Laws of 1903, ch. 238.....	17,600	1.6	215,250	0.5	10,000
Laws of 1903, ch. 253.....	89,004	7.9	1,328,462	2.8	50,000
Laws of 1919, ch. 354.....	7,000	0.6	50,000	0.1	.....
Special acts.....	62,000	5.5	950,000	2.0	.....
U. S. Reclamation Service.....	8,000	0.7	146,000	0.3	.....
Irrigation districts.....	167,200	14.0	786,325	1.6	2,543,829
Commercial developments.....	17,635	1.6	854,300	1.8	.....
Individual ownership.....	180,043	11.6	2,878,865	6.0	330,000
Nonoperating enterprises.....	12,900	1.2	1,000	( <sup>1</sup> )	400,000
Drainage districts—Laws of 1906, ch. 233.....	12,900	1.2	1,000	( <sup>1</sup> )	400,000

<sup>1</sup> Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 3,009.8 miles of open ditches, 85.6 miles of tile drains, and 1,131.1 miles of levees; the additional lengths under construction were 204.4 miles of open ditches, 23.0 miles of tile drains, and 120.4 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are 96 pumping districts among the operating enterprises, equipped with 191 centrifugal pumps and 1 water wheel.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	1,108,319	100.0	\$47,687,153	100.0	\$6,334,474
Open ditches only.....	130,659	11.8	1,240,730	2.6	2,188,645
Open ditches and levees.....	713,421	64.4	39,752,693	83.4	2,304,000
Tile drains only.....	1,194	0.1	60,000	0.1	—
Open ditches and tile drains.....	154,100	13.9	1,376,691	2.9	1,613,829
Open ditches, tile drains, and levees.....	108,945	9.8	5,257,039	11.0	250,000

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	1,108,319	100.0	\$47,687,153	100.0	\$6,334,474
Gravity drainage only.....	400,989	36.2	5,060,751	10.6	3,718,645
All drainage by pumping.....	300,422	27.1	20,303,606	42.6	994,000
Part gravity and part pumping..	406,908	36.7	22,322,796	46.8	1,623,829
Total area served by pumps.....	604,446	51.2	—	—	—

TABLE 9.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horse-power.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises...	28,526	100.0	4,699,042	100.0	604,446	100.0
Steam.....	161	0.6	33,000	0.7	7,840	1.3
Electric.....	23,547	82.5	3,790,690	80.7	490,152	81.1
Internal-combustion.....	793	2.8	121,852	2.6	45,937	7.6
Steam and electric.....	1,315	11.0	564,000	12.0	45,200	7.5
Electric and internal-combustion.....	890	3.1	189,500	4.0	14,723	2.4
Water wheel.....	—	—	—	—	594	0.1

<sup>1</sup> Includes 1,000 steam, 580 electric, and 1,555 not divided.  
<sup>2</sup> Includes 230 electric, 245 internal-combustion, and 415 not divided.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths of less than 3 feet and those of 10 feet and more were omitted, as they seemed not to represent so well the average depths of outlet provided for all the farms in the districts. To include both of these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 5.2 instead of 4.5 feet.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	1,108,319	100.0
Less than 3 feet.....	3,110	0.3
3.0 to 3.9 feet.....	181,551	16.4
4.0 to 4.9 feet.....	337,482	30.4
5.0 to 5.9 feet.....	151,428	13.7
6.0 to 6.9 feet.....	51,247	4.6
7.0 to 7.9 feet.....	5,600	0.5
8.0 to 8.9 feet.....	61,925	5.6
9.0 to 9.9 feet.....	10,600	1.0
10 feet and more.....	121,500	11.0
Not reporting branches.....	183,876	16.6

Maintenance of works.—The trustees of each reclamation district are empowered to keep the drainage works of the district in repair. Assessments for maintenance work are made in accordance with estimates prepared by the trustees, apportioned according to the original assessment of benefits or, by an amendment approved May 26, 1917 (ch. 671), according to assessment valuations made after completion of construction. The directors of drainage districts organized under the law of 1903 (ch. 238) are required each year to make an estimate of the money that will be required for maintenance purposes, and the amount is assessed against the land according to assessed value. Drainage districts organized under the law of 1919 (ch. 354) are required to be maintained by the boards of county supervisors, who are required to levy each year an ad valorem tax upon the real estate in each district, sufficient to raise the revenue that will be needed to keep the district works in repair. The law which this law superseded (ch. 258 of 1903) required that the landowners keep the works in repair.

DRAINAGE—CALIFORNIA.

TABLE 11.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	1,108,319	100.0	\$47,687,153	100.0	\$6,334,474
By district forces.....	741,012	66.9	33,113,046	69.4	3,547,829
By contract.....	213,028	19.2	10,504,961	22.0	2,376,645
By method not specified.....	19,857	1.8	891,000	1.9	40,000
By landowners.....	14,384	1.3	1,216,271	2.6	60,000
Individual ownerships.....	52,920	4.8	1,014,015	2.1	
No maintenance provided.....	63,796	5.8	797,860	1.7	320,000
Not reported.....	3,294	0.3	150,000	0.3	

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county supervisors, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 12.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	1,108,319	100.0	1,108,319	100.0
1860 to 1869.....	13,200	1.2	13,200	1.2
1870 to 1879.....	26,100	2.4	26,100	2.4
1880 to 1889.....	76,737	6.9	76,737	6.9
1890 to 1899.....	71,699	6.5	71,699	6.5
1900 to 1904.....	33,695	3.0	33,695	3.0
1905 to 1909.....	249,965	22.6	249,965	22.6
1910 to 1914.....	412,351	37.2	412,351	37.2
1915 to 1919.....	153,763	13.9	153,763	13.9
Not reported.....	70,809	6.4	70,809	6.4

TABLE 13.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$47,687,153	100.0	\$6,334,474
1860 to 1869.....	350,000	0.7	
1870 to 1879.....	2,500,000	5.2	
1880 to 1889.....	2,329,106	4.9	1,033,829
1890 to 1899.....	4,240,215	8.9	70,000
1900 to 1904.....	1,585,078	3.3	68,000
1905 to 1909.....	6,247,723	13.1	1,330,000
1910 to 1914.....	20,734,896	43.5	1,020,000
1915 to 1919.....	7,687,320	16.1	2,592,645
Not reported.....	2,012,816	4.2	200,000

TABLE 14.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1860 to 1869.....	13.0	0.4			21.0	1.7
1870 to 1879.....	39.7	1.2			52.0	4.2
1880 to 1889.....	128.5	4.0	7.1	6.5	39.5	3.2
1890 to 1899.....	230.5	7.2	2.0	1.8	108.2	8.6
1900 to 1904.....	223.9	7.0			79.6	6.4
1905 to 1909.....	618.6	19.2	18.6	17.1	237.6	19.0
1910 to 1914.....	1,244.7	38.7	7.6	7.0	422.8	33.8
1915 to 1919.....	512.0	15.9	67.3	62.0	130.5	10.4
Not reported.....	203.3	6.3	6.0	5.5	160.3	12.8

Crops.—The principal crops grown upon the drained land in drainage enterprises were reported as small grains, potatoes, alfalfa, and corn. Statistics were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—CALIFORNIA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Alameda.	Butte.	Colusa.	Contra Costa.	Del Norte.	Fresno.	Glenn.	Humboldt.
1	Number of all farms in the state or county.....	117,670	2,778	2,219	816	1,675	130	8,917	1,320	1,758
2	Farms reporting land having drainage.....	5,078	30	280	182	78	24	326	88	193
3	Farms reporting land needing drainage.....	3,187	26	24	63	4	44	79	28	139
4	Farms in drainage and levee districts.....	3,203	15	178	128	72	4	309	81	20
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county..... acres..	99,617,280	488,480	1,088,720	729,600	456,960	655,360	3,808,000	855,680	2,288,000
6	All land in farms..... acres..	29,365,667	359,742	464,625	438,417	375,065	43,830	1,319,531	524,407	717,174
7	Improved land in farms..... acres..	11,878,339	183,324	253,745	302,429	238,369	13,252	672,591	336,483	98,064
8	Woodland in farms..... acres..	4,252,287	21,200	70,816	30,132	31,265	19,207	107,456	36,461	223,857
9	Other unimproved land in farms..... acres..	13,235,041	153,218	140,065	105,856	105,431	11,371	539,484	151,464	383,253
10	Farm land reported as provided with drainage..... acres..	813,960	3,019	18,266	59,876	18,915	758	64,297	19,770	5,082
11	Farm land reported as needing drainage..... acres..	286,320	3,126	3,312	9,928	340	3,060	688	2,774	7,582
12	Drainage only..... acres..	92,898	538	2,547	3,407	180	811	534	947	811
13	Drainage and clearing..... acres..	193,512	2,588	765	6,521	160	2,749	154	1,827	6,761

		Imperial.	Inyo.	Kern.	Kings.	Lake.	Lassen.	Los Angeles.	Marin.	Mendocino.
1	Number of all farms in the county.....	2,843	521	2,020	2,171	771	606	12,444	718	1,789
2	Farms reporting land having drainage.....	465	15	85	26	50	31	91	21	91
3	Farms reporting land needing drainage.....	63	28	46	51	172	43	85	26	233
4	Farms in drainage and levee districts.....	440	1	23	27	18	10	32	7	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	2,616,980	6,394,240	5,121,920	741,760	792,320	2,899,840	2,633,600	338,560	2,264,060
6	All land in farms..... acres..	347,485	140,029	1,497,045	595,553	241,899	741,220	882,333	290,148	923,087
7	Improved land in farms..... acres..	310,708	39,904	390,932	259,639	45,355	140,887	483,096	87,846	101,230
8	Woodland in farms..... acres..	1,865	20,158	45,877	5,870	64,781	233,724	32,078	58,876	261,196
9	Other unimproved land in farms..... acres..	85,412	79,967	1,060,236	240,044	141,763	366,609	367,167	143,426	560,671
10	Farm land reported as provided with drainage..... acres..	96,801	701	17,605	17,968	1,783	9,962	5,087	7,517	2,342
11	Farm land reported as needing drainage..... acres..	2,597	3,299	8,057	2,448	8,254	10,043	5,072	2,893	14,157
12	Drainage only..... acres..	1,169	1,976	1,585	1,641	904	5,245	1,318	2,798	1,857
13	Drainage and clearing..... acres..	1,428	1,323	1,492	807	7,350	4,798	3,754	102	12,309

		Merced.	Modoc.	Monterey.	Napa.	Orange.	Plumas.	Riverside.	Sacramento.	San Benito.
1	Number of all farms in the county.....	2,846	743	1,712	1,428	4,188	150	3,949	2,975	945
2	Farms reporting land having drainage.....	106	27	31	53	182	14	46	479	4
3	Farms reporting land needing drainage.....	118	50	32	42	41	20	63	38	2
4	Farms in drainage and levee districts.....	81	6	6	11	132	.....	21	424	.....
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	1,276,800	2,448,720	2,131,200	591,120	508,800	1,659,520	4,622,720	629,120	890,880
6	All land in farms..... acres..	1,122,650	596,757	1,104,048	293,925	325,703	101,653	678,293	555,503	539,378
7	Improved land in farms..... acres..	506,582	169,251	398,320	116,723	200,945	34,223	348,538	399,024	122,606
8	Woodland in farms..... acres..	38,873	129,519	201,891	40,321	2,453	14,864	26,027	63,155	13,577
9	Other unimproved land in farms..... acres..	577,095	298,687	508,837	136,881	122,305	52,566	301,728	93,244	403,195
10	Farm land reported as provided with drainage..... acres..	32,003	6,983	1,237	2,100	14,240	1,138	1,884	92,053	1,025
11	Farm land reported as needing drainage..... acres..	43,101	6,691	1,610	3,242	1,996	1,613	3,493	4,328	73
12	Drainage only..... acres..	24,664	1,345	577	1,069	1,382	1,348	1,118	2,984	70
13	Drainage and clearing..... acres..	18,437	5,346	1,033	2,173	604	265	2,375	1,344	3

		San Bernardino.	San Diego.	San Joaquin.	San Mateo.	Santa Barbara.	Santa Clara.	Santa Cruz.	Shasta.	Sierra.
1	Number of all farms in the county.....	4,023	3,200	4,500	624	1,485	5,016	1,789	949	77
2	Farms reporting land having drainage.....	101	26	352	11	29	200	62	22	2
3	Farms reporting land needing drainage.....	57	66	23	11	30	82	52	76	6
4	Farms in drainage and levee districts.....	55	3	275	2	21	14	3	9	.....
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	12,912,000	2,701,440	928,720	238,080	1,753,600	849,920	278,400	2,469,120	590,720
6	All land in farms..... acres..	415,738	925,192	706,308	117,109	869,781	576,812	144,751	565,235	60,667
7	Improved land in farms..... acres..	175,272	282,646	599,403	77,736	210,353	208,890	67,838	103,470	21,607
8	Woodland in farms..... acres..	35,843	60,320	18,471	10,291	88,244	70,668	46,618	276,284	14,152
9	Other unimproved land in farms..... acres..	204,623	602,226	88,434	29,082	571,184	299,254	20,295	185,481	24,908
10	Farm land reported as provided with drainage..... acres..	3,880	1,448	117,262	1,242	865	3,453	1,007	13,299	740
11	Farm land reported as needing drainage..... acres..	3,917	11,836	2,039	959	2,496	3,164	4,978	6,157	201
12	Drainage only..... acres..	1,143	1,168	734	261	1,007	1,417	619	348	20
13	Drainage and clearing..... acres..	2,774	10,718	1,305	698	1,479	1,747	4,359	5,809	181

		Stakiyon.	Solano.	Sonoma.	Stanislaus.	Sutter.	Tehama.	Trinity.	Ventura.	Yolo.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,052	1,358	5,739	4,566	1,437	1,414	377	1,543	1,613	14,538
2	Farms reporting land having drainage.....	17	56	110	236	330	3	31	47	128	270
3	Farms reporting land needing drainage.....	88	19	108	128	115	13	67	31	20	653
4	Farms in drainage and levee districts.....	7	47	23	223	335	.....	5	24	112	32
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	4,003,840	526,080	1,012,480	928,000	389,120	1,872,000	1,981,440	1,189,120	648,960	15,478,400
6	All land in farms..... acres..	537,396	408,298	748,147	748,678	288,940	1,124,502	130,290	384,885	398,165	5,087,403
7	Improved land in farms..... acres..	166,621	269,264	251,730	477,871	232,070	232,722	15,078	189,924	300,094	1,732,695
8	Woodland in farms..... acres..	71,912	17,142	204,763	98,320	9,367	324,240	40,246	15,049	28,805	1,033,262
9	Other unimproved land in farms..... acres..	298,863	91,882	291,654	172,487	47,508	567,540	74,966	179,892	68,266	2,321,446
10	Farm land reported as provided with drainage..... acres..	927	32,301	6,555	18,387	69,514	1,718	820	2,920	28,246	2,480
11	Farm land reported as needing drainage..... acres..	2,490	3,871	12,917	7,956	9,999	1,310	3,553	2,603	7,577	49,495
12	Drainage only..... acres..	1,706	3,488	369	3,011	4,556	280	84	1,330	7,393	1,581
13	Drainage and clearing..... acres..	784	883	12,548	4,945	5,443	1,030	3,469	1,273	184	47,914

<sup>1</sup> Drainage on farms was reported in all counties in California.

DRAINAGE—CALIFORNIA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Butte.	Colusa.	Contra Costa.	Fresno.	Imperial.	Merced.	
<b>LAND AREA.</b>								
1	Approximate land area of the state or county.....acres	99,617,280	1,086,720	729,600	456,960	3,808,000	2,616,960	1,276,800
2	All land in operating drainage enterprises.....acres	1,108,319	29,175	60,200	40,236	16,979	8,000	24,247
3	Improved land.....acres	1,038,836	29,175	60,200	40,036	15,994	8,000	24,207
4	Per cent of all improved land in farms.....	8.7	11.5	19.9	16.8	2.4	2.6	4.8
5	Timber and cut-over land.....acres	12,263						
6	Other unimproved land.....acres	57,221			200	985		40
7	Swampy, subject to overflow, seeped, or alkali in enterprises.....acres	45,163				985	900	40
8	Suffering a loss of crops from defective drainage.....acres	42,209			463	15	900	4,600
9	Assessed acreage.....acres	1,108,319	29,175	60,200	40,236	16,979	8,000	24,247
10	Excess over all land in operating enterprises.....acres							
<b>DRAINAGE WORKS.</b>								
Open ditches:								
11	Completed.....miles	3,009.8	115.0	27.8	253.9	33.0	11.7	47.8
12	Additional under construction.....miles	204.4						9.4
13	Maximum completed in any enterprise.....miles	324.0	70.0	19.5	68.5	20.0	11.7	29.8
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	400	30	400	35	24	12	12
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	20.0	8.0	20.0	10.0	9.0	5.0	10.0
16	Mean depth of branch ditches <sup>1</sup> .....feet	4.5	4.2		4.1		5.0	4.0
Tile drains:								
17	Completed.....miles	85.6	0.4			3.7	4.0	
18	Additional under construction.....miles	23.0						0.1
19	Maximum completed in any enterprise.....miles	47.0	0.4			2.0	4.0	0.1
20	Maximum size of tile <sup>1</sup> .....inches	36	12			36	20	36
Accessory levees and dikes:								
21	Completed.....miles	1,131.1	2.5	22.3	125.0	12.0	17.0	
22	Additional under construction.....miles	120.4		2.4	1.5			
Pumping plants:								
23	Engine capacity.....horsepower	28,526		60	1,800	(5)	120	21
24	Pump capacity.....gallons per minute	4,699,042		10,000	391,000	(5)	17,952	1,750
25	Area served by pumps.....acres	604,443		23,000	39,286	594	8,000	700
26	Area drained by open ditches only <sup>1</sup> .....acres	130,659	17,000			6,625		9,247
27	Length of these ditches.....miles	343.0	70.0			9.5		44.7
28	Average length per acre.....feet	14.7	21.7			7.6		25.5
29	Area having open ditches and levees <sup>1</sup> .....acres	713,421	6,175	60,200	40,236			
30	Length of these ditches.....miles	2,301.7	20.0	27.8	253.9			
31	Average length per acre.....feet	17.0	17.1	2.4	33.3			
32	Length of the accessory levees.....miles	1,127.0	2.5	24.7	126.5			
33	Area drained by open ditches and tile <sup>1</sup> .....acres	*155,294	6,000			1,894		15,000
34	Length of these drains.....miles	312.6	25.4			7.0		12.6
35	Average length per acre.....feet	10.6	22.4			19.5		4.4
36	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres	108,945				8,460	8,000	
37	Length of these drains.....miles	345.5				20.2	15.7	
38	Average length per acre.....feet	16.7				12.6	10.4	
39	Length of the accessory levees.....miles	124.6				12.0	17.0	
<b>DEVELOPMENT OF LAND.</b>								
40	Improved land in operating enterprises, 1920.....acres	1,038,836	29,175	60,200	40,036	15,994	8,000	24,207
41	Improved land prior to drainage.....acres	350,148	29,175	5,000	3,500	7,492	8,000	8,462
42	Increase since drainage.....acres	688,688		55,200	36,536	8,502		15,755
43	Per cent of increase <sup>4</sup> .....	196.7				113.5		186.4
44	Per cent increase is of all improved land in farms, 1920.....	5.8		18.3	15.3	1.3		3.1
45	Timber and cut-over land, 1920.....acres	12,263						
46	Timber and cut-over land prior to drainage.....acres	42,047						
47	Decrease since drainage.....acres	29,784						
48	Per cent of decrease.....	70.8						
49	Other unimproved land, 1920.....acres	57,221			200	985		40
50	Other unimproved land prior to drainage.....acres	716,124		55,200	36,736	9,487		15,795
51	Decrease since drainage.....acres	658,903		55,200	36,536	8,502		15,755
52	Per cent of decrease.....	92.0		100.0	99.5	89.6		99.7
53	Swampy or subject to overflow, 1920.....acres	45,163				985	900	40
54	Swampy or subject to overflow prior to drainage.....acres	822,326	946	60,200	40,236	10,137	900	4,795
55	Decrease since drainage.....acres	777,163	946	60,200	40,236	9,152		4,755
56	Per cent of decrease.....	94.5	100.0	100.0	100.0	90.3		99.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
57	Total capital invested in and required for completion of operating enterprises.....dollars	54,021,627	355,000	2,077,000	3,528,272	254,000	146,000	652,548
58	Capital invested in these enterprises to Dec. 31, 1919.....dollars	47,687,153	355,000	1,927,000	3,486,272	254,000	146,000	389,091
59	Additional capital required to complete these enterprises.....dollars	6,334,474		150,000	42,000			263,457
60	Average cost per acre when completed.....dollars	48.74	12.17	34.50	87.69	14.96	18.25	26.91
61	Enterprises constructing open ditches only.....dollars	3,407,375	180,000			49,000		301,272
62	Average cost per acre when completed.....dollars	26.08	10.59			7.40		32.58
63	Enterprises constructing open ditches and levees.....dollars	42,056,693	100,000	2,077,000	3,528,272			
64	Average cost per acre when completed.....dollars	58.95	16.19	34.50	87.69			
65	Enterprises constructing open ditches and tile drains.....dollars	*3,050,520	75,000			32,000		351,276
66	Average cost per acre when completed.....dollars	16.64	12.50			16.90		23.42
67	Enterprises constructing open ditches, tile drains, and levees.....dollars	3,507,039				173,000	146,000	
68	Average cost per acre when completed.....dollars	50.55				20.45	18.25	
<b>CROPS.</b>								
Improved land in enterprises reporting—								
69	Small grains as principal crop on drained land.....acres	436,635		23,000	7,460			15,000
70	Alfalfa as principal crop on drained land.....acres	97,259	6,000			14,100		
71	White potatoes as principal crop on drained land.....acres	97,461			28,036			
72	Corn as principal crop on drained land.....acres	96,589		37,200	1,000			
73	Vegetables as principal crop on drained land.....acres	80,288			3,500			8,547
74	Hay (except alfalfa) as principal crop on drained land.....acres	28,875						
75	Sugar beets as principal crop on drained land.....acres	14,825						
76	Rice as principal crop on drained land.....acres	77,037		17,000				
77	Fruit as principal crop on drained land.....acres	38,173		6,175				660
78	Cotton as principal crop on drained land.....acres	42,200					8,000	
79	Beans as principal crop on drained land.....acres	27,197						
80	Other crops as principal ones on drained land.....acres	2,096				1,894		
<b>FLOOD-PROTECTION ENTERPRISES.<sup>5</sup></b>								
81	Land in operating enterprises.....acres	298,495		42,200	20,750			
Open ditches:								
82	Completed.....miles	1,309.9		8.3	27.5			
83	Additional under construction.....miles	11.7						
Accessory levees and dikes:								
84	Completed.....miles	487.6		21.0	63.0			
85	Additional under construction.....miles	43.8						
86	Total capital invested in and required for completion of operating enterprises.....dollars	13,320,563		577,000	1,545,000			
87	Capital invested in these enterprises to Dec. 31, 1919.....dollars	12,260,563		577,000	1,545,000			
88	Additional capital required to complete these enterprises.....dollars	1,060,000						

<sup>1</sup> When works under construction have been completed.  
<sup>2</sup> Drainage by water wheel.  
<sup>3</sup> Includes 1,194 acres having tile only.

<sup>4</sup> Per cent not shown when more than 1,000.  
<sup>5</sup> Includes cost of 5.1 miles of tile only.

DRAINAGE—CALIFORNIA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Monterey.	Orange.	Riverside.	Sacramento.	San Joaquin.	Shasta.
<b>LAND AREA.</b>							
1	Approximate land area of the county.....	2,131,200	508,800	4,622,720	629,120	928,720	2,480,120
2	All land in operating drainage enterprises.....	4,700	35,600	50,600	104,779	164,410	19,000
3	Improved land.....	4,700	35,600	42,000	104,591	164,350	18,200
4	Per cent of all improved land in farms.....	1.2	17.4	12.1	26.2	27.4	15.7
5	Timber and cut-over land.....				80		
6	Other unimproved land.....		600	8,600	108	60	2,800
7	Swampy, subject to overflow, seeped, or alkali in enterprises.....				108		2,800
8	Suffering a loss of crops from defective drainage.....	4,230		1,080	1,655	3,835	1,400
9	Assessed acreage.....	4,700	35,600	50,600	104,779	164,410	19,000
10	Excess over all land in operating enterprises.....						
<b>DRAINAGE WORKS.</b>							
<b>Open ditches:</b>							
11	Completed.....	29.4	95.8	26.1	250.0	905.1	21.0
12	Additional under construction.....	12.6	38.5	11.7		21.8	4.5
13	Maximum completed in any enterprise.....	29.4	40.0	25.0	88.0	78.0	18.0
14	Maximum width at bottom of ditch <sup>1</sup> .....	20	30	12	100	26	40
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	5.0	14.0	15.0	16.0	16.0	20.0
16	Mean depth of branch ditches <sup>1</sup> .....	3.0	5.1	8.0	4.9	4.5	3.8
<b>Tile drains:</b>							
17	Completed.....		10.3	1.5	1.6		
18	Additional under construction.....			1.6		1.5	
19	Maximum completed in any enterprise.....		6.0	1.6	1.0		
20	Maximum size of tile <sup>1</sup> .....		24	24	16		
<b>Accessory levees and dikes:</b>							
21	Completed.....		2.0	20.0	168.1	306.4	34.8
22	Additional under construction.....			25.0	2.8	22.5	13.2
<b>Pumping plants:</b>							
23	Engine capacity.....				5,740	4,930	
24	Pump capacity.....				857,600	1,013,600	
25	Area served by pumps.....				96,348	126,281	
26	Area drained by open ditches only <sup>1</sup> .....	4,700	11,000	4,290	467	4,280	5,000
27	Length of these ditches.....	42.0	39.0	2.0	2.0	17.0	7.5
28	Average length per acre.....	47.2	18.7		22.6	21.0	7.9
29	Area having open ditches and levees <sup>1</sup> .....			50,000	87,504	130,130	14,000
30	Length of these ditches.....			37.8	157.0	849.9	18.0
31	Average length per acre.....			4.0	12.3	34.5	6.8
32	Length of the accessory levees.....			45.0	147.4	328.9	48.0
33	Area drained by open ditches and tile <sup>1</sup> .....		16,600	600		30,000	
34	Length of these drains.....		83.1	3.1		61.5	
35	Average length per acre.....		20.1	27.3		10.8	
36	Area having open ditches, tile drains, and levees <sup>1</sup> .....		8,000		36,808		
37	Length of these drains.....		42.5		92.6		
38	Average length per acre.....		28.1		13.3		
39	Length of the accessory levees.....		2.0		23.5		
<b>DEVELOPMENT OF LAND.</b>							
40	Improved land in operating enterprises, 1920.....	4,700	35,600	42,000	104,591	164,350	18,200
41	Improved land prior to drainage.....		21,800	41,600	15,783	18,216	
42	Increase since drainage.....	4,700	13,200	500	88,808	146,134	16,200
43	Per cent of increase.....		60.6	1.2	562.7	802.2	
44	Per cent increase is of all improved land in farms, 1920.....	1.2	6.6	0.1	22.3	24.4	15.7
45	Timber and cut-over land, 1920.....				80		
46	Timber and cut-over land prior to drainage.....				1,599	180	
47	Decrease since drainage.....				1,519	180	
48	Per cent of decrease.....				95.0	100.0	
49	Other unimproved land, 1920.....		600	8,600	108	60	2,800
50	Other unimproved land prior to drainage.....	4,700	13,800	9,100	87,397	146,014	19,000
51	Decrease since drainage.....	4,700	13,200	500	87,289	145,954	18,200
52	Per cent of decrease.....	100.0	95.7	5.5	99.9	100.0	85.3
53	Swampy or subject to overflow, 1920.....				108		2,800
54	Swampy or subject to overflow prior to drainage.....	4,700	16,700	18,400	101,720	162,704	19,000
55	Decrease since drainage.....	4,700	16,700	18,400	101,612	162,704	18,200
56	Per cent of decrease.....	100.0	100.0	100.0	99.9	100.0	85.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>							
57	Total capital invested in and required for completion of operating enterprises.....	190,000	295,000	1,149,384	8,452,309	8,161,563	540,600
58	Capital invested in these enterprises to Dec. 31, 1919.....	140,000	295,000	149,384	8,402,309	7,659,563	510,600
59	Additional capital required to complete these enterprises.....	50,000		1,000,000	50,000	502,000	30,000
60	Average cost per acre when completed.....	40.43	8.29	22.72	80.67	49.64	28.45
61	Enterprises constructing open ditches only.....	190,000	40,000		5,000	207,520	40,600
62	Average cost per acre when completed.....	40.43	3.64		10.71	48.49	8.12
63	Enterprises constructing open ditches and levees.....			1,114,384	6,421,218	7,468,628	500,000
64	Average cost per acre when completed.....			22.29	95.12	57.39	35.71
65	Enterprises constructing open ditches and tile drains.....		140,000	35,000		485,415	
66	Average cost per acre when completed.....		8.43	58.33		16.18	
67	Enterprises constructing open ditches, tile drains, and levees.....		115,000		2,026,091		
68	Average cost per acre when completed.....		14.38		55.04		
<b>CROPS.</b>							
69	Improved land in enterprises reporting—						
70	Small grains as principal crop on drained land.....			7,200	53,400	66,212	
71	Alfalfa as principal crop on drained land.....		5,400		11,530	8,590	
72	White potatoes as principal crop on drained land.....	4,700				63,775	
73	Corn as principal crop on drained land.....					21,550	
74	Vegetables as principal crop on drained land.....		18,600		18,940	3,323	
75	Hay (except alfalfa) as principal crop on drained land.....				461		16,200
76	Sugar beets as principal crop on drained land.....		11,000			900	
77	Rice as principal crop on drained land.....						
78	Fruit as principal crop on drained land.....			600	7,063		
79	Cotton as principal crop on drained land.....			34,200			
80	Beans as principal crop on drained land.....				13,197		
80	Other crops as principal ones on drained land.....						
<b>FLOOD-PROTECTION ENTERPRISES.*</b>							
81	Land in operating enterprises.....			38,000	38,681	28,670	14,000
<b>Open ditches:</b>							
82	Completed.....			1.1	67.2	45.0	18.0
83	Additional under construction.....			11.7			
<b>Accessory levees and dikes:</b>							
84	Completed.....				100.2	86.7	34.8
85	Additional under construction.....			25.0	2.8		13.2
86	Total capital invested in and required for completion of operating enterprises.....			1,026,634	3,994,988	1,028,000	500,000
87	Capital invested in these enterprises to Dec. 31, 1919.....			29,634	3,944,988	1,028,000	500,000
88	Additional capital required to complete these enterprises.....			1,000,000	50,000		

\* These are enterprises in which the total length of levees, completed and under construction, is equal to or greater than the total length of drains (open ditches and tile); the statistics for the enterprises are included in the figures for drainage enterprises, given above. <sup>1</sup> Includes 0.5 mile of tile drains.

DRAINAGE—CALIFORNIA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Solano.	Sonoma.	Stanislaus.	Sutter.	Yolo.	Yuba.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>								
1	Approximate land area of the county..... acres	526,080	1,012,480	928,000	389,120	648,960	404,480	31,873,280
2	All land in operating drainage enterprises..... acres	43,745	4,000	65,000	180,283	188,630	25,375	70,860
3	Improved land..... acres	43,490	4,000	64,000	173,561	186,630	25,375	47,326
4	Per cent of all improved land in farms.....	14.5	1.6	13.4	74.8	45.5	25.6	2.0
5	Timber and cut-over land..... acres				3,999	1,000	7,000	184
6	Other unimproved land..... acres	255		1,000	2,723	16,125	875	23,350
7	Swampy, subject to overflow, seeped, or alkali in enterprises..... acres	205			1,125	16,125	875	22,500
8	Suffering a loss of crops from defective drainage..... acres	355	1,000	5,511		1,075		16,080
9	Assessed acreage.....	43,745	4,000	65,000	180,283	188,630	25,375	70,860
10	Excess over all land in operating enterprises..... acres							
<b>DRAINAGE WORKS.</b>								
<b>Open ditches:</b>								
11	Completed..... miles	183.3	6.6	38.1	521.1	275.5	36.5	131.6
12	Additional under construction..... miles	1.2	2.4	29.4	24.7	8.2		39.0
13	Maximum completed in any enterprise..... miles	100.0	6.6	28.0	324.0	53.6	30.0	37.5
14	Maximum width at bottom of ditch <sup>2</sup> ..... feet	150	18	12	110	150	15	70
15	Maximum of average depths of outlet ditches <sup>2</sup> ..... feet	10.0	5.0	10.0	12.0	20.0	18.0	15.0
16	Mean depth of branch ditches <sup>2</sup> ..... feet	4.0	4.0	6.0	3.7	4.7	3.0	4.2
<b>Tile drains:</b>								
17	Completed..... miles	47.1			1.5	0.4		15.1
18	Additional under construction..... miles			17.0				2.8
19	Maximum completed in any enterprise..... miles	47.0			1.0	0.2		11.4
20	Maximum size of tile <sup>2</sup> ..... inches	10			24	36		36
<b>Accessory levees and dikes:</b>								
21	Completed..... miles	72.5			152.7	101.5	43.9	50.4
22	Additional under construction..... miles	6.1			16.2	27.9		2.8
<b>Pumping plants:</b>								
23	Engine capacity..... horsepower	2,025		17	7,708	5,175	450	480
24	Pump capacity..... gallons per minute	311,100		3,000	1,003,540	888,500	60,000	142,000
25	Area served by pumps..... acres	39,908		600	126,085	108,948	15,000	9,700
26	Area drained by open ditches only <sup>3</sup> ..... acres	7,500	4,000		14,000			46,840
27	Length of these ditches..... miles	8.0	10.0		25.0			88.2
28	Average length per acre..... feet	5.6	13.2		9.4			10.0
29	Area having open ditches and levees <sup>3</sup> ..... acres	29,238			133,134	183,334	32,750	16,820
30	Length of these ditches..... miles	153.5			450.8	226.7	36.5	69.8
31	Average length per acre..... feet	27.7			17.9	9.0	5.9	21.9
32	Length of the accessory levees..... miles	63.3			148.9	103.7	43.9	44.2
33	Area drained by open ditches and tile <sup>3</sup> ..... acres			65,000	15,000			5,200
34	Length of these drains..... miles			84.5	27.0			28.4
35	Average length per acre..... feet			6.9	9.5			28.8
36	Area having open ditches, tile drains, and levees <sup>3</sup> ..... acres	7,007			18,149	20,521		2,000
37	Length of these drains..... miles	70.6			44.5	57.4		2.0
38	Average length per acre..... feet	53.2			12.9	14.8		5.3
39	Length of the accessory levees..... miles	15.3			20.0	25.7		9.0
<b>DEVELOPMENT OF LAND.</b>								
40	Improved land in operating enterprises, 1920..... acres	43,490	4,000	64,000	173,561	186,630	25,375	47,326
41	Improved land prior to drainage..... acres	12,039	3,000	63,000	72,293	10,107	24,938	5,853
42	Increase since drainage..... acres	31,451	1,000	1,000	101,268	126,523	437	41,473
43	Per cent of increase <sup>4</sup> .....	261.2	33.3	1.6	140.1		1.8	708.6
44	Per cent increase is of all improved land in farms, 1920.....	10.5	0.4	0.2	43.6	42.2	0.4	1.7
45	Timber and cut-over land, 1920..... acres				3,999	1,000	7,000	184
46	Timber and cut-over land prior to drainage..... acres				22,509	10,300	7,000	459
47	Decrease since drainage..... acres				18,510	9,300		275
48	Per cent of decrease.....				82.2	90.3		59.9
49	Other unimproved land, 1920..... acres	255		1,000	2,723	16,125	875	23,350
50	Other unimproved land prior to drainage..... acres	31,706	1,000	2,000	85,481	133,348	812	64,548
51	Decrease since drainage..... acres	31,451	1,000	1,000	82,758	117,223	437	41,198
52	Per cent of decrease.....	99.2	100.0	50.0	96.8	87.9	53.8	63.8
53	Swampy or subject to overflow, 1920..... acres	205			1,125	16,125	375	22,500
54	Swampy or subject to overflow prior to drainage..... acres	43,745	1,000	4,000	112,177	134,348	20,812	67,806
55	Decrease since drainage..... acres	43,540	1,000	4,000	111,052	118,223	20,437	45,306
56	Per cent of decrease.....	99.5	100.0	100.0	99.0	88.0	98.2	66.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
57	Total capital invested in and required for completion of operating enterprises..... dollars	1,421,992	30,000	1,413,829	13,331,045	9,526,469	1,037,500	1,459,116
58	Capital invested in these enterprises to Dec. 31, 1919..... dollars	1,339,492	20,000	433,457	10,974,400	6,988,969	1,037,500	1,179,116
59	Additional capital required to complete these enterprises..... dollars	82,500	10,000	980,372	2,356,645	537,500		280,000
60	Average cost per acre when completed..... dollars	32.51	7.50	21.75	73.95	61.96	31.63	20.59
61	Enterprises constructing open ditches only..... dollars	50,000	30,000		1,876,645			437,338
62	Average cost per acre when completed..... dollars	6.67	7.50		134.05			9.34
63	Enterprises constructing open ditches and levees..... dollars	864,742			10,415,144	8,062,719	1,037,500	447,086
64	Average cost per acre when completed..... dollars	30.26			78.23	60.62	31.63	26.58
65	Enterprises constructing open ditches and tile drains..... dollars			1,413,829	75,000			443,000
66	Average cost per acre when completed..... dollars			21.75	5.00			85.19
67	Enterprises constructing open ditches, tile drains, and levees..... dollars	487,250			964,256	1,463,750		131,692
68	Average cost per acre when completed..... dollars	69.54			53.13	71.33		65.85
<b>CROPS.</b>								
<b>Improved land in enterprises reporting—</b>								
69	Small grains as principal crop on drained land..... acres	24,355		45,000	131,724	88,182	10,500	14,812
70	Alfalfa as principal crop on drained land..... acres	139		19,000	2,625	6,000	875	23,000
71	White potatoes as principal crop on drained land..... acres							300
72	Corn as principal crop on drained land..... acres	12,039				24,800		
73	Vegetables as principal crop on drained land..... acres	6,507				4,925		350
74	Hay (except alfalfa) as principal crop on drained land..... acres	450	4,000					2,839
75	Sugar beets as principal crop on drained land..... acres							2,925
76	Rice as principal crop on drained land..... acres							
77	Fruit as principal crop on drained land..... acres				4,037	42,000	14,000	
78	Cotton as principal crop on drained land..... acres				21,175			2,500
79	Beans as principal crop on drained land..... acres							
80	Other crops as principal ones on drained land..... acres					202		
<b>FLOOD-PROTECTION ENTERPRISES.<sup>5</sup></b>								
81	Land in operating enterprises..... acres	2,539			35,809	39,425	21,500	6,921
<b>Open ditches:</b>								
82	Completed..... miles	8.5			56.8	30.2	25.0	12.8
83	Additional under construction..... miles							
<b>Accessory levees and dikes:</b>								
84	Completed..... miles	10.5			61.0	47.0	43.0	20.4
85	Additional under construction..... miles							2.8
86	Total capital invested in and required for completion of operating enterprises..... dollars	14,300			1,875,144	1,467,719	1,000,000	288,778
87	Capital invested in these enterprises to Dec. 31, 1919..... dollars	14,300			1,875,144	1,467,719	1,000,000	278,778
88	Additional capital required to complete these enterprises..... dollars							10,000

<sup>1</sup> Includes only Humboldt, Kern, Kings, Lake, Los Angeles, Marin, Modoc, Napa, Placer, San Bernardino, Santa Barbara, Santa Clara, and Sierra Counties.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Per cent not shown when more than 1,000.  
<sup>4</sup> See footnote 6, p. 11.



## COLORADO.

The following pages present the statistics of drainage for Colorado collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land that is not yet included in farms.

The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	59,934	100.0
Farms reporting land having drainage.....	2,749	4.6
Farms reporting land needing drainage.....	4,399	7.3
All land in farms.....acres..	24,462,014	100.0
Improved land in farms.....acres..	7,744,757	31.7
Farm land reported as provided with drainage.....acres..	127,037	0.5
Farm land reported as needing drainage.....acres..	270,997	1.1
Needing drainage only.....acres..	80,121	0.3
Needing drainage and clearing.....acres..	190,876	0.8
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state.....acres..	66,341,120	100.0
All land in operating drainage enterprises.....acres..	171,656	0.3
Improved land.....acres..	123,031	0.2
Per cent of all improved land in farms.....	1.6	.....
Unimproved land <sup>1</sup> .....acres..	48,625	0.1
Swampy, subject to overflow, seeped, or alkali.....acres..	26,446	(3)
Suffering a loss of crops from defective drainage.....acres..	15,282	(2)
Improved land prior to drainage.....acres..	68,657	0.1
Increase since drainage began.....acres..	54,374	0.1
Land in nonoperating enterprises.....acres..	.....	.....
Open ditches in operating enterprises.....miles..	146.8	100.0
Completed.....miles..	132.5	90.3
Additional under construction.....miles..	14.3	9.7
Tile drains in operating enterprises.....miles..	208.2	100.0
Completed.....miles..	195.2	93.8
Additional under construction.....miles..	13.0	6.2
Total capital invested in and required for completion of operating enterprises..	\$1,285,670	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	1,081,875	84.2
Additional capital required to complete these enterprises.....	203,195	15.8
Average cost per acre when completed.....	7.49	.....

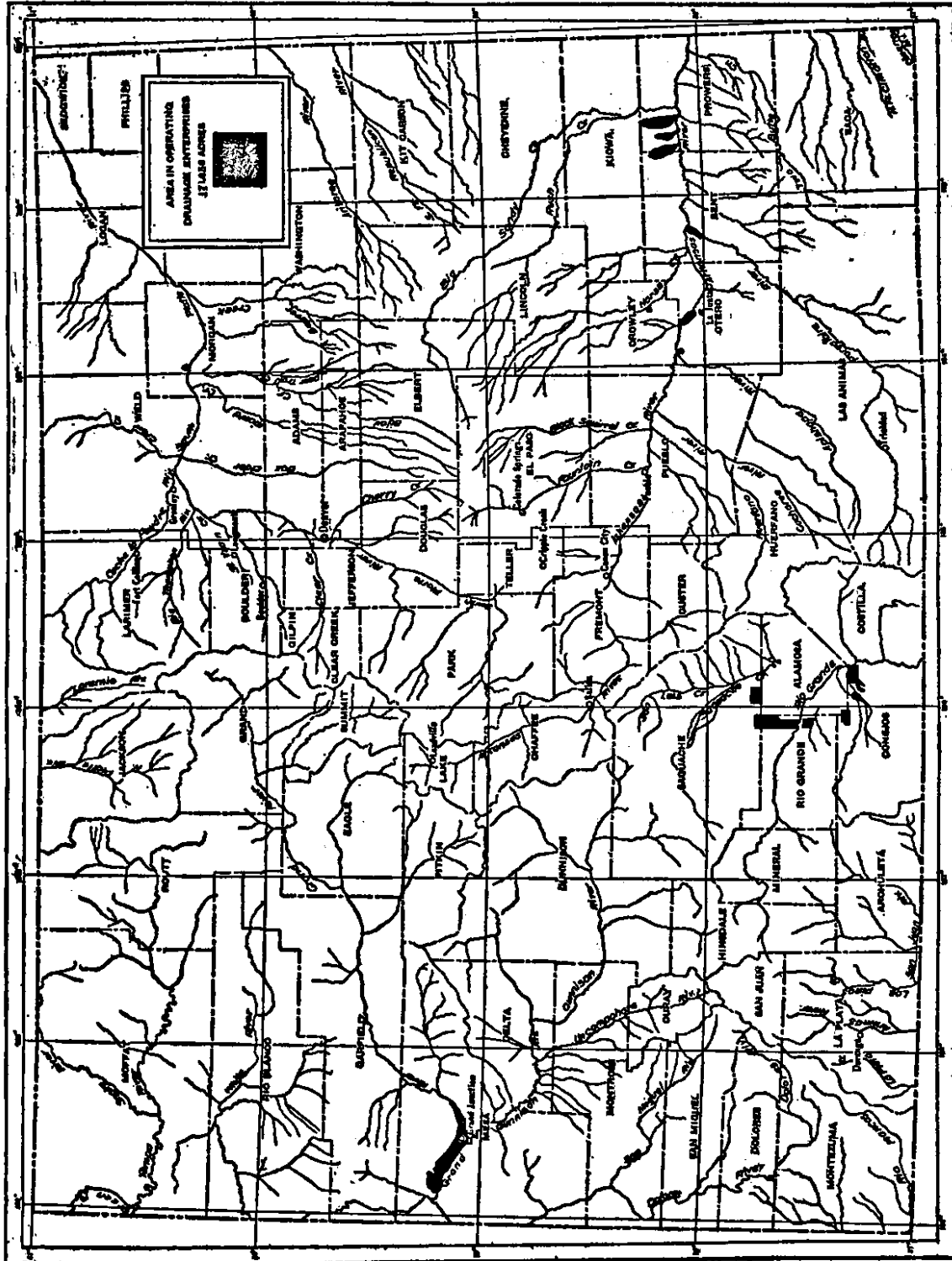
<sup>1</sup> No timber or cut-over land reported.

<sup>2</sup> Less than one-tenth of 1 per cent.



# COLORADO

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in Colorado. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>2</sup> .....	171,656	100.0	\$1,081,875	100.0	\$208,195
With works completed.....	66,816	61.1	508,663	47.0	.....
With works under construction.....	104,840	38.9	573,212	53.0	208,195

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to December 31, 1919," and for an "estimate of additional investment to complete."  
<sup>2</sup> No nonoperating enterprises in Colorado.

Location of enterprises.—The land in drainage enterprises in Colorado is about equally divided between the eastern, southern, and western parts of the state, though much the greater number of them are located along Arkansas River and in the Rio Grande basin.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	171,656	100.0	\$1,081,875	100.0	\$208,195
Rio Grande.....	65,140	37.9	463,907	42.0	90,000
Arkansas River.....	55,129	32.1	391,500	36.2	26,000
Grand River <sup>2</sup> .....	51,387	30.0	236,468	21.8	87,195

<sup>1</sup> No nonoperating enterprises in Colorado.  
<sup>2</sup> Includes 747 acres in Platte River basin.

Condition of land in enterprises.—With one exception, in Rio Grande County, all the drainage enterprises in this state were organized to drain and protect land injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation.

For the state, 2,174 acres of irrigated land in drainage enterprises are reported as not having needed drainage, but as having been assessed merely for contributing to the injury of the other lands.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and

to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES. <sup>1</sup>			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	171,656	100.0	66,816	104,840
Improved land.....	123,031	71.7	12,536	56,121
Unimproved land <sup>2</sup> .....	48,625	28.3	54,280	48,719
Swampy, seeped, or alkali.....	26,446	15.4	494	25,952
Suffering a loss of crops.....	16,282	8.9	182	15,100

<sup>1</sup> No nonoperating enterprises in Colorado.  
<sup>2</sup> No timber or cut-over land reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 24 operating drainage enterprises are counted in Colorado, with an average area of 7,152 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	171,656	171,656	100.0
500 to 999 acres.....	8,396	3,396	2.0
1,000 to 4,999 acres.....	21,260	21,260	12.4
5,000 to 9,999 acres.....	26,000	26,000	15.1
10,000 to 49,999 acres.....	71,000	71,000	41.4
50,000 to 99,999 acres.....	50,000	50,000	29.1

Character of enterprises.—The existing drainage enterprises in Colorado are drainage districts, except those under individual ownership, although the laws of the state authorize some other forms of organized drainage undertakings.

Drainage districts are established under the drainage law of June 2, 1911 (ch. 124). This law repealed that of April 24, 1909 (ch. 161), which provided for methods of organization and control generally similar to those of the later statute. The districts are established by the county commissioners of the county in which the larger part of the proposed district is located, upon petition from a majority of the owners, who must hold a major portion of the acreage in the proposed district. The question of organization may be submitted to a vote

of the landowners, and the district is established if a majority of the votes cast are favorable. At the same time three directors are elected to be the executive officers of the enterprise. If an election would be impracticable or would cause undue expense, the district may be organized without vote of the landowners, and the county commissioners serve as the officers until the owners petition for an election of directors. Originally the law of 1911 required that all the district be assessed at uniform rate per acre to pay the cost of the drainage, but an amendment in 1913 (ch. 75) provided for assessments according to benefits, as had been provided by the law of 1909.

The boundaries of the district are determined by the county commissioners after public hearing. The plan of drainage and the classification of land according to benefits are determined by the directors. Appeal from this classification may be made to the county court for trial by jury, and to the district court if the county judge consents. A law of 1919 (ch. 115) permits the assessment of maximum benefits against the land, representing the increased value to result from drainage, instead of merely apportioning the benefits. The project is abandoned if the total estimated cost exceeds the total benefits assessed. An annual levy is made by the directors to provide for all expenses of the district for the following year. Bonds may be issued, to run not more than 20 years, if approved by a majority vote of the voters of the district.

Voluntary districts may be formed under this law of 1911 by agreement signed by all the landowners to be affected, and stating the name of the district, the plan of drainage, the land owned by each person, the amount of money each will pay, and the names of the first directors. The county commissioners examine the land and, if the plan is practicable and the agreement is equitable, establish the district with all the powers of other drainage districts.

Public drains will be constructed by the county commissioners, under a law of April 11, 1903 (ch. 103), upon petition from one or more persons who own or represent the major portion of the land to be affected, if the improvements will be feasible and of benefit and are desired by the owners of a major part of the land. The cost is assessed against the land in proportion to the benefits that will accrue. An investigation of the feasibility of the project and an estimate of the cost are made by three disinterested viewers appointed by the commissioners, who hold public hearing upon the project and report to the commissioners with assessments of benefits against the land or with allotments of work for the landowners to construct. When the work has been completed, the commissioners apportion the total cost against the land for collection like other taxes. For a drain in more than one county the same procedure is required in each county as though the drain were in that county only, but all the boards of viewers prepare a joint report.

An irrigation district may provide for all drainage made necessary by the irrigation provided by the district, upon petition to the board of directors of the district, signed by not less than two-thirds of the legal voters each owning 5 acres or more in the district. The officers of such irrigation districts have the same powers and duties respecting such drainage as they have respecting irrigation. Whether the irrigation works have been constructed or not, the board of directors shall provide for the construction and maintenance of the drainage works that are found will be necessary by reason of the irrigation, and any land benefited by the drainage system, not previously included in the district, shall be taxed for irrigation district and drainage purposes.

An act of March 8, 1883, authorized the establishment of public drains by the county courts for the benefit of persons desiring to cut a drain through land of other owners, for agricultural or sanitary purposes, but this statute was repealed in 1885. An act of March 1, 1893 (ch. 84), grants the right of eminent domain for the drainage of wet land.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	171,656	100.0	\$1,081,875	100.0	\$203,195
Drainage districts.....	138,026	80.4	674,875	62.4	188,195
Laws of 1909, ch. 161.....	1,850	1.1	25,000	2.3	
Laws of 1911, ch. 124.....	6,140	3.6	89,907	8.3	90,000
Laws of 1913, ch. 75.....	130,036	75.7	559,968	51.8	98,195
Individual ownership.....	33,630	19.6	407,000	37.6	15,000

<sup>1</sup> No nonoperating enterprises in Colorado.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 111.6 miles of open ditches and 193.6 miles of tile drains; the additional lengths under construction were 21.9 miles of open ditches and 14.6 miles of tile drains. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	171,656	100.0	\$1,081,875	100.0	\$203,195
Open ditches only.....	41,100	23.9	119,000	11.0	5,000
Tile drains only.....	10,776	6.3	183,663	17.0	
Open ditches and tile drains.....	119,780	69.8	779,212	72.0	198,195

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would show the mean depth for the state 6.8 instead of 7 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	171,656	100.0
Less than 3 feet.....	9,240	5.4
3.0 to 3.9 feet.....	22,000	12.8
4.0 to 4.9 feet.....	1,040	0.6
5.0 to 5.9 feet.....	24,000	14.0
6.0 to 6.9 feet.....	70,500	41.1
7.0 to 7.9 feet.....	1,400	0.8
8.0 to 8.9 feet.....	48,476	28.3
9.0 to 9.9 feet.....		
Not reporting branches.....		

Maintenance of works.—The drainage district law requires that each year, before July 1, the directors determine the money that will be required during the coming year, including expenses for maintenance, and make out a tax list apportioned on the assessment of benefits. The drains provided by irrigation districts are to be maintained like a part of the irrigation works.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	171,656	100.0	\$1,081,875	100.0	\$203,195
By district forces.....	133,836	78.0	608,468	56.3	94,195
By contract.....	4,190	2.4	66,407	6.1	94,000
By landowners.....	33,630	19.6	407,000	37.6	15,000

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates

when the districts were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	171,656	100.0	171,656	100.0
1910 to 1914.....	47,490	27.7	47,490	27.7
1915 to 1919.....	124,166	72.3	124,166	72.3

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,081,875	100.0	\$203,195
1910 to 1914.....	214,907	19.9	90,000
1915 to 1919.....	866,968	80.1	113,195

TABLE 12.—DRAINS (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains.....	146.8	100.0	208.2	100.0
1910 to 1914.....	48.5	33.0	38.5	18.5
1915 to 1919.....	98.3	67.0	169.7	81.5

Crops.—The principal crops grown upon the drained land in drainage enterprises are alfalfa, wheat, and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—COLORADO.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adams.	Alamosa.	Bent.	Boulder.	Conchos.	Costilla.	Delta.	El Paso.
1	Number of all farms in the state or county.....	59,324	1,753	302	1,058	1,420	814	443	1,707	1,571
2	Farms reporting land having drainage.....	2,749	40	47	69	358	24	115	122	13
3	Farms reporting land needing drainage.....	4,399	56	77	122	290	72	57	155	26
4	Farms in drainage and levee districts.....	696	7	43	26	4	39	1	65	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county.....acres..	66,341,120	807,680	465,280	975,360	488,060	801,280	758,400	768,640	1,357,440
6	All land in farms.....acres..	24,462,014	452,115	236,847	433,970	221,202	231,938	434,410	169,768	919,013
7	Improved land in farms.....acres..	7,744,757	229,192	60,852	102,037	119,530	128,018	45,598	74,473	208,517
8	Woodland in farms.....acres..	1,415,420	5,118	4,252	4,706	32,177	9,362	80,229	6,427	52,208
9	Other unimproved land in farms.....acres..	15,301,837	217,805	171,048	327,227	69,495	94,558	307,583	88,868	658,288
10	Farm land reported as provided with drainage.....acres..	127,037	994	8,291	4,725	11,499	14,476	6,557	2,427	814
11	Farm land reported as needing drainage.....acres..	270,397	1,110	14,052	5,514	6,009	9,154	6,168	3,447	2,292
12	Drainage only.....acres..	80,121	875	4,428	5,197	4,483	4,872	24	2,084	352
13	Drainage and clearing.....acres..	190,876	235	9,624	317	1,526	4,282	6,144	1,363	1,940
		Garfield.	Gunnison.	Jackson.	Jefferson.	Larimer.	Logan.	Mesa.	Moffat.	Montrose.
1	Number of all farms in the county.....	930	876	182	1,446	1,921	1,574	2,207	1,023	1,368
2	Farms reporting land having drainage.....	12	19	13	160	396	16	137	3	161
3	Farms reporting land needing drainage.....	37	72	8	214	205	45	179	400	348
4	Farms in drainage and levee districts.....	4	18	.....	4	31	16	117	8	21
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	1,888,480	2,034,560	1,044,480	517,120	1,632,560	1,166,080	2,024,320	2,981,120	1,448,960
6	All land in farms.....acres..	211,875	121,579	234,214	249,922	730,533	857,359	232,225	461,777	218,255
7	Improved land in farms.....acres..	74,214	49,351	93,468	60,625	192,976	416,120	90,582	75,225	88,096
8	Woodland in farms.....acres..	13,492	2,648	4,031	71,108	96,689	4,497	15,735	12,268	14,414
9	Other unimproved land in farms.....acres..	124,169	69,580	136,715	109,189	440,868	436,742	116,908	374,284	115,745
10	Farm land reported as provided with drainage.....acres..	584	539	1,165	1,515	12,711	2,393	2,407	830	8,836
11	Farm land reported as needing drainage.....acres..	649	4,625	608	5,531	4,232	2,308	3,689	61,519	8,188
12	Drainage only.....acres..	367	298	490	1,000	3,999	1,632	1,567	212	5,786
13	Drainage and clearing.....acres..	282	4,327	18	4,531	238	676	2,122	61,307	2,400
		Morgan.	Otero.	Prowers.	Pueblo.	Rio Grande.	Saguache.	Weld.	Yuma.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,720	1,486	1,469	1,826	603	432	5,765	2,179	24,061
2	Farms reporting land having drainage.....	20	107	106	20	18	17	575	2	179
3	Farms reporting land needing drainage.....	52	292	120	87	64	43	437	5	986
4	Farms in drainage and levee districts.....	20	53	81	14	21	14	43	1	49
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	823,040	805,780	1,043,200	1,557,120	574,720	2,005,120	2,574,080	1,514,880	34,132,480
6	All land in farms.....acres..	555,890	334,293	669,262	993,226	190,231	436,024	1,756,973	1,203,781	11,990,332
7	Improved land in farms.....acres..	237,374	94,201	188,230	146,972	115,044	139,856	878,520	591,605	2,224,961
8	Woodland in farms.....acres..	9,528	3,856	9,657	116,271	11,480	31,021	12,704	10,211	781,331
9	Other unimproved land in farms.....acres..	308,988	236,236	471,375	729,983	72,707	265,147	865,749	601,965	7,980,020
10	Farm land reported as provided with drainage.....acres..	844	5,144	6,442	541	6,080	7,835	19,683	680	4,324
11	Farm land reported as needing drainage.....acres..	1,939	5,538	12,435	1,180	10,799	24,066	8,951	840	66,756
12	Drainage only.....acres..	1,870	5,069	12,432	663	2,336	2,040	8,351	840	9,354
13	Drainage and clearing.....acres..	69	469	3	517	8,463	22,026	600	.....	57,402

<sup>1</sup> No drainage on farms reported in Baca, Cheyenne, Clear Creek, Dolores, Douglas, Elbert, Lincoln, Mineral, San Juan, and Sedgwick Counties.

# DRAINAGE—COLORADO.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Bent.	Conejos.	Mesa.	Otero.	Prowers.	Rio Grande.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres..	66,341,120	975,960	801,280	2,024,320	805,780	1,043,200	574,720	8,810,560
2	All land in operating drainage enterprises.....acres..	171,656	11,550	17,100	50,640	4,539	33,040	27,000	22,787
3	Improved land.....acres..	123,031	8,736	9,163	30,640	4,196	30,359	23,650	16,237
4	Per cent of all improved land in farms.....	1.6	8.6	7.2	30.8	4.5	16.1	20.6	2.9
5	Unimproved land. <sup>2</sup> .....acres..	48,625	2,814	7,937	20,000	343	7,681	3,350	6,500
6	Swampy, seeped, or alkali, in enterprises.....acres..	26,446	974	550	20,000	211	441	3,450	820
7	Suffering a loss of crops from defective drainage.....acres..	15,282	92		15,000	150			40
8	Assessed acreage.....	171,656	11,560	17,100	50,640	4,539	33,040	27,000	22,787
9	Excess over all land in operating enterprises.....acres..								
<b>DRAINAGE WORKS.</b>									
Open ditches:									
10	Completed.....miles..	132.5	5.2	21.0	26.5	8.3	22.0	20.9	28.6
11	Additional under construction.....miles..	14.3			13.3	0.5		0.5	
12	Maximum completed in any enterprise.....miles..	26.5	5.0	13.0	26.5	6.8	11.0	13.9	20.0
13	Maximum width at bottom of ditch <sup>3</sup> .....feet..	12	4	12	12	8	5	10	6
14	Maximum of average depths of outlet ditches <sup>3</sup> .....feet..	16.0	8.0	8.0	8.0	13.0	16.0	6.0	7.0
15	Mean depth of branch ditches <sup>3</sup> .....feet..	7.0	8.0	7.0	8.0	9.0	8.0	6.6	8.0
Tile drains:									
16	Completed.....miles..	195.2	18.3	74.6	6.6	26.7	12.6	23.5	32.9
17	Additional under construction.....miles..	13.0	1.4	6.0		1.5	0.4	2.7	1.0
18	Maximum completed in any enterprise.....miles..	59.0	11.4	59.0	6.0	22.0	12.6	10.5	16.0
19	Maximum size of tile <sup>3</sup> .....inches..	38	24	15	15	15	15	38	21
20	Area drained by open ditches only <sup>3</sup> .....acres..	41,100				600	28,500		12,000
21	Length of these ditches.....miles..	38.0				2.0	16.0		20.0
22	Average length per acre.....feet..	4.9				17.6	3.0		8.8
23	Area drained by tile only <sup>3</sup> .....acres..	10,776	1,850	4,000	640	2,539			1,747
24	Length of these tile.....miles..	70.0	6.0	9.6	5.0	26.2			23.2
25	Average length per acre.....feet..	34.3	17.1	12.7	41.3	54.5			70.1
26	Area drained by open ditches and tile <sup>3</sup> .....acres..	119,780	9,700	13,100	50,000	1,400	9,540	27,000	9,040
27	Length of these drains.....miles..	247.0	18.9	92.0	41.4	8.8	19.0	47.6	19.3
28	Average length per acre.....feet..	10.9	10.3	37.1	4.4	33.2	10.5	9.3	108.4
<b>DEVELOPMENT OF LAND.</b>									
29	Improved land in operating enterprises, 1920.....acres..	123,031	8,736	9,163	30,640	4,196	30,359	23,650	16,237
30	Improved land prior to drainage.....acres..	68,657	6,477	1,563	30,640	1,949	14,618	8,950	4,460
31	Increase since drainage.....acres..	54,374	2,259	7,600		2,247	15,741	14,700	11,827
32	Per cent of increase.....	79.2	34.9	486.2		115.3	107.7	164.2	265.2
33	Per cent increase is of all improved land in farms, 1920.....	0.7	2.2	5.9		2.4	8.4	12.8	2.1
34	Unimproved land, 1920 <sup>2</sup> .....acres..	48,625	2,814	7,937	20,000	343	7,681	3,350	6,500
35	Unimproved land prior to drainage <sup>2</sup> .....acres..	102,999	5,073	15,537	20,000	2,590	23,422	18,050	18,327
36	Decrease since drainage.....acres..	54,374	2,259	7,600		2,247	15,741	14,700	11,827
37	Per cent of decrease.....	52.8	44.5	48.9		86.8	67.2	81.4	64.5
38	Swampy, seeped, or alkali, 1920.....acres..	26,446	974	550	20,000	211	441	3,450	820
39	Swampy, seeped, or alkali prior to drainage.....acres..	98,581	3,341	15,950	20,640	1,926	20,741	21,500	14,483
40	Decrease since drainage.....acres..	72,135	2,367	15,400	640	1,715	20,300	18,050	13,663
41	Per cent of decrease.....	73.2	70.8	86.6	3.1	89.0	97.9	84.0	94.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
42	Total capital invested in and required for completion of operating enterprises.....dollars..	1,255,070	110,500	343,907	312,000	156,000	126,000	108,200	128,463
43	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	1,081,875	99,500	253,907	224,805	141,000	126,000	108,200	128,463
44	Additional capital required to complete these enterprises.....dollars..	203,195	11,000	90,000	87,195	15,000			
45	Average cost per acre, when completed.....dollars..	7.49	9.57	20.11	6.16	34.37			5.64
46	Enterprises constructing open ditches only.....dollars..	124,000				20,000	44,000		60,000
47	Average cost per acre when completed.....dollars..	3.02				33.33	1.54		5.00
48	Enterprises constructing tile drains only.....dollars..	183,663	25,000	44,000	12,000	66,000			36,663
49	Average cost per acre when completed.....dollars..	17.04	13.51	11.00	18.75	25.99			20.99
50	Enterprises constructing open ditches and tile drains.....dollars..	977,407	85,500	299,907	300,000	70,000	82,000	108,200	81,800
51	Average cost per acre when completed.....dollars..	8.16	8.81	22.89	6.00	50.00	8.60	4.01	5.52
<b>CROPS.</b>									
Improved land in enterprises reporting—									
52	Alfalfa as principal crop on drained land.....acres..	89,838	8,116	5,163	30,000	450	11,609	20,900	13,600
53	Wheat, oats and corn as principal crops on drained land.....acres..	8,295	620	4,000		510		2,126	1,040
54	Sugar beets as principal crop on drained land.....acres..	4,883				3,236			1,647
55	Not reporting principal crop on drained land.....acres..	20,015			640		18,750	625	

<sup>1</sup> Includes only Alamosa, Crowley, Morgan, and Saguache Counties.  
<sup>2</sup> No timber or cut-over land reported.

<sup>3</sup> When works under construction have been completed.

## FLORIDA.

The following pages present the statistics of drainage for Florida collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

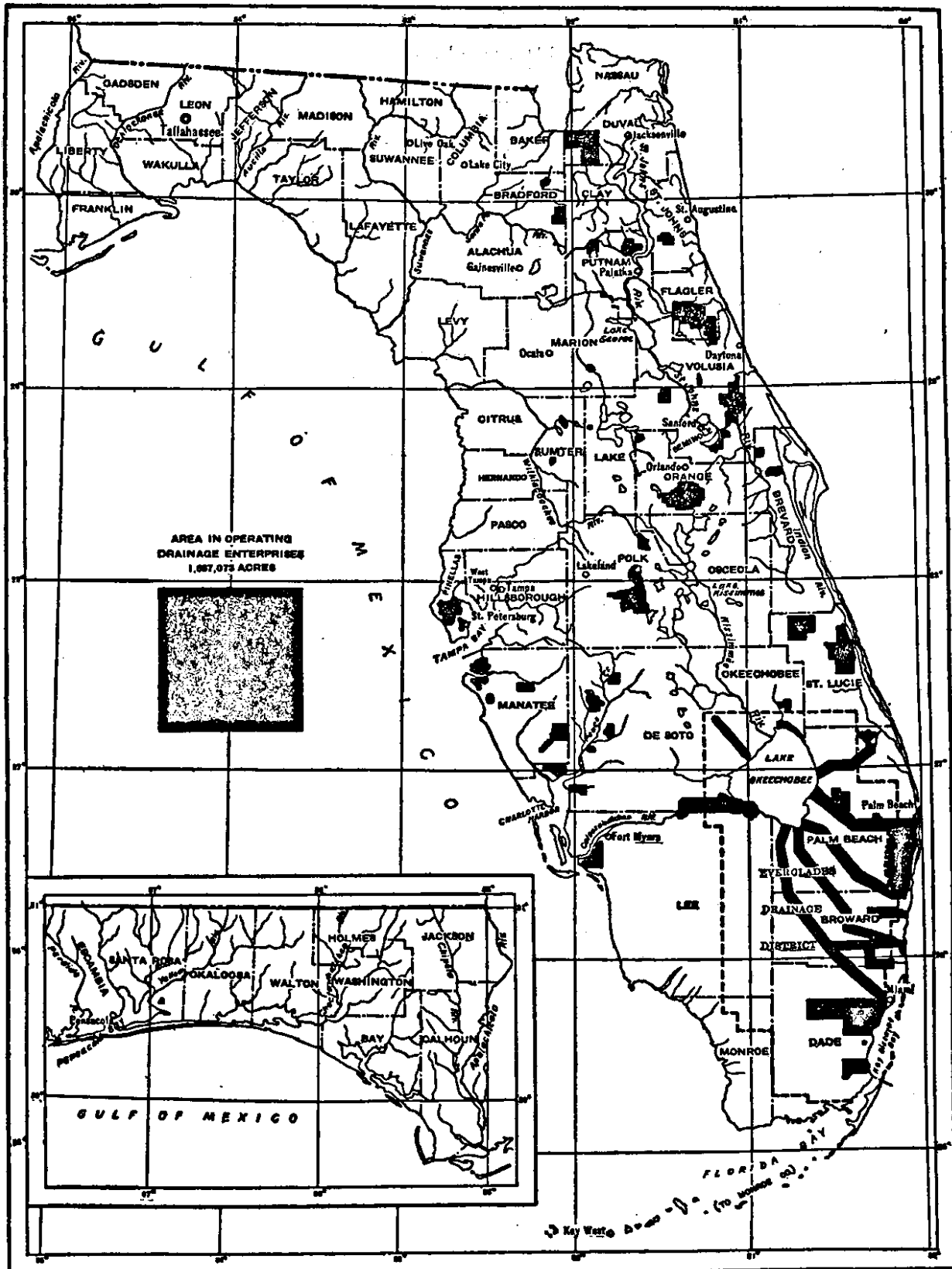
in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	54,005	100.0
Farms reporting land having drainage.....	4,597	8.5
Farms reporting land needing drainage.....	8,486	15.7
All land in farms..... acres..	6,046,691	100.0
Improved land in farms..... acres..	2,297,271	38.0
Farm land reported as provided with drainage..... acres..	147,940	2.4
Farm land reported as needing drainage..... acres..	687,021	11.4
Needing drainage only..... acres..	87,814	1.5
Needing drainage and clearing..... acres..	599,207	9.9
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	35,111,040	100.0
All land in operating drainage enterprises..... acres..	1,637,073	4.7
Improved land..... acres..	94,589	0.3
Per cent of all improved land in farms.....	4.1	.....
Timber and cut-over land..... acres..	542,648	1.5
Other unimproved land..... acres..	999,836	2.8
Swampy, subject to overflow, seeped, or alkali..... acres..	731,691	2.1
Suffering a loss of crops from defective drainage..... acres..	40,498	0.1
Improved land prior to drainage..... acres..	30,341	0.1
Increase since drainage began..... acres..	64,248	0.2
Land in nonoperating enterprises..... acres..	1,008,743	2.9
Open ditches in operating enterprises..... miles..	2,684.8	100.0
Completed..... miles..	1,990.8	74.2
Additional under construction..... miles..	694.0	25.8
Tile drains in operating enterprises..... miles..	.....	.....
Completed..... miles..	.....	.....
Additional under construction..... miles..	.....	.....
Total capital invested in and required for completion of operating enterprises..	\$26,762,497	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	13,846,807	51.7
Additional capital required to complete these enterprises.....	12,915,690	48.3
Average cost per acre when completed.....	16.35	.....

# FLORIDA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.<sup>1</sup>



<sup>1</sup> Boundary of Everglades Drainage District shown thus: - - - -



**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost. The Everglades Drainage District as a whole is not included in the tabulations, but those parts against which special assessments are levied for improvement works that actually have been undertaken are included as separate enterprises.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	2,645,816	100.0	\$14,060,857	100.0	\$14,933,090
Operating enterprises.....	1,637,073	61.9	13,846,807	98.5	12,915,690
With works completed.....	352,068	13.3	2,917,261	20.7	.....
With works under construction.....	1,285,005	48.6	10,929,546	77.7	12,915,690
Nonoperating enterprises.....	1,008,743	38.1	214,050	1.5	2,017,400

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

**Location of enterprises.**—Practically all the organized drainage enterprises in Florida are in the southern and the extreme eastern parts of the state. Most of the drainage is eastward, either through St. Johns River or almost directly into the Atlantic Ocean.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	2,645,816	100.0	\$14,060,857	100.0	\$14,933,090
Operating enterprises.....	1,637,073	61.9	13,846,807	98.5	12,915,690
Gulf of Mexico.....	304,690	11.5	1,714,076	12.2	555,000
Suwannee River.....	23,020	0.9	42,000	0.3	1,000
Atlantic Ocean.....	1,067,901	40.4	11,021,371	78.4	11,941,190
St. Johns River.....	241,462	9.1	1,069,360	7.6	418,500
Nonoperating enterprises.....	1,008,743	38.1	214,050	1.5	2,017,400
Gulf of Mexico.....	3,000	0.1	2,500	.....	6,200
Suwannee River.....	1,000	.....	.....	.....	125
Atlantic Ocean.....	559,398	21.1	46,104	0.3	1,261,000
St. Johns River.....	445,345	16.8	165,321	1.2	719,280

**Condition of land in enterprises.**—The drainage enterprises in this state are almost entirely for the reclamation of areas that naturally are too swampy or wet for agricultural uses. The extremely level ground surface has not been conducive to the formation of natural channels adequate in number or in size to drain the land, so in seasons of more than average rainfall the water stands upon the surface or moves across it slowly in a broad sheet. Particularly is this true in the Everglades, due to overflow from Lake Okeechobee. In the southern part of the peninsula and in sections along the east coast, many of the drainage enterprises have no natural boundaries, the promoters merely separating from the general body of swamp land a portion suited to their financial resources or to their judgment regarding economy of development.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	1,637,073	100.0	352,068	1,285,005	1,008,743
Improved land.....	94,589	5.8	32,511	62,078	17,925
Timber and cut-over land.....	542,648	33.1	100,560	442,088	303,666
Other unimproved land.....	999,836	61.1	218,997	780,839	687,152
Swampy or subject to overflow.....	731,691	44.7	75,398	656,293	692,241
Suffering a loss of crops.....	40,498	2.5	21,931	18,567	29,348

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 94 operating drainage enterprises are counted in Florida, with an average area of 18,723 acres assessed. Of the total number of enterprises, 12 comprise 50,000 acres or more each, and only 5 less than 1,000 acres each. The assessed acreage exceeds the land in enterprises by 122,868 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	1,637,073	1,759,941	100.0
500 to 999 acres.....	3,370	3,370	0.2
1,000 to 4,999 acres.....	60,207	63,157	3.6
5,000 to 9,999 acres.....	94,038	114,456	6.5
10,000 to 49,999 acres.....	625,245	694,045	39.4
50,000 to 99,999 acres.....	604,913	604,913	34.4
100,000 to 499,999 acres.....	249,300	280,000	15.9

**Character of enterprises.**—The drainage enterprises in Florida are state projects under immediate control of state officials, drainage districts established under general drainage laws and special acts of the legislature, commercial organizations developing land for sale, and private drainage undertakings by individual landowners.

The state government has undertaken to encourage and assist in the development of its great area of swamp and overflowed land. The Internal Improvement Fund was created by an act of the legislature January 6, 1855 (ch. 610), to consist of the unsold land granted to the state by Congress in 1845 for internal improvement purposes, and of the swamp and overflowed land granted to the state by Congress in 1850. The board of trustees for that fund, which consists of the governor of the state, the comptroller, the state treasurer, the attorney general, and the commissioner of agriculture, is empowered to make such arrangements for the drainage of the swamp and overflowed land as may seem most advantageous. The state board of drainage commissioners was created by act of May 27, 1905 (ch. 5377), to drain and reclaim swamp and overflowed land in certain drainage districts; the members are the trustees of the Internal Improvement Fund. The Everglades Drainage District in the southern end of the state was created by a statute of June 6, 1913 (ch. 6456), and the commissioners of that district are the state drainage commissioners. A drainage district with approximately the same boundaries had been created by the act that created the state drainage commissioners.

The Everglades Drainage District now comprises some 4,200,000 acres, located as indicated on the map on page 2. The district commissioners are empowered to plan and construct all works necessary for the reclamation of the district, and to issue bonds to finance the work. The land is divided into classes for assessment of drainage taxes. The organization of subdistricts wholly or partly within the Everglades Drainage District is provided by an act of June 7, 1919 (ch. 7866). The statistics for the Everglades district as a whole are not given in this bulletin, but

statistics are included for the parts where drainage has been undertaken. Most of the state enterprises are reported as under control of the commissioners of the Everglades district, though a few are reported as under the trustees of the Internal Improvement Fund or under the state board of drainage commissioners.

Drainage districts may be established under general drainage laws by the boards of county commissioners or by the circuit courts of the counties in which the districts are situated. Districts established by the circuit courts are formed in accordance with a law of June 9, 1913 (ch. 6458), upon petition from the state board of drainage commissioners or from a majority in either number or acreage of the owners of the wet or overflowed land to be drained. After public hearings upon the petition and with the written consent of the owners of a majority of the acreage to be included, the district is decreed a public corporation for a stated term of years. The officials of the district are a board of three supervisors elected by the landowners, each of whom has one vote for each acre of his holdings. The plan of drainage works is determined by the board of supervisors, which also constructs the works. Benefits and damages are assessed by three commissioners appointed by the judge of the court, who holds hearings upon their report and confirms the assessments with any modifications deemed equitable. Appeals may be taken to the supreme court of the state. The cost of the enterprise is assessed in proportion to the benefits and not in excess of them. The supervisors may issue bonds for not exceeding 90 per cent of the tax levy, to mature in not more than 30 years.

Drainage districts have been established by the county commissioners under acts of June 1, 1899 (ch. 4807), and of May 3, 1901 (ch. 5035). The later statute supersedes the earlier one, to which it is similar, and legalizes drainage contracts and assessments made under the earlier law. The existing act, as amended June 7, 1913 (ch. 6457), requires that the petition for a drain must be made by a majority of the owners of the land that will be affected or by the owners of a majority of the acreage, and must be approved by the county commissioners. The plan of drainage and the estimate of cost are procured by a committee of three disinterested freeholders appointed by the county commissioners. The cost is assessed against the land in proportion to the benefits as determined by the committee and approved by the county commissioners after public hearing. The commissioners let contracts for construction and the committee supervises that work. The commissioners issue bonds of the district to finance the enterprise.

Drainage of swamp and overflowed land by the board of county commissioners in any county, upon petition

of two or more owners of land that would be assessed for the cost, is authorized by a law of June 2, 1893 (ch. 4178). The general method of establishment is rather similar to that provided by the law of 1901. No enterprises were reported as organized under this statute. The only previous drainage law in Florida, except that creating the Internal Improvement Fund, was an act of 1834 providing for the establishment of drains by the county courts upon petition from one or more landowners. In each instance three commissioners were to be appointed to locate the ditch and determine what damages must be paid by the petitioners to the owners of the land through which the drain would be constructed.

A number of drainage districts have been created by special acts of the legislature defining for each separate district its boundaries, form of organization, and powers. Some enterprises that were begun as land-development or land-sales companies have been reorganized as drainage districts.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All enterprises.....	2,645,816	100.0	\$14,060,857	100.0	\$14,933,090
Operating enterprises.....	1,637,073	61.9	13,846,807	98.5	12,915,690
State projects.....	604,900	22.9	5,742,617	40.8	6,434,440
Drainage districts.....	913,283	34.5	6,613,444	47.0	5,988,000
Laws of 1899, ch. 4807.....	17,280	0.7	28,500	0.2	.....
Laws of 1901, ch. 5035.....	23,840	0.9	158,678	1.1	.....
Laws of 1913, ch. 6457.....	59,662	2.3	455,900	3.2	20,000
Laws of 1913, ch. 6458.....	111,201	23.1	5,675,468	40.4	4,015,000
Special acts.....	201,300	7.6	297,000	2.1	1,951,000
Commercial developments..	104,050	3.9	1,368,846	9.7	458,500
Individual ownerships.....	14,840	0.6	122,000	0.9	38,750
Nonoperating enterprises.....	1,008,743	38.1	214,050	1.5	2,017,400
Drainage districts <sup>1</sup> .....	1,008,743	38.1	214,050	1.5	2,017,400
Laws of 1901, ch. 5035.....	12,000	0.5	6,500	(?)	14,480
Laws of 1913, ch. 6457.....	5,250	0.2	1,900	(?)	78,000
Laws of 1913, ch. 6458.....	505,693	19.1	204,246	1.5	1,749,820
Special acts <sup>2</sup> .....	485,800	18.4	2,404	(?)	175,000

<sup>1</sup> Includes 5,000 acres under individual ownership.  
<sup>2</sup> Less than one-tenth of 1 per cent.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 1,990.8 miles of open ditches and 66.2 miles of levees; the additional lengths under construction were 694.0 miles of open ditches and 106.5 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. The cost of nine locks and dams completed in the state canals in the Everglades Drainage District, amounting to about \$273,000, and of two others under construction is included in the cost of the enterprises.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	1,637,073	100.0	\$13,846,807	100.0	\$12,915,690
Open ditches only.....	1,093,128	66.8	8,374,539	60.5	7,295,690
Open ditches and levees.....	543,945	33.2	5,472,268	39.5	5,620,000

There are two pumping districts for land drainage in the state. The pumping plants are equipped with five centrifugal pumps of 39,000 gallons per minute total capacity, and with steam engines and internal-combustion engines of 35 horsepower and 85 horsepower, respectively.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	1,637,073	100.0	\$13,846,807	100.0	\$12,915,690
Gravity drainage only.....	1,631,073	99.6	13,763,307	99.4	12,890,690
All drainage by pumping.....	3,000	0.2	38,500	0.3	.....
Part gravity and part pumping.....	3,000	0.2	45,000	0.3	25,000
Total area served by pumps...	4,500	0.3	.....	.....	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.4 instead of 4.3 feet.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	1,637,073	100.0
Less than 3 feet.....	50,100	3.1
3.0 to 3.9 feet.....	135,330	8.3
4.0 to 4.9 feet.....	355,480	21.7
5.0 to 5.9 feet.....	93,912	5.7
6.0 to 6.9 feet.....	130,000	7.9
7.0 to 7.9 feet.....		
8.0 to 8.9 feet.....	3,186	0.2
9.0 to 9.9 feet.....		
10 feet and more.....	15,645	1.0
Not reporting branches.....	853,420	52.1

**Maintenance of works.**—The state board of drainage commissioners is empowered to maintain the drainage works constructed by it. The supervisors of drainage districts organized under the circuit court are authorized to maintain and protect the drainage works of their respective districts, and for this purpose may levy taxes, not to exceed in any year 10 per cent of the net assessment of benefits for original construction and to be apportioned like those benefits. A readjustment of apportionment of maintenance costs is provided for, upon petition from the owners of 25 per cent of the acreage in the district and after public hearing. All drains constructed by districts organized under the county commissioners are under the control of those commissioners for purposes of repair and maintenance. Taxes for these purposes may be levied by the county commissioners when deemed necessary, a separate fund to be kept for each district. These taxes are levied in the same proportions as the original assessments of cost.

TABLE 10.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises..	1,637,073	100.0	\$13,946,807	100.0	\$12,915,690
By district forces.....	312,835	19.1	2,906,008	20.3	2,331,000
By contract.....	418,700	25.6	3,853,915	27.8	673,000
By land owners.....	58,500	3.6	453,348	3.3	730,000
Method not specified.....	25,028	1.5	178,000	1.3	151,250
No maintenance provided.....	180,179	11.0	3,261,670	23.6	1,006,440
Not reporting.....	641,833	39.2	3,293,868	23.8	3,024,000

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of enterprises, which are the dates when the districts were established by the courts or the county commissioners, since there may be a period of one or more years between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy

several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Florida earlier than 1905.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	1,637,073	100.0	1,750,941	100.0
1905 to 1909.....	6,970	0.4	15,170	0.9
1910 to 1914.....	859,617	52.5	885,617	50.3
1915 to 1919.....	770,486	47.1	850,154	48.8

TABLE 12.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$13,946,807	100.0	\$12,915,690
1905 to 1909.....	125,000	0.9	
1910 to 1914.....	8,936,048	64.5	7,288,000
1915 to 1919.....	4,785,759	34.6	5,627,690

TABLE 13.—DITCHES AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All ditches and levees.....	2,684.8	100.0	172.7	100.0
1905 to 1909.....	75.8	2.8	1.5	0.9
1910 to 1914.....	1,628.3	62.9	76.0	44.0
1915 to 1919.....	920.7	34.3	95.2	55.1

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are potatoes and other vegetables. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—FLORIDA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Alachua.	Bay.	Bradford.	Brevard.	Broward.	Calhoun.	Clay.	Dade.
1	Number of all farms in the state or county.....	54,005	2,684	173	1,286	672	280	679	314	855
2	Farms reporting land having drainage.....	4,597	33	30	43	169	121	45	97	38
3	Farms reporting land needing drainage.....	8,486	509	44	158	361	5	62	191	34
4	Farms in drainage and levee districts.....	1,266	2		2	9	18	4	1	15
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county..... acres..	35,111,040	804,480	500,480	344,960	656,000	775,680	696,320	393,600	1,292,160
6	All land in farms..... acres..	6,046,691	297,091	34,484	134,608	58,670	20,400	74,938	107,742	132,721
7	Improved land in farms..... acres..	2,297,271	161,737	4,897	59,207	10,945	9,092	23,377	15,001	29,082
8	Woodland in farms..... acres..	2,780,790	122,581	28,968	65,385	18,707	2,261	48,142	71,050	76,988
9	Other unimproved land in farms..... acres..	968,630	12,773	819	10,036	28,918	9,047	3,499	21,691	26,651
10	Farm land reported as provided with drainage..... acres..	147,040	641	901	4,929	3,428	5,849	590	6,820	3,802
11	Farm land reported as needing drainage..... acres..	637,021	35,959	8,490	16,795	35,616	4,521	7,574	39,308	8,651
12	Drainage only..... acres..	87,814	6,253	1,049	16,120	10,071	3,680	4,276	9,113	7,401
13	Drainage and clearing..... acres..	599,207	29,736	7,441	16,675	25,545	841	3,298	30,196	1,250

		De Soto.	Duval.	Flagler.	Hamilton.	Hernando.	Hillsborough.	Holmes.	Jackson.	Lake.
1	Number of all farms in the county.....	1,719	916	187	1,102	408	1,687	1,597	4,031	376
2	Farms reporting land having drainage.....	259	150	63	8	7	286	122	219	60
3	Farms reporting land needing drainage.....	439	458	92	24	6	581	441	541	104
4	Farms in drainage and levee districts.....	34	35	60		1	49		1	15
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	2,402,560	500,480	314,240	337,920	318,080	663,040	302,720	600,960	670,080
6	All land in farms..... acres..	300,209	65,165	10,517	101,907	95,618	87,483	154,110	368,117	68,339
7	Improved land in farms..... acres..	43,601	13,456	4,070	82,818	15,520	33,905	64,198	212,260	32,917
8	Woodland in farms..... acres..	103,294	48,527	5,832	74,833	79,542	39,452	84,155	135,914	34,474
9	Other unimproved land in farms..... acres..	153,314	8,182	715	4,266	556	14,426	5,767	16,948	20,948
10	Farm land reported as provided with drainage..... acres..	12,248	2,047	2,604	950	694	3,577	1,114	2,677	4,561
11	Farm land reported as needing drainage..... acres..	38,139	32,944	4,660	1,476	998	20,058	26,480	30,137	9,839
12	Drainage only..... acres..	1,868	2,260	456	746	266	2,738	3,972	1,131	3,647
13	Drainage and clearing..... acres..	36,271	30,694	4,204	730	732	17,320	22,508	29,006	6,242

		Lee.	Liberty.	Manatee.	Marion.	Orange.	Osceola.	Palm Beach.	Pinellas.	Polk.
1	Number of all farms in the county.....	573	227	938	2,215	1,093	304	624	536	2,652
2	Farms reporting land having drainage.....	187	1	534	48	123	14	228	111	62
3	Farms reporting land needing drainage.....	153	1	335	167	190	28	115	81	151
4	Farms in drainage and levee districts.....	19		380	5	11	5	117	43	27
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	2,579,840	526,720	855,680	1,054,080	594,560	867,840	1,624,320	187,520	1,220,480
6	All land in farms..... acres..	48,934	36,681	40,469	225,048	242,443	66,918	87,527	31,671	299,153
7	Improved land in farms..... acres..	12,917	11,039	15,273	105,471	70,672	6,304	12,055	11,273	54,676
8	Woodland in farms..... acres..	21,097	18,294	21,667	107,118	158,509	39,766	18,853	17,167	139,095
9	Other unimproved land in farms..... acres..	9,970	7,348	3,529	12,459	13,362	20,848	8,619	3,231	105,383
10	Farm land reported as provided with drainage..... acres..	4,446	580	10,104	2,915	2,113	1,126	9,021	1,469	16,464
11	Farm land reported as needing drainage..... acres..	10,364	3,345	16,229	18,586	22,868	26,384	4,927	2,649	15,946
12	Drainage only..... acres..	743		1,095	5,364	1,427	2,793	1,091	524	834
13	Drainage and clearing..... acres..	9,621	3,345	15,134	13,222	21,441	17,591	3,836	2,126	15,112

		Putnam.	St. Johns.	St. Lucie.	Seminole.	Sumter.	Volusia.	Walton.	Washington.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	893	402	719	573	1,213	998	1,073	1,218	18,368
2	Farms reporting land having drainage.....	258	214	438	268	54	37	42	58	172
3	Farms reporting land needing drainage.....	358	234	182	112	209	88	153	401	1,443
4	Farms in drainage and levee districts.....	42	3	222	33	26	4	1	4	74
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	481,280	389,120	689,280	205,440	373,120	718,720	700,800	396,800	10,071,680
6	All land in farms..... acres..	66,085	47,417	40,365	65,466	85,188	69,623	121,020	101,698	2,233,566
7	Improved land in farms..... acres..	23,248	12,915	13,042	11,795	39,337	18,258	38,669	46,031	978,814
8	Woodland in farms..... acres..	39,212	32,669	15,071	39,192	39,664	33,387	58,436	46,238	899,280
9	Other unimproved land in farms..... acres..	3,625	1,833	12,252	14,479	6,197	17,978	23,915	9,329	355,772
10	Farm land reported as provided with drainage..... acres..	9,317	11,216	12,334	3,358	1,799	1,120	524	1,414	1,718
11	Farm land reported as needing drainage..... acres..	17,947	22,937	7,177	12,753	13,394	3,458	9,624	14,728	147,680
12	Drainage only..... acres..	1,678	347	2,095	1,911	2,151	642	1,195	695	5,182
13	Drainage and clearing..... acres..	16,269	22,590	5,082	10,842	11,243	2,816	9,729	14,033	142,488

<sup>1</sup> No drainage on farms reported in Lafayette, Levy, Monroe, Okaloosa, and Suwannee Counties.

DRAINAGE—FLORIDA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Bradford.	Brevard.	Broward.	Dade.	De Soto.	Duval.	
<b>LAND AREA.</b>								
1	Approximate land area of the state or county.....acres..	35,111,040	344,960	656,000	775,680	1,292,160	2,402,560	500,480
2	All land in operating drainage enterprises.....acres..	1,637,073	20,780	17,000	162,250	199,300	165,640	57,600
3	Improved land.....acres..	94,589	3,152	200	14,792	8,048	12,541	5,760
4	Per cent of all improved land in farms.....	4.1	5.3	1.8	52.7	27.7	28.8	42.8
5	Timber and cut-over land.....acres..	542,648	17,488	4,000	18,810	6,000	34,146	25,920
6	Other unimproved land.....acres..	999,836	140	12,800	138,648	185,252	118,953	25,920
7	Swampy or subject to overflow in enterprises.....acres..	731,691	16,952	2,000	74,450	175,777	65,100	14,400
8	Suffering a loss of crops from defective drainage.....acres..	40,498	17,136	.....	12,076	2,850	1,123	.....
9	Assessed acreage.....acres..	1,759,941	20,780	43,000	163,000	217,000	201,640	57,600
10	Excess over all land in operating enterprises.....acres..	122,868	.....	26,000	760	17,700	36,000	.....
<b>DRAINAGE WORKS.</b>								
Open ditches:								
11	Completed.....miles..	1,990.8	45.1	116.5	173.3	77.2	210.3	57.4
12	Additional under construction.....miles..	694.0	60.0	7.5	.....	113.0	106.9	22.0
13	Maximum completed in any enterprise.....miles..	166.0	30.1	60.0	40.0	29.2	58.0	57.4
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	90	50	35	80	80	50	36
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	22.0	6.0	10.0	14.0	14.0	10.0	5.0
16	Mean depth of branch ditches <sup>3</sup> .....feet..	4.3	3.1	4.2	4.2	3.0	5.0	4.0
Accessory levees and dikes:								
17	Completed.....miles..	66.2	.....	.....	10.5	.....	1.8	.....
18	Additional under construction.....miles..	106.5	.....	.....	.....	40.0	.....	.....
Pumping plants:								
19	Engine capacity.....horsepower..	120	.....	.....	.....	.....	.....	.....
20	Pump capacity.....gallons per minute..	39,000	.....	.....	.....	.....	.....	.....
21	Area served by pumps.....acres..	4,500	.....	.....	.....	.....	.....	.....
22	Area drained by open ditches only <sup>4</sup> .....acres..	1,093,128	20,780	17,000	160,250	57,000	100,640	57,600
23	Length of these ditches.....miles..	1,791.2	105.1	124.0	133.3	163.2	238.8	79.4
24	Average length per acre.....feet..	8.7	26.7	38.5	4.4	15.1	12.5	7.8
25	Area having open ditches and levees <sup>5</sup> .....acres..	543,945	.....	.....	2,000	142,300	65,000	.....
26	Length of these ditches.....miles..	893.6	.....	.....	40.0	27.0	78.4	.....
27	Average length per acre.....feet..	8.7	.....	.....	105.0	1.0	6.4	.....
28	Length of the accessory levees.....miles..	172.7	.....	.....	10.5	40.0	1.8	.....
<b>DEVELOPMENT OF LAND.</b>								
29	Improved land in operating enterprises, 1920.....acres..	94,589	3,152	200	14,792	8,048	12,541	5,760
30	Improved land prior to drainage.....acres..	30,341	1,763	.....	11,488	4,070	1,663	2,880
31	Increase since drainage.....acres..	64,248	1,389	200	3,304	3,978	10,878	2,880
32	Per cent of increase.....	211.8	78.8	.....	222.0	97.7	654.1	100.0
33	Per cent increase is of all improved and in farms, 1920.....	2.8	2.3	1.8	36.3	13.7	24.9	21.4
34	Timber and cut-over land, 1920.....acres..	542,648	17,488	4,000	18,810	6,000	34,146	25,920
35	Timber and cut-over land prior to drainage.....acres..	565,741	18,352	4,000	19,200	6,000	34,512	28,800
36	Decrease since drainage.....acres..	23,093	864	.....	390	.....	366	2,880
37	Per cent of decrease.....	4.1	4.7	.....	2.0	.....	1.1	10.0
38	Other unimproved land, 1920.....acres..	999,836	140	12,800	138,648	185,252	118,953	25,920
39	Other unimproved land prior to drainage.....acres..	1,040,991	665	13,000	141,562	189,230	129,465	25,920
40	Decrease since drainage.....acres..	41,156	825	200	2,914	3,978	10,512	.....
41	Per cent of decrease.....	4.0	78.9	1.5	2.1	2.1	8.1	.....
42	Swampy or subject to overflow, 1920.....acres..	731,691	16,952	2,000	74,450	175,777	65,100	14,400
43	Swampy or subject to overflow, prior to drainage.....acres..	1,328,313	18,680	16,500	159,050	193,520	128,440	46,080
44	Decrease since drainage.....acres..	596,622	1,728	14,500	84,600	17,743	63,340	31,680
45	Per cent of decrease.....	44.9	9.3	87.9	53.2	9.2	49.3	68.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
46	Total capital invested in and required for completion of operating enterprises.....dollars..	26,762,497	35,500	585,000	3,634,992	4,060,562	1,204,550	365,000
47	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	13,846,807	35,500	585,000	1,689,945	710,894	1,030,110	260,835
48	Additional capital required to complete these enterprises.....dollars..	12,915,690	.....	.....	1,945,047	3,349,668	174,440	104,165
49	Average cost per acre when completed.....dollars..	16.35	1.71	34.41	22.40	20.37	7.27	6.34
50	Enterprises constructing open ditches only.....dollars..	15,670,229	35,500	585,000	3,534,992	2,040,562	652,550	365,000
51	Average cost per acre when completed.....dollars..	14.34	1.71	34.41	22.06	35.80	6.48	6.34
52	Enterprises constructing open ditches and levees.....dollars..	11,092,268	.....	.....	100,000	2,020,000	552,000	.....
53	Average cost per acre when completed.....dollars..	20.39	.....	.....	60.00	14.20	8.49	.....
<b>CROPS.</b>								
Improved land in enterprises reporting—								
54	Vegetables as principal crop on drained land.....acres..	31,505	.....	100	4,782	6,625	3,211	.....
55	Potatoes as principal crop on drained land.....acres..	18,784	.....	.....	.....	.....	1,050	.....
56	Sugar cane as principal crop on drained land.....acres..	17,623	.....	.....	.....	1,423	6,500	5,760
57	Citrus fruits as principal crop on drained land.....acres..	10,820	.....	100	.....	.....	.....	.....
58	Other crops as principal ones on drained land.....acres..	13,761	2,592	.....	.....	.....	880	.....
59	Not reporting crops.....acres..	2,096	560	.....	.....	.....	900	.....

<sup>1</sup> Estimated total for county.

<sup>2</sup> When works under construction have been completed.

# DRAINAGE—FLORIDA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Flagler.	Lake.	Lee.	Manatee.	Nassau.	Oksecho-bee.	Orange.	Palm Beach.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres..	314,240	670,080	2,579,840	855,680	403,200	478,080	594,560	1,624,820
2	All land in operating drainage enterprises.....	acres..	78,313	7,500	29,500	60,250	11,520	14,400	57,000	448,786
3	Improved land.....	acres..	1,202 <sup>1</sup>	750	1,940	10,204	1,152	350	1,080	17,658
4	Per cent of all improved land in farms.....		49.8	2.8	15.0	66.8	9.1	28.5	1.5	63.5
5	Timber and cut-over land.....	acres..	63,221	3,950	24,435	23,336	5,184	42,120	122,570	122,570
6	Other unimproved land.....	acres..	11,066	2,800	3,125	26,710	5,184	14,050	13,800	313,558
7	Swampy or subject to overflow in enterprises.....	acres..	25,525	4,225	26,350	33,574	2,880	4,450	10,800	195,586
8	Suffering a loss of crops from defective drainage.....	acres..	433	60	625	—	50	—	—	15,846
9	Assessed acreage.....		78,313	7,500	31,700	60,250	11,520	14,400	57,000	499,004
10	Excess over all land in operating enterprises.....	acres..	—	—	2,200	—	—	—	—	40,218
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....	miles..	62.6	27.0	15.7	55.5	10.0	25.0	66.0	266.1
12	Additional under construction.....	miles..	22.4	4.5	16.9	21.3	3.9	4.5	9.0	81.9
13	Maximum completed in any enterprise.....	miles..	31.4	25.5	9.6	10.8	10.0	18.0	36.0	48.0
14	Maximum width at bottom of ditch.....	feet..	40	40	24	22	36	20	30	90
15	Maximum of average depths of outlet ditches.....	feet..	10.0	7.0	6.0	10.0	5.0	4.0	7.0	22.0
16	Mean depth of branch ditches.....	feet..	4.0	3.0	—	3.6	—	—	3.0	4.1
Accessory levees and dikes:										
17	Completed.....	miles..	6.0	—	0.2	—	—	—	7.5	—
18	Additional under construction.....	miles..	—	—	3.5	—	—	—	—	42.0
Pumping plants:										
19	Engine capacity.....	horsepower..	—	—	—	—	—	—	—	75
20	Pump capacity.....	gallons per minute..	—	—	—	—	—	—	—	38,000
21	Area served by pumps.....	acres..	—	—	—	—	—	—	—	3,000
22	Area drained by open ditches only.....	acres..	51,313	7,500	5,500	60,250	11,520	14,400	54,000	329,786
23	Length of these ditches.....	miles..	52.0	31.5	9.5	76.8	13.9	29.5	45.0	257.2
24	Average length per acre.....	feet..	5.4	22.2	9.1	6.7	6.4	10.8	4.4	4.1
25	Area having open ditches and levees.....	acres..	25,000	—	24,000	—	—	—	3,000	119,000
26	Length of these ditches.....	miles..	33.0	—	23.1	—	—	—	30.0	90.8
27	Average length per acre.....	feet..	7.0	—	5.1	—	—	—	52.8	4.0
28	Length of the accessory levees.....	miles..	6.0	—	3.7	—	—	—	7.5	42.0
<b>DEVELOPMENT OF LAND.</b>										
29	Improved land in operating enterprises, 1920.....	acres..	1,202 <sup>1</sup>	750	1,940	10,204	1,152	350	1,080	17,658
30	Improved land prior to drainage.....	acres..	1,216	100	240	2,692	576	540	540	14,752
31	Increase since drainage.....	acres..	810	650	1,700	7,512	576	350	540	2,906
32	Per cent of increase.....		66.6	650.0	708.3	279.0	100.0	100.0	100.0	61.2
33	Per cent increase is of all improved land in farms, 1920.....		19.9	2.0	13.2	49.2	4.6	28.5	0.8	24.1
34	Timber and cut-over land, 1920.....	acres..	63,221	3,950	24,435	23,336	5,184	—	42,120	122,570
35	Timber and cut-over land prior to drainage.....	acres..	64,031	3,950	26,135	28,690	5,760	—	42,120	123,810
36	Decrease since drainage.....	acres..	810	—	1,700	6,254	576	—	—	1,240
37	Per cent of decrease.....		1.3	—	6.5	18.4	10.0	—	—	1.0
38	Other unimproved land, 1920.....	acres..	11,066	2,800	3,125	26,710	5,184	14,050	13,800	313,558
39	Other unimproved land prior to drainage.....	acres..	11,066	3,450	3,125	28,968	5,184	14,400	14,340	320,224
40	Decrease since drainage.....	acres..	—	650	—	2,258	—	350	540	1,666
41	Per cent of decrease.....		—	18.8	—	7.8	—	2.8	3.8	0.5
42	Swampy or subject to overflow, 1920.....	acres..	25,525	4,225	26,350	33,574	2,880	4,450	10,800	195,586
43	Swampy or subject to overflow prior to drainage.....	acres..	56,313	7,175	29,250	39,764	9,216	11,200	13,800	395,286
44	Decrease since drainage.....	acres..	30,788	2,950	2,900	6,190	6,336	6,750	3,000	199,700
45	Per cent of decrease.....		54.7	41.1	9.9	15.6	68.8	60.3	21.7	50.5
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
46	Total capital invested in and required for completion of operating enterprises.....	dollars..	352,650	97,900	389,350	412,276	75,000	74,346	183,500	9,703,753
47	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	277,590	77,900	29,350	297,276	54,165	62,846	163,500	4,773,218
48	Additional capital required to complete these enterprises.....	dollars..	105,060	20,000	360,000	115,000	20,835	11,500	20,000	4,925,535
49	Average cost per acre when completed.....	dollars..	5.01	13.05	13.20	6.84	6.51	5.16	3.22	21.62
50	Enterprises constructing open ditches only.....	dollars..	237,650	97,900	17,650	412,276	75,000	74,346	145,000	6,683,753
51	Average cost per acre when completed.....	dollars..	4.63	13.05	3.25	6.84	6.51	5.16	2.69	20.27
52	Enterprises constructing open ditches and levees.....	dollars..	145,000	—	371,500	—	—	—	38,500	3,020,000
53	Average cost per acre when completed.....	dollars..	5.80	—	15.48	—	—	—	12.83	25.38
<b>CROPS.</b>										
Improved land in enterprises reporting—										
54	Vegetables as principal crop on drained land.....	acres..	—	400	—	7,612	—	—	—	5,258
55	Potatoes as principal crop on drained land.....	acres..	2,026	—	—	—	—	—	—	80
56	Sugar cane as principal crop on drained land.....	acres..	—	350	—	—	1,152	350	—	1,000
57	Citrus fruits as principal crop on drained land.....	acres..	—	—	1,940	1,200	—	—	—	700
58	Other crops as principal ones on drained land.....	acres..	—	—	—	1,392	—	—	1,080	—
59	Not reporting crops.....	acres..	—	—	—	—	—	—	—	620

<sup>1</sup> Estimated total for county.

<sup>2</sup> When works under construction have been completed.

## DRAINAGE—FLORIDA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Pinellas.	Polk.	Putnam.	St. Johns.	St. Lucie.	Seminole.	Volusia.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>									
1	Approximate land area of the county.....	187,520	1,220,480	481,280	389,120	639,280	205,440	718,720	2,083,200
2	All land in operating drainage enterprises.....	32,900	56,400	34,000	7,740	115,645	6,972	48,937	6,640
3	Improved land.....	2,598	7,800	7,700	4,043	19,347	405	673	2,370
4	Per cent of all improved land in farms.....	23.0	14.2	33.1	31.3	71.7	3.4	3.7	1.4
5	Timber and cut-over land.....	23,450	21,700	16,600	3,697	53,540	6,511	25,230	740
6	Other unimproved land.....	6,852	26,900	9,700	.....	52,758	56	23,034	3,530
7	Swampy or subject to overflow in enterprises.....	120	.....	8,200	.....	42,911	111	24,325	3,955
8	Suffering a loss of crops from defective drainage.....	150	48	1,956	3,868	2,730	.....	27	1,510
9	Assessed acreage.....	32,900	56,400	34,000	7,740	115,645	6,972	48,937	6,640
10	Excess over all land in operating enterprises.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>									
11	Open ditches:								
12	Completed.....	148.0	167.0	26.5	7.3	319.9	24.5	22.2	67.7
13	Additional under construction.....	.....	14.0	7.5	0.7	153.4	.....	15.8	28.8
14	Maximum completed in any enterprise.....	66.0	124.5	15.3	4.5	186.0	19.5	15.4	42.0
15	Maximum width at bottom of ditch <sup>2</sup> .....	50	50	30	24	65	20	40	26
16	Maximum of average depths of outlet ditches <sup>2</sup> .....	7.0	8.0	11.0	4.0	15.0	7.0	10.0	10.0
17	Mean depth of branch ditches <sup>2</sup> .....	3.0	4.1	5.0	4.0	5.5	5.0	5.8	3.0
18	Accessory levees and dikes:								
19	Completed.....	.....	.....	.....	.....	23.5	.....	6.7	10.0
20	Additional under construction.....	.....	.....	.....	.....	21.0	.....	.....	.....
21	Pumping plants:								
22	Engine capacity.....	.....	.....	.....	.....	.....	.....	.....	45
23	Pump capacity.....	.....	.....	.....	.....	.....	.....	.....	1,000
24	Area served by pumps.....	.....	.....	.....	.....	.....	.....	.....	1,500
25	Area drained by open ditches only <sup>2</sup> .....	32,900	56,400	34,000	7,740	.....	6,972	8,937	3,640
26	Length of these ditches.....	148.0	181.0	34.0	8.0	.....	24.5	10.0	28.5
27	Average length per acre.....	23.8	18.9	5.3	5.5	.....	18.6	13.4	38.4
28	Area having open ditches and levees <sup>2</sup> .....	.....	.....	.....	.....	115,645	.....	45,000	3,000
29	Length of these ditches.....	.....	.....	.....	.....	473.3	.....	28.0	70.0
30	Average length per acre.....	.....	.....	.....	.....	21.6	.....	3.3	123.2
31	Length of the accessory levees.....	.....	.....	.....	.....	44.5	.....	6.7	10.0
<b>DEVELOPMENT OF LAND.</b>									
32	Improved land in operating enterprises, 1920.....	2,598	7,800	7,700	4,043	19,347	405	673	2,370
33	Improved land prior to drainage.....	614	.....	6,100	1,510	1,000	56	81	.....
34	Increase since drainage.....	1,984	7,800	2,600	2,533	8,347	349	592	2,370
35	Per cent of increase.....	323.1	.....	61.0	167.7	834.7	623.2	730.9	.....
36	Per cent increase is of all improved land in farms, 1920.....	17.6	14.3	11.2	19.6	64.0	3.0	3.2	1.4
37	Timber and cut-over land, 1920.....	23,450	21,700	16,600	3,697	53,540	6,511	25,230	740
38	Timber and cut-over land prior to drainage.....	23,842	21,700	18,300	6,230	57,322	6,880	25,347	880
39	Decrease since drainage.....	392	.....	1,700	2,533	3,782	349	117	140
40	Per cent of decrease.....	1.6	.....	9.3	40.7	8.6	5.1	0.5	15.9
41	Other unimproved land, 1920.....	6,852	26,900	9,700	.....	52,758	56	23,034	3,530
42	Other unimproved land prior to drainage.....	8,444	34,700	10,600	.....	57,323	56	23,509	5,760
43	Decrease since drainage.....	1,592	7,800	900	.....	4,565	.....	475	2,230
44	Per cent of decrease.....	18.9	22.5	8.5	.....	8.0	.....	2.0	38.7
45	Swampy or subject to overflow, 1920.....	120	.....	8,200	.....	42,911	111	24,325	3,955
46	Swampy or subject to overflow, prior to drainage.....	30,500	53,000	23,200	7,740	50,645	6,972	26,082	5,920
47	Decrease since drainage.....	30,380	53,000	15,000	7,740	7,734	6,861	1,737	1,965
48	Per cent of decrease.....	99.6	100.0	64.7	100.0	15.3	93.4	6.7	33.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
49	Total capital invested in and required for completion of operating enterprises.....	167,000	355,000	83,000	22,500	4,261,308	52,000	536,310	81,000
50	Capital invested in these enterprises to Dec. 31, 1919.....	167,000	325,000	67,000	20,000	2,801,308	52,000	306,370	55,000
51	Additional capital required to complete these enterprises.....	.....	30,000	16,000	2,500	1,460,000	.....	229,940	26,000
52	Average cost per acre when completed.....	5.08	6.29	2.44	2.91	36.85	7.46	10.96	12.20
53	Enterprises constructing open ditches only.....	167,000	355,000	83,000	22,500	.....	52,000	22,350	11,000
54	Average cost per acre when completed.....	5.08	6.29	2.44	2.91	.....	7.46	5.68	3.02
55	Enterprises constructing open ditches and levees.....	.....	.....	.....	.....	4,261,308	.....	513,960	70,000
56	Average cost per acre when completed.....	.....	.....	.....	.....	36.85	.....	11.42	23.33
<b>CROPS.</b>									
57	Improved land in enterprises reporting—								
58	Vegetables as principal crop on drained land.....	2,582	.....	.....	.....	.....	405	.....	520
59	Potatoes as principal crop on drained land.....	.....	7,800	3,200	4,043	.....	.....	835	.....
60	Sugar cane as principal crop on drained land.....	.....	.....	.....	.....	1,000	.....	88	.....
61	Citrus fruits as principal crop on drained land.....	.....	.....	.....	.....	6,000	.....	.....	.....
62	Other crops as principal ones on drained land.....	.....	.....	4,500	.....	2,347	.....	.....	1,850
63	Not reporting crops.....	16	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> Includes only Marion, Santa Rosa, and Sumter Counties.<sup>2</sup> Estimated total for county.<sup>3</sup> When works under construction have been completed.



## GEORGIA.

The following pages present the statistics of drainage for Georgia collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

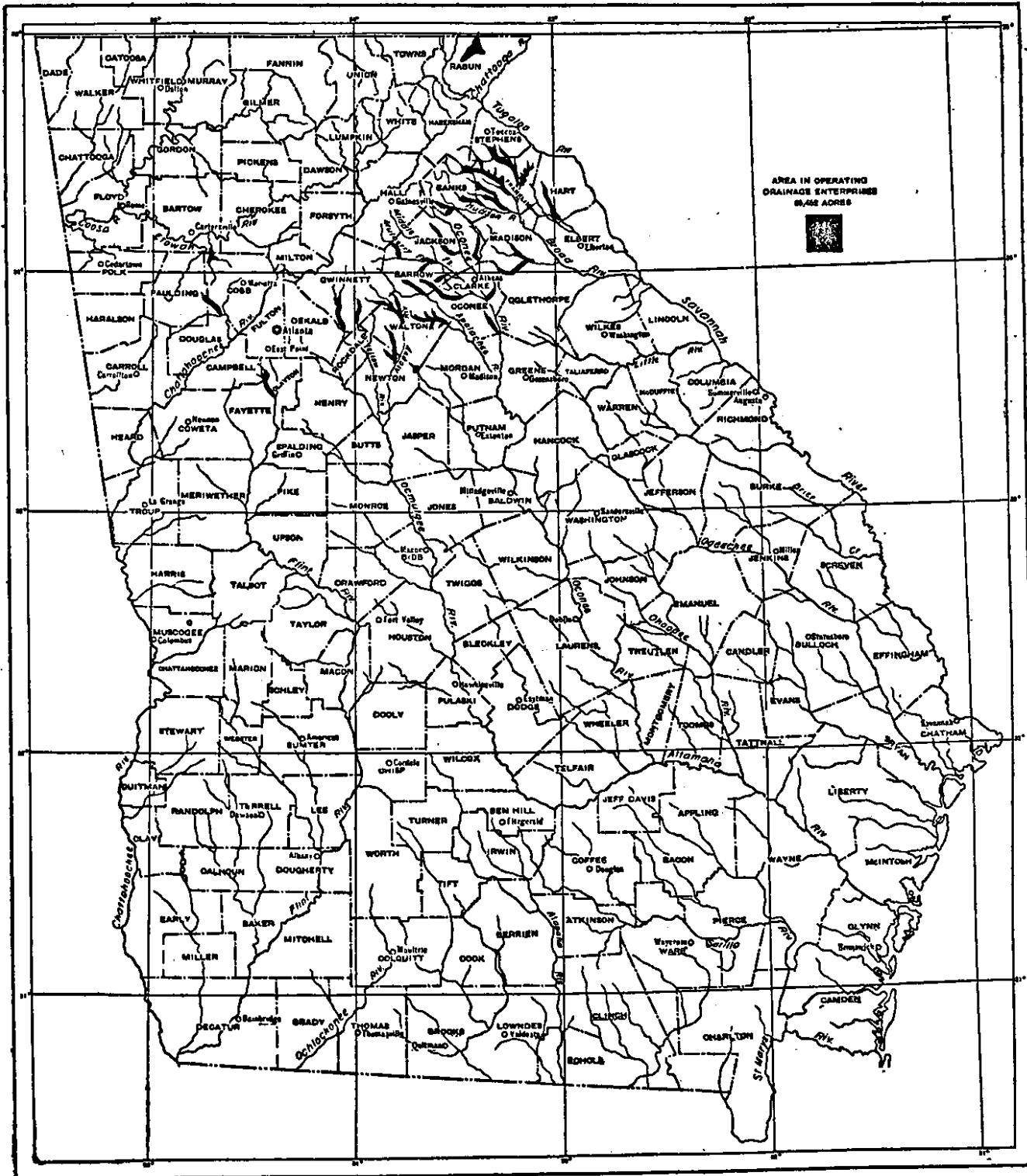
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Percent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	310,732	100.0
Farms reporting land having drainage.....	15,121	4.9
Farms reporting land needing drainage.....	34,337	11.1
All land in farms.....acres..	25,441,061	100.0
Improved land in farms.....acres..	13,055,209	51.3
Farm land reported as provided with drainage.....acres..	274,688	1.1
Farm land reported as needing drainage.....acres..	1,819,611	7.2
Needing drainage only.....acres..	143,187	0.6
Needing drainage and clearing.....acres..	1,676,424	6.6
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state.....acres..	37,584,000	100.0
All land in operating drainage enterprises.....acres..	65,452	0.2
Improved land.....acres..	29,753	0.1
Per cent of all improved land in farms.....	0.2	.....
Timber and cut-over land.....acres..	10,155	(1)
Other unimproved land.....acres..	25,544	0.1
Swampy, subject to overflow, seeped, or alkali.....acres..	21,951	0.1
Suffering a loss of crops from defective drainage.....acres..	1,832	(1)
Improved land prior to drainage.....acres..	7,229	(1)
Increase since drainage began.....acres..	22,524	0.1
Land in nonoperating enterprises.....acres..	38,554	0.1
Open ditches in operating enterprises.....miles..	356.7	100.0
Completed.....miles..	276.8	77.6
Additional under construction.....miles..	79.9	22.4
Tile drains in operating enterprises.....miles..	.....	.....
Completed.....miles..	.....	.....
Additional under construction.....miles..	.....	.....
Total capital invested in and required for completion of operating enterprises..	\$1,098,239	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	794,585	72.4
Additional capital required to complete these enterprises.....	303,654	27.6
Average cost per acre when completed.....	16.78	.....

(1) Less than one-tenth of 1 per cent.

# GEORGIA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by the drainage court and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	104,006	100.0	\$623,681	100.0	\$1,231,176
Operating enterprises.....	65,452	62.9	794,585	95.9	303,654
With works completed.....	43,723	42.0	614,636	74.2	.....
With works under construction...	21,729	20.9	179,949	21.7	303,654
Nonoperating enterprises.....	38,554	37.1	34,096	4.1	927,522

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—All the drainage enterprises in Georgia, both operating and nonoperating, are situated in the northern part of the state. The map on page 2 shows the location of the operating enterprises; the nonoperating enterprises are in the same and adjoining counties.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	104,006	100.0	\$623,681	100.0	\$1,231,176
Operating enterprises.....	65,452	62.9	794,585	95.9	303,654
Alabama River.....	1,550	1.5	38,077	4.6	.....
Apalachicola River.....	2,338	2.2	47,986	5.8	20,000
Savannah River.....	43,599	41.9	376,701	45.5	156,284
Altamaha River.....	17,965	17.3	331,821	40.0	127,390
Nonoperating enterprises.....	38,554	37.1	34,096	4.1	927,522
Apalachicola River.....	2,582	2.5	3,700	0.4	71,624
Savannah River.....	6,572	6.3	13,146	1.6	148,932
Altamaha River.....	29,400	28.3	17,250	2.1	707,016

Condition of land in enterprises.—The drainage enterprises are in the rolling and hilly section of the

state, and are for the drainage and protection of the land which is subject to overflow when floods occur in the streams. The areas to be drained usually are long and narrow, and the improvements generally are made by cleaning out or enlarging and straightening the natural watercourses.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	65,452	100.0	43,723	21,729	38,554
Improved land.....	29,753	45.5	25,699	4,054	9,622
Timber and cut-over land.....	10,155	15.5	3,605	6,550	9,426
Other unimproved land.....	25,544	39.0	14,419	11,126	19,506
Swampy or subject to overflow..	21,951	33.5	3,322	18,629	23,232
Suffering a loss of crops.....	1,832	2.8	1,832	.....	6,862

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 46 operating and 27 nonoperating drainage enterprises are counted in Georgia. The average area of the operating enterprises is thus 1,423 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	65,452	65,452	100.0
Less than 200 acres.....	488	488	0.7
200 to 499 acres.....	2,764	2,764	4.2
500 to 999 acres.....	11,750	11,750	18.0
1,000 to 4,999 acres.....	25,205	25,205	38.5
5,000 to 9,999 acres.....	15,245	15,245	23.3
10,000 to 49,999 acres.....	10,000	10,000	15.3

Character of enterprises.—With one exception all the drainage enterprises found in Georgia are drainage districts organized under a law approved August 19, 1911 (ch. 265). One enterprise of 10,000 acres was formed by mutual agreement among the landowners who would receive the benefit from the work, and each performed or paid for the excavation of the ditch across his own land.

Drainage districts are established by a special court in each county, comprised of the clerk of the superior court and the board of commissioners of roads and revenues or, if there be no such board, the ordinary of the county. A petition for establishment must be signed by a majority of the landowners resident in the proposed district or by the owners of three-fifths or more of the land. A preliminary investigation as to the practicability and utility of the undertaking is made, before the district is formally established, by a board of three viewers appointed by the drainage court. After the order establishing the district is made, the viewers prepare the plan of drainage improvements, assess the damages for which claims are filed, and divide the land into five classes according to the benefits each tract will receive. Public hearings are held by the court upon the viewers' preliminary report and again upon their final report presenting the plan for drainage and the assessments of damages and the classification of the land. Appeals from decisions of the drainage court may be taken to the superior court of the county. A board of three drainage commissioners, appointed by the court after election by the landowners in the district, lets contract for constructing the improvements and administers the other affairs of the district. The cost is apportioned according to the classification of the land, the assessments against the respective classes being, per acre, in the ratio 5:4:3:2:1. Bonds may be issued by the commissioners if the cost exceeds an average of 25 cents per acre on all the land in the district.

A law of August 27, 1879, authorized each county to establish and maintain a system of drainage, and other drainage laws were enacted in 1893 and 1909, but these seem to have been designed for the improvement of sanitary conditions. The drainage law of 1911 has been amended in 1913, 1917, and 1918, but without affecting the character of the enterprises as described.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 276.8 miles of open ditches, and the additional works under construction on that date were 79.9 miles of ditches. No tile drains were included in the plans of improvement undertaken by the operating enterprises. The figures given do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts for land drainage in Georgia.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of

the depth of soil drainage that may be obtained in the enterprises, as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 6.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	65,452	100.0
4.0 to 4.9 feet.....	10,950	16.7
5.0 to 5.9 feet.....	29,589	45.4
6.0 to 6.9 feet.....	3,073	4.7
7.0 to 7.9 feet.....	2,802	4.0
8.0 to 8.9 feet.....	3,434	5.2
9.0 to 9.9 feet.....	700	1.1
Not reporting branches.....	15,004	22.9

**Maintenance of works.**—The drainage law of 1911 provides that it shall be the duty of the board of drainage commissioners of each district to keep the ditches and other drainage works in good repair, and for that purpose they may levy assessments against the land benefited by the construction of the works in the same manner and in the same proportion as the cost of original construction was apportioned. Individual landowners are liable for the cost of repair work made necessary by their negligence.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	65,452	100.0	\$794,585	100.0	\$303,654
By district forces.....	2,108	3.2	52,205	6.6	.....
By contract.....	9,659	14.8	194,533	24.5	74,408
By method not specified.....	11,812	18.0	150,486	18.9	.....
No maintenance provided.....	18,113	27.7	306,682	38.6	94,284
Not reporting <sup>1</sup> .....	23,760	36.3	90,679	11.4	134,968

<sup>1</sup> Includes one enterprise maintained by landowners.

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the drainage court, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, including extensions made after the original plan of reclamation was completed.

DRAINAGE—GEORGIA.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	65,452	100.0	65,452	100.0
1880 to 1889.....	10,000	15.3	10,000	15.3
1910 to 1914.....	11,326	17.3	11,326	17.3
1915 to 1919.....	44,126	67.4	44,126	67.4

TABLE 9.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL INVESTED.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Percent of total.	
All operating enterprises.....	\$704,585	100.0	\$303,654
1910 to 1914 <sup>1</sup> .....	140,500	17.7	.....
1915 to 1919.....	654,085	82.3	303,654

<sup>1</sup> Includes cost for 10,000 acres under individual ownership constructed prior to 1889.

TABLE 10.—DRAINS (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.	
	Miles.	Per cent of total.
All drains.....	356.7	100.0
1880 to 1889.....	8.0	2.2
1910 to 1914.....	43.4	13.6
1915 to 1919.....	300.3	84.2

Crops.—The principal crop grown upon the drained land in drainage enterprises is corn; the crop of second importance is oats, for all enterprises reporting this item. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—GEORGIA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		The State.	Bacon.	Baker.	Banks.	Barrow.	Bartow.	Berrien.
1	Number of all farms in the state or county.....	310,732	802	1,407	2,111	1,851	3,091	1,744
2	Farms reporting land having drainage.....	15,121	53	45	245	38	50	28
3	Farms reporting land needing drainage.....	34,337	229	84	254	75	238	240
4	Farms in drainage and levee districts.....	995			70	23	1	
<b>LAND AND FARM AREA.</b>								
5	Approximate land area of the state or county..... acres..	37,584,000	173,440	228,480	142,080	107,520	301,440	320,000
6	All land in farms..... acres..	25,441,061	114,491	121,236	123,385	80,816	220,980	230,750
7	Improved land in farms..... acres..	13,055,209	34,269	85,211	61,449	59,526	123,191	70,457
8	Woodland in farms..... acres..	10,491,848	79,196	33,395	53,239	16,138	90,590	150,963
9	Other unimproved land in farms..... acres..	1,894,004	1,026	2,630	8,697	5,152	7,199	9,330
10	Farm land reported as provided with drainage..... acres..	274,688	2,137	522	2,438	623	956	762
11	Farm land reported as needing drainage..... acres..	1,819,611	20,198	4,212	3,830	2,107	9,489	23,466
12	Drainage only..... acres..	143,187	2,494	77	252	313	453	250
13	Drainage and clearing..... acres..	1,676,424	17,704	4,135	3,578	1,794	9,006	23,186

		Bleckley.	Brooks.	Bryan.	Bulloch.	Burke.	Calhoun.	Camden.	Carroll.
1	Number of all farms in the county.....	1,255	2,726	792	3,672	4,675	1,442	334	5,436
2	Farms reporting land having drainage.....	60	131	157	257	84	66	106	296
3	Farms reporting land needing drainage.....	277	574	326	149	188	91	176	777
4	Farms in drainage and levee districts.....			1				1	1
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	131,200	328,960	275,840	427,520	611,840	181,760	455,040	314,880
6	All land in farms..... acres..	106,091	269,735	163,946	354,015	414,582	123,962	152,900	274,929
7	Improved land in farms..... acres..	68,927	141,649	29,024	158,882	274,423	84,631	8,597	163,352
8	Woodland in farms..... acres..	34,785	122,383	123,075	166,318	120,368	37,155	125,788	89,356
9	Other unimproved land in farms..... acres..	2,379	5,708	11,847	28,815	19,791	2,176	18,515	22,221
10	Farm land reported as provided with drainage..... acres..	604	1,308	6,346	2,616	3,221	1,446	3,538	2,708
11	Farm land reported as needing drainage..... acres..	14,533	36,479	51,386	8,511	15,080	11,086	33,882	20,666
12	Drainage only..... acres..	845	2,779	11,600	597	1,299	1,840	2,958	823
13	Drainage and clearing..... acres..	13,688	36,700	39,786	7,914	13,781	9,246	30,924	19,843

		Chatham.	Chattahoochee.	Chattooga.	Cherokee.	Clinch.	Cobb.	Coffee.	Colquitt.
1	Number of all farms in the county.....	625	425	1,870	2,626	650	3,698	2,049	3,421
2	Farms reporting land having drainage.....	45	43	28	325	43	106	60	118
3	Farms reporting land needing drainage.....	89	98	281	258	99	206	277	414
4	Farms in drainage and levee districts.....	40	1	2	1		53		
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	236,800	139,520	209,920	274,560	576,000	225,920	404,480	338,560
6	All land in farms..... acres..	104,493	60,742	172,018	213,152	209,317	192,078	297,215	260,496
7	Improved land in farms..... acres..	15,510	24,142	92,486	81,518	23,532	110,375	108,892	145,422
8	Woodland in farms..... acres..	70,688	33,175	65,376	112,233	164,922	67,838	113,674	108,206
9	Other unimproved land in farms..... acres..	18,295	3,425	14,156	19,401	20,853	13,855	74,649	6,868
10	Farm land reported as provided with drainage..... acres..	5,515	720	502	1,999	961	1,917	1,475	810
11	Farm land reported as needing drainage..... acres..	47,301	8,525	14,922	2,902	10,398	4,211	34,597	16,869
12	Drainage only..... acres..	11,584	132	1,956	786	3,010	617	2,897	895
13	Drainage and clearing..... acres..	35,707	8,393	12,066	2,116	7,388	3,594	31,700	15,974

		Columbia.	Cook.	Coweta.	Crawford.	Crisp.	Dawson.	DeKalb.	Dooly.
1	Number of all farms in the county.....	1,914	1,223	3,374	1,369	2,052	845	2,903	2,772
2	Farms reporting land having drainage.....	172	43	140	162	229	66	99	396
3	Farms reporting land needing drainage.....	65	396	262	339	248	34	353	856
4	Farms in drainage and levee districts.....		1		1	1		1	2
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	234,000	154,240	283,520	204,160	177,280	138,240	174,080	254,080
6	All land in farms..... acres..	135,308	113,913	215,962	153,390	143,717	88,130	126,000	190,272
7	Improved land in farms..... acres..	80,255	60,448	135,225	69,128	97,156	29,329	73,815	138,735
8	Woodland in farms..... acres..	46,787	55,473	60,940	69,615	44,145	53,193	42,648	43,387
9	Other unimproved land in farms..... acres..	8,266	7,992	19,797	14,647	2,416	5,608	9,537	8,150
10	Farm land reported as provided with drainage..... acres..	2,958	813	1,799	4,643	2,541	729	567	5,631
11	Farm land reported as needing drainage..... acres..	1,332	22,819	6,403	32,403	7,759	378	7,344	29,540
12	Drainage only..... acres..	518	899	499	2,642	488	273	615	2,731
13	Drainage and clearing..... acres..	814	21,920	5,904	29,761	7,271	105	6,729	26,809

		Douglas.	Early.	Effingham.	Fannin.	Fayette.	Floyd.	Forsyth.	Franklin.
1	Number of all farms in the county.....	1,783	3,128	1,176	1,387	2,026	3,516	2,329	3,378
2	Farms reporting land having drainage.....	375	135	182	246	68	196	200	374
3	Farms reporting land needing drainage.....	342	238	463	142	113	412	342	432
4	Farms in drainage and levee districts.....	2		8	3	1	2	3	203
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	133,120	335,360	288,720	256,640	149,760	321,280	158,080	178,560
6	All land in farms..... acres..	102,915	225,366	183,724	147,066	97,728	253,369	145,394	142,053
7	Improved land in farms..... acres..	50,423	151,917	44,319	36,548	64,848	132,663	72,887	90,578
8	Woodland in farms..... acres..	49,041	66,002	138,084	105,574	27,712	98,746	63,956	40,330
9	Other unimproved land in farms..... acres..	3,451	7,447	1,321	4,943	5,168	21,980	8,561	11,150
10	Farm land reported as provided with drainage..... acres..	9,808	1,687	5,180	2,352	852	4,231	1,117	7,869
11	Farm land reported as needing drainage..... acres..	14,236	18,047	39,675	1,726	1,105	15,267	6,485	7,813
12	Drainage only..... acres..	327	767	1,490	329	30	1,350	294	1,231
13	Drainage and clearing..... acres..	13,909	17,280	38,185	1,397	1,075	13,887	6,191	6,581

# DRAINAGE—GEORGIA.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Gilmer.	Gordon.	Gwinnett.	Haber-sham.	Hall.	Hancock.	Haralson.	Heard.
1	Number of all farms in the county.....	1,433	2,736	4,460	1,185	2,997	2,772	2,068	2,147
2	Farms reporting land having drainage.....	137	351	421	106	108	55	213	159
3	Farms reporting land needing drainage.....	260	392	606	52	189	271	217	121
4	Farms in drainage and levee districts.....	3	7	115	68		1		12
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	281,600	240,000	281,600	185,600	279,680	339,200	181,760	182,400
6	All land in farms.....acres..	180,119	196,262	241,820	109,471	210,431	208,801	141,050	154,824
7	Improved land in farms.....acres..	37,240	103,199	133,668	39,265	95,850	121,643	66,009	77,713
8	Woodland in farms.....acres..	137,417	81,349	89,765	67,994	97,686	66,669	61,385	66,133
9	Other unimproved land in farms.....acres..	5,462	11,714	17,887	2,212	16,895	20,489	13,655	10,978
10	Farm land reported as provided with drainage.....acres..	1,255	4,011	2,673	1,528	2,140	1,098	1,576	2,556
11	Farm land reported as needing drainage.....acres..	9,590	6,905	7,908	630	6,189	6,275	4,591	2,939
12	Drainage only.....acres..	166	1,646	704	174	619	1,151	415	297
13	Drainage and clearing.....acres..	9,424	5,259	7,199	456	5,570	5,124	4,176	2,642

		Houston.	Irwin.	Jeff Davis.	Jefferson.	Jenkins.	Laurens.	Lee.	Lincoln.
1	Number of all farms in the county.....	2,076	1,659	908	3,253	2,119	5,337	1,691	1,668
2	Farms reporting land having drainage.....	101	193	46	77	188	59	156	127
3	Farms reporting land needing drainage.....	167	139	118	352	451	330	122	212
4	Farms in drainage and levee districts.....			23		1	1		
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	374,400	241,920	192,000	413,440	218,680	515,840	208,640	186,240
6	All land in farms.....acres..	248,581	171,956	139,656	235,331	165,854	370,557	172,048	128,828
7	Improved land in farms.....acres..	159,762	89,925	39,637	141,025	84,077	250,278	111,015	56,169
8	Woodland in farms.....acres..	82,009	77,228	96,387	81,698	78,135	109,666	53,272	62,770
9	Other unimproved land in farms.....acres..	6,820	4,803	3,632	12,708	3,642	10,613	7,761	9,889
10	Farm land reported as provided with drainage.....acres..	2,648	3,359	697	1,454	1,583	855	2,320	3,396
11	Farm land reported as needing drainage.....acres..	25,354	19,301	9,870	8,016	83,572	8,775	16,098	8,939
12	Drainage only.....acres..	238	2,053	181	84	433	348	68	901
13	Drainage and clearing.....acres..	25,116	17,248	9,689	7,931	83,139	8,429	16,030	8,038

		Lowndes.	Lumpkin.	Macon.	Marion.	Merri-wether.	Milton.	Monroe.	Murray.
1	Number of all farms in the county.....	2,065	925	1,912	1,059	3,652	1,306	2,958	1,557
2	Farms reporting land having drainage.....	51	80	22	31	211	132	122	72
3	Farms reporting land needing drainage.....	502	262	135	67	406	203	231	142
4	Farms in drainage and levee districts.....	3		1	1		1		
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	304,640	179,200	236,160	230,400	317,440	62,800	373,760	218,880
6	All land in farms.....acres..	273,927	96,002	216,784	164,552	229,732	78,802	234,897	130,641
7	Improved land in farms.....acres..	106,507	27,012	131,637	80,754	147,213	42,141	127,714	56,547
8	Woodland in farms.....acres..	121,737	62,387	79,697	68,445	63,024	28,913	53,200	67,120
9	Other unimproved land in farms.....acres..	45,683	7,223	5,450	15,353	19,496	7,745	23,923	6,974
10	Farm land reported as provided with drainage.....acres..	1,257	1,387	771	1,576	2,194	753	996	1,776
11	Farm land reported as needing drainage.....acres..	43,694	12,513	8,563	4,708	8,188	3,762	4,961	3,923
12	Drainage only.....acres..	1,652	745	1,426	1,140	883	680	302	568
13	Drainage and clearing.....acres..	42,042	11,768	7,137	3,563	7,305	3,082	4,659	3,355

		Newton.	Ogle-thorpe.	Faulding.	Pickens.	Pierce.	Polk.	Pulaski.	Rabun.
1	Number of all farms in the county.....	2,439	3,503	2,467	1,162	1,378	2,229	1,435	745
2	Farms reporting land having drainage.....	186	606	77	60	107	96	157	89
3	Farms reporting land needing drainage.....	292	508	133	455	236	103	461	34
4	Farms in drainage and levee districts.....	13	6		1	9		25	
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	167,680	322,560	207,360	147,840	330,880	202,680	165,120	241,280
6	All land in farms.....acres..	144,313	202,960	166,445	119,769	189,600	145,545	127,049	72,461
7	Improved land in farms.....acres..	98,597	122,698	76,840	36,248	81,006	81,679	79,345	19,514
8	Woodland in farms.....acres..	31,480	60,461	76,888	79,298	106,549	64,067	41,466	50,353
9	Other unimproved land in farms.....acres..	14,236	19,801	12,717	4,223	31,945	9,799	6,238	2,594
10	Farm land reported as provided with drainage.....acres..	5,455	16,249	659	554	6,141	2,569	1,494	1,766
11	Farm land reported as needing drainage.....acres..	4,855	15,159	1,716	23,220	14,040	3,680	14,200	279
12	Drainage only.....acres..	989	1,482	112	157	1,328	628	483	159
13	Drainage and clearing.....acres..	3,866	13,677	1,604	23,063	13,312	3,052	13,717	120

## DRAINAGE—GEORGIA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Richmond.	Scriven.	Stephens.	Stewart.	Sumter.	Talferro.	Taylor.	Telfair.
1 Number of all farms in the county.....	1,584	3,636	1,348	1,454	3,040	1,553	1,527	1,897
2 Farms reporting land having drainage.....	29	301	52	167	368	457	243	239
3 Farms reporting land needing drainage.....	14	407	234	273	369	291	235	324
4 Farms in drainage and levee districts.....		3	18		1		1	
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	204,160	508,160	106,240	263,040	291,840	135,680	217,600	238,720
6 All land in farms.....acres..	130,611	331,386	87,530	206,559	263,898	87,413	191,009	175,401
7 Improved land in farms.....acres..	70,821	149,428	34,388	106,532	175,117	46,788	84,791	87,055
8 Woodland in farms.....acres..	57,328	170,800	47,916	85,325	81,575	33,019	97,779	82,526
9 Other unimproved land in farms.....acres..	2,462	11,158	5,246	14,702	7,206	7,606	8,439	5,820
10 Farm land reported as provided with drainage.....acres..	756	3,333	529	11,241	6,724	11,913	10,199	10,592
11 Farm land reported as needing drainage.....acres..	323	31,306	6,363	17,935	21,131	17,177	22,332	16,726
12 Drainage only.....acres..	190	268	72	2,531	1,672	919	1,148	828
13 Drainage and clearing.....acres..	133	31,040	6,321	15,404	19,459	16,258	21,234	15,898

	Terrell.	Towns.	Troup.	Twiggs.	Union.	Upson.	Walton.	Ware.
1 Number of all farms in the county.....	2,469	696	2,781	1,316	1,170	1,753	3,636	874
2 Farms reporting land having drainage.....	291	62	36	48	217	98	118	145
3 Farms reporting land needing drainage.....	142	27	117	216	240	50	148	228
4 Farms in drainage and levee districts.....	1						66	1
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	206,080	115,840	278,400	200,960	207,360	202,880	211,840	493,440
6 All land in farms.....acres..	163,688	67,412	207,850	142,619	130,429	146,536	176,011	127,863
7 Improved land in farms.....acres..	120,492	22,750	121,932	80,781	35,722	75,964	121,445	31,923
8 Woodland in farms.....acres..	29,836	41,707	58,441	56,219	88,480	56,942	41,406	72,641
9 Other unimproved land in farms.....acres..	13,360	2,955	27,477	5,619	6,227	13,630	13,160	25,299
10 Farm land reported as provided with drainage.....acres..	6,416	762	2,340	1,083	1,968	857	1,115	4,205
11 Farm land reported as needing drainage.....acres..	4,159	170	4,473	15,933	2,613	821	3,656	40,731
12 Drainage only.....acres..	582	55	688	232	659	368	290	471
13 Drainage and clearing.....acres..	3,577	115	3,785	15,701	1,964	453	3,366	40,260

	Washing- ton.	Wayne.	White.	Whitfield.	Wilcox.	Wilkes.	Worth.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	4,031	1,406	941	1,852	2,153	3,789	3,605	111,040
2 Farms reporting land having drainage.....	56	42	283	53	405	149	129	977
3 Farms reporting land needing drainage.....	544	422	103	74	118	551	183	10,351
4 Farms in drainage and levee districts.....	2	5		1	1	22		160
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	428,160	504,320	156,800	181,120	257,920	293,120	416,640	13,566,720
6 All land in farms.....acres..	310,230	244,677	92,075	157,279	185,833	242,014	259,688	8,918,322
7 Improved land in farms.....acres..	196,673	52,753	27,434	78,022	115,818	138,644	167,329	4,736,973
8 Woodland in farms.....acres..	77,632	187,307	59,755	70,595	61,544	83,361	69,166	3,411,185
9 Other unimproved land in farms.....acres..	35,625	4,617	4,886	8,662	8,473	20,009	23,193	770,164
10 Farm land reported as provided with drainage.....acres..	511	949	3,354	915	4,868	2,598	1,225	11,706
11 Farm land reported as needing drainage.....acres..	13,690	45,864	2,161	2,636	4,992	18,118	8,648	565,110
12 Drainage only.....acres..	698	2,878	303	918	669	493	1,901	39,706
13 Drainage and clearing.....acres..	13,292	42,986	1,858	1,718	4,323	17,625	6,747	525,404

<sup>1</sup> No drainage on farms reported in Campbell, Decatur, Echols, Glascock, Harris, McIntosh, Rockdale, Schley, Toombs, and Wheeler Counties.



# DRAINAGE—GEORGIA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Banks.	Barrow.	Cobb.	Franklin.	Gwinnett.
<b>LAND AREA.</b>							
1	Approximate land area of the state or county.....acres..	87,584,000	142,080	107,520	225,920	178,560	281,600
2	All land in operating drainage enterprises.....acres..	65,452	5,097	3,274	2,502	21,055	2,692
3	Improved land.....acres..	29,753	2,419	889	1,500	5,548	1,661
4	Per cent of all improved land in farms.....	0.2	3.9	1.5	1.4	6.1	1.2
5	Timber and cut-over land.....acres..	10,155	1,077	433	250	3,797	113
6	Other unimproved land.....acres..	25,544	1,601	1,952	752	11,710	918
7	Swampy or subject to overflow, in enterprises.....acres..	21,951	2,846	1,823	1,252	9,556	18
8	Suffering a loss of crops from defective drainage.....acres..	1,832	772	223	.....	.....	2
9	Assessed acreage.....	65,452	5,097	3,274	2,502	21,055	2,692
10	Excess over all land in operating enterprises.....acres..	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>							
Open ditches:							
11	Completed.....miles.....	276.8	28.5	15.9	16.3	54.5	23.1
12	Additional under construction.....miles.....	79.9	2.9	12.5	5.2	24.1	4.5
13	Maximum completed in any enterprise.....miles.....	21.5	8.0	3.5	11.0	21.5	13.5
14	Maximum width at bottom of ditch <sup>1</sup> .....feet.....	46	46	30	20	45	22
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet.....	10.0	8.0	10.0	9.0	9.0	8.0
16	Mean depth of branch ditches <sup>1</sup> .....feet.....	5.1	4.6	6.7	7.0	5.0	8.0
17	Area drained by open ditches only <sup>1</sup> .....acres.....	65,452	5,097	3,274	2,502	21,055	2,692
18	Length of these ditches.....miles.....	356.7	31.4	28.4	21.5	78.6	27.6
19	Average length per acre.....feet.....	28.8	32.5	45.8	45.4	19.7	54.1
<b>DEVELOPMENT OF LAND.</b>							
20	Improved land in operating enterprises, 1920.....acres..	29,753	2,419	889	1,500	5,548	1,661
21	Improved land prior to drainage.....acres..	7,229	949	238	500	3,491	200
22	Increase since drainage.....acres.....	22,524	1,470	651	1,000	2,057	1,461
23	Per cent of increase.....	311.6	154.9	273.5	200.0	58.9	730.5
24	Per cent increase is of all improved land in farms, 1920.....	0.2	2.4	1.1	0.9	2.3	1.1
25	Timber and cut-over land, 1920.....acres.....	10,155	1,077	433	250	3,797	113
26	Timber and cut-over land prior to drainage.....acres..	25,081	2,184	721	500	4,749	676
27	Decrease since drainage.....acres.....	14,926	1,107	288	250	952	563
28	Per cent of decrease.....	59.5	50.7	39.9	50.0	20.0	83.3
29	Other unimproved land, 1920.....acres.....	25,544	1,601	1,952	752	11,710	918
30	Other unimproved land prior to drainage.....acres..	33,142	1,964	2,315	1,502	12,815	1,816
31	Decrease since drainage.....acres.....	7,598	363	363	750	1,105	898
32	Per cent of decrease.....	22.9	18.5	15.7	49.9	8.6	49.4
33	Swampy or subject to overflow, 1920.....acres.....	21,951	2,846	1,823	1,252	9,556	18
34	Swampy or subject to overflow, prior to drainage.....acres..	54,092	4,650	2,793	2,502	12,655	2,132
35	Decrease since drainage.....acres.....	32,141	1,804	970	1,250	3,099	2,114
36	Per cent of decrease.....	59.4	38.8	34.7	50.0	24.5	99.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>							
37	Total capital invested in and required for completion of operating enterprises.....dollars..	1,098,239	100,500	94,558	73,000	308,574	53,000
38	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	794,585	100,500	52,570	53,000	182,857	42,000
39	Additional capital required to complete these enterprises.....dollars..	303,654	.....	41,988	20,000	125,717	11,000
40	Average cost per acre when completed.....dollars.....	16.78	19.72	28.88	29.18	14.66	19.69
41	Enterprises constructing open ditches only.....dollars.....	1,098,239	100,500	94,558	73,000	308,574	53,000
42	Average cost per acre when completed.....dollars.....	16.78	19.72	28.88	29.18	14.66	19.69
<b>CROPS.</b>							
Improved land in enterprises reporting—							
43	Corn as principal crop on drained land.....acres.....	20,201	2,216	889	1,500	5,548	1,661
44	Not reporting principal crop on drained land.....acres.....	462	203	.....	.....	.....	.....

<sup>1</sup> When works under construction have been completed.

## DRAINAGE—GEORGIA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Hart.	Jackson.	Madison.	Oconee	Stephens.	Walton.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>								
1	Approximate land area of the county.....acres..	167,040	227,200	181,760	110,080	106,240	211,840	1,553,920
2	All land in operating drainage enterprises.....acres..	1,831	4,681	1,372	2,750	3,522	3,232	13,444
3	Improved land.....acres..	183	1,442	61	1,385	1,012	2,305	11,848
4	Per cent of all improved land in farms.....	0.2	1.1	0.1	2.1	2.9	1.9	1.9
5	Timber and cut-over land.....acres..	549	2,305	213	523	251	306	338
6	Other unimproved land.....acres..	1,099	934	1,098	842	2,259	621	1,758
7	Swampy or subject to overflow, in enterprises.....acres..	1,831	3,239	608	438	299		41
8	Suffering a loss of crops from defective drainage.....acres..		190		438		118	89
9	Assessed acreage.....acres..	1,831	4,681	1,372	2,750	3,522	3,232	13,444
10	Excess over all land in operating enterprises.....acres..							
<b>DRAINAGE WORKS.</b>								
11	Open ditches:							
12	Completed.....miles.....	6.5	19.8	11.6	20.9	7.3	34.5	37.9
13	Additional under construction.....miles.....	2.1	21.7	6.6		0.3		
14	Maximum completed in any enterprise.....miles.....	6.5	11.5	10.2	7.5	7.2	17.3	8.0
15	Maximum width at bottom of ditch <sup>2</sup> .....feet.....	16	40	26	20	9	35	26
16	Maximum of average depths of outlet ditches <sup>2</sup> .....feet.....	5.5	10.0	10.0	8.0	7.0	9.5	10.0
16	Mean depth of branch ditches <sup>2</sup> .....feet.....		6.3			5.0	5.0	4.0
17	Area drained by open ditches only <sup>3</sup> .....acres..	1,831	4,681	1,372	2,750	3,522	3,232	13,444
18	Length of these ditches.....miles.....	8.6	41.5	18.2	20.9	7.6	34.5	37.9
19	Average length per acre.....feet.....	24.8	46.8	70.0	40.1	11.4	56.4	14.9
<b>DEVELOPMENT OF LAND.</b>								
20	Improved land in operating enterprises, 1920.....acres..	183	1,442	61	1,385	1,012	2,305	11,848
21	Improved land prior to drainage.....acres..	183	123	31	272	689	124	429
22	Increase since drainage.....acres..		1,319	30	1,113	323	2,181	10,919
23	Per cent of increase <sup>3</sup> .....				408.2	46.9		
24	Per cent increase is of all improved land in farms, 1920.....		1.1		1.7	0.9	1.8	1.8
25	Timber and cut-over land, 1920.....acres..	549	2,305	213	523	251	306	338
26	Timber and cut-over land prior to drainage.....acres..	549	2,428	243	1,228	413	769	10,621
27	Decrease since drainage.....acres..		123	30	705	162	463	10,283
28	Per cent of decrease.....		5.1	12.3	57.4	39.2	60.2	96.8
29	Other unimproved land, 1920.....acres..	1,099	934	1,098	842	2,259	621	1,758
30	Other unimproved land prior to drainage.....acres..	1,099	2,130	1,098	1,250	2,420	2,339	2,394
31	Decrease since drainage.....acres..		1,196		408	161	1,718	636
32	Per cent of decrease.....		56.2		32.6	6.7	73.5	26.6
33	Swampy or subject to overflow, 1920.....acres..	1,831	3,239	608	438	299		41
34	Swampy or subject to overflow, prior to drainage.....acres..	1,831	4,481	1,372	1,770	3,522	3,232	13,152
35	Decrease since drainage.....acres..		1,242	764	1,332	3,223	3,232	13,111
36	Per cent of decrease.....		27.7	55.7	75.3	91.5	100.0	99.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
37	Total capital invested in and required for completion of operating enterprises.....dollars..	37,003	152,581	45,790	48,258	26,398	68,500	90,077
38	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	27,752	78,179	24,494	48,258	26,398	68,500	90,077
39	Additional capital required to complete these enterprises.....dollars..	9,251	74,402	21,296				
40	Average cost per acre when completed.....dollars..	20.21	32.60	33.37	17.55	7.50	21.19	6.76
41	Enterprises constructing open ditches only.....dollars..	37,003	152,581	45,790	48,258	26,398	68,500	90,077
42	Average cost per acre, when completed.....dollars..	20.21	32.60	33.37	17.55	7.50	21.19	6.70
<b>CROPS.</b>								
43	Improved land in enterprises reporting—							
44	Corn as principal crop on drained land.....acres..		1,442	30	1,385	967	2,305	11,848
44	Not reporting principal crop on drained land.....acres..	183		31		45		

<sup>1</sup> Includes only Bartow, Clarke, Clayton, Fayette, Newton, Oglethorpe, Paulding, and Rabun Counties.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Per cent not shown when base is less than 100 or when per cent is more than 1,000.

# IDAHO.

The following pages present the statistics of drainage for Idaho collected at the census of 1920. The figures relate to conditions as of January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of unimproved land not yet in

farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	42, 106	100. 0
Farms reporting land having drainage.....	1, 167	2. 8
Farms reporting land needing drainage.....	2, 895	6. 9
All land in farms..... acres..	8, 375, 873	100. 0
Improved land in farms..... acres..	4, 511, 680	53. 9
Farm land reported as provided with drainage..... acres..	64, 648	0. 8
Farm land reported as needing drainage..... acres..	199, 874	2. 4
Needing drainage only..... acres..	37, 566	0. 4
Needing drainage and clearing..... acres..	162, 308	1. 9
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	53, 346, 560	100. 0
All land in operating drainage enterprises..... acres..	64, 642	0. 1
Improved land..... acres..	52, 098	0. 1
Per cent of all improved land in farms.....	1. 2	-----
Timber and cut-over land..... acres..	87	(1)
Other unimproved land..... acres..	12, 457	(1)
Swampy, subject to overflow, seeped, or alkali..... acres..	11, 402	(1)
Suffering a loss of crops from defective drainage..... acres..	164	(1)
Improved land prior to drainage..... acres..	24, 650	(1)
Increase since drainage began..... acres..	27, 448	0. 1
Land in nonoperating enterprises..... acres..	14, 090	(1)
Open ditches in operating enterprises..... miles..	289. 2	100. 0
Completed..... miles..	274. 5	94. 9
Additional under construction..... miles..	14. 7	5. 1
Tile drains in operating enterprises..... miles..	3. 6	100. 0
Completed..... miles..	1. 8	50. 0
Additional under construction..... miles..	1. 8	50. 0
Total capital invested in and required for completion of operating enterprises..	\$1, 788, 569	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	1, 668, 569	93. 3
Additional capital required to complete these enterprises.....	120, 000	6. 7
Average cost per acre when completed.....	27. 67	-----

(1) Less than one-tenth of 1 per cent.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	78,732	100.0	\$1,678,294	100.0	\$250,000
Operating enterprises.....	64,642	82.1	1,668,559	99.4	120,000
With works completed.....	48,892	55.7	1,237,578	73.7	.....
With works under construction.....	20,750	26.4	430,991	25.7	120,000
Nonoperating enterprises.....	14,090	17.9	9,725	0.6	130,000

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to December 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The greater part of the drainage enterprises in Idaho is located in the southern and southwestern parts of the state, though there are a few in some of the northern counties.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	78,732	100.0	\$1,678,294	100.0	\$250,000
Operating enterprises.....	64,642	82.1	1,668,559	99.4	120,000
Snake River.....	61,310	77.9	1,510,269	90.0	120,000
Clark Fork and Spokane River.....	3,332	4.2	158,300	9.4	.....
Nonoperating enterprises.....	14,090	17.9	9,725	0.6	130,000
Snake River.....	1,090	1.4	.....	.....	30,000
Spokane River.....	13,000	16.5	9,725	0.6	100,000

Condition of land in enterprises.—In the basin of Clark Fork and Spokane River, the enterprises are for the drainage and protection of lands subject to overflow by streams. With the exception of one small enterprise in Bannock County, all the enterprises in the Snake River basin are to drain and protect land injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation.

For the state, 1,200 acres of irrigated land in drainage districts, 93,500 acres in irrigation districts, and 35,000 acres under the United States Reclamation Service are reported as not having needed drainage, but as having been assessed merely as being responsible for damage to the other lands. These acreages, except the 1,200 acres in drainage districts, are omitted from the tables in this bulletin.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate. Supplemental work by individual landowners may have been contemplated when the drainage plan of the enterprise was adopted, and that work may not have been done.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	64,642	100.0	43,892	20,750	14,090
Improved land.....	52,098	80.6	41,878	10,220	7,514
Timber and cut-over land.....	87	0.1	87	.....	1,850
Other unimproved land.....	12,457	19.3	1,927	10,530	4,826
Swampy, subject to overflow, seeped, and alkali.....	11,402	17.6	1,472	9,930	3,826
Suffering a loss of crops.....	164	0.3	64	100	2,101

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 13 operating drainage enterprises are counted in Idaho, with an average area of 4,972 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	64,642	64,642	100.0
500 to 999 acres.....	2,472	2,472	3.8
1,000 to 4,999 acres.....	15,210	15,210	23.5
5,000 to 9,999 acres.....	6,950	6,950	10.8
10,000 to 49,999 acres.....	40,000	40,000	61.9

Character of enterprises.—The organized drainage enterprises of Idaho include, besides drainage districts, irrigation districts and United States Reclamation Service projects draining lands within their boundaries.

Drainage districts are established by the district court of the county in which the greater portion of the land is situated, in accordance with the law of February 21, 1913 (ch. 16), as amended in 1915 and in 1919. Petition for establishment must be signed by the owners of at least one-fifth of the acreage in the proposed district. Every district must be "conducive to the public health, convenience, or welfare, or increase the public revenue, or be of special benefit to the majority of the lands included," and the benefits must not be less than the total cost. A board of three drainage commissioners, residents of the county and appointed by the judge of the court, are the executive officers of the district and have exclusive charge of the construction and maintenance of all drainage systems in the district, that are established under this law. The total cost of the enterprise is paid by the landowners in proportion to the benefits their lands will receive, and "high lands shall be considered as being benefited to the extent and in the amount that such lands are responsible for damage to low lands from seepage and saturation by irrigation water."

The petition must state approximately the boundaries of the proposed district, the acreage, and the plan of drainage. After public hearing upon the petition, the judge of the district court may amend the boundaries and establish the district, and appoint the first drainage commissioners. Copy of the decree of establishment is filed with the secretary of state. These commissioners examine the land and report regarding the plan of drainage, area to be benefited, and cost, with award of damages and apportionment of the cost to each tract. After public hearing upon this report, the court may confirm it with any modification deemed equitable. Any person may demand a jury trial upon the damages awarded him or the assessment against his own land. Appeal in regard to benefits and damages may be made to the supreme

court of the state. The commissioners may issue bonds to finance the district, not to exceed 90 per cent of the assessments against the land in the district, to run not less than 5 nor more than 20 years. A uniform tax not exceeding \$1 per acre may be levied to pay such preliminary expenses as for making the survey and drainage plan and for making the assessments of damages and benefits.

The first drainage district law of this state was passed in 1903, approved March 11. It provided for petition to the board of county commissioners, their favorable finding to be followed by an election upon the question of establishing the district and for choosing the drainage commissioners. In 1912 this law was declared invalid, the requirements for voting at the election being contrary to provisions in the state constitution.

An irrigation district, by the law of February 21, 1917 (ch. 31), may construct drainage works to drain or to protect land in the district, whether the irrigation works have been actually acquired or constructed or not, and to that end has the same power as it has regarding irrigation. The United States Reclamation Service may provide drainage as needed for the reclamation or protection of the lands in its irrigation projects.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All drainage enterprises.....	78,732	100.0	\$1,678,294	100.0	\$250,000
Operating enterprises.....	64,642	82.1	1,668,569	99.4	120,000
Drainage districts.....	16,082	20.4	214,370	12.8	110,000
Irrigation districts.....	18,000	22.9	673,389	40.1	10,000
U. S. Reclamation Service.....	30,000	38.1	778,000	46.3	.....
Individual ownership.....	560	0.7	2,880	0.2	.....
Nonoperating enterprises.....	14,090	17.9	9,725	0.6	130,000
Drainage districts.....	14,090	17.9	9,725	0.6	130,000

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 274.5 miles of open ditches, 1.8 miles of tile drains, and 9.5 miles of accessory levees; the additional lengths under construction were 14.7 miles of open ditches and 1.8 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There are 4 pumping districts in the state, all equipped with 6 centrifugal pumps.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	64,642	100.0	\$1,668,569	100.0	\$120,000
Open ditches only.....	39,980	61.8	1,194,171	71.6	10,000
Open ditches and tile drains.....	22,750	35.2	354,398	21.2	110,000
Open ditches and levees.....	1,412	2.2	80,000	4.8	.....
Open ditches, tile drains, and levees.....	500	0.8	40,000	2.4	.....

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	64,642	100.0	\$1,668,569	100.0	\$120,000
Gravity drainage only.....	32,730	50.6	770,569	46.2	120,000
All drainage by pumping.....	1,412	2.2	60,000	3.6	.....
Part gravity and part pumping.....	30,500	47.2	838,000	50.2	.....
Total area served by pumps.....	7,912	12.2	.....	.....	.....

TABLE 9.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horse-power.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	285	100.0	38,200	100.0	7,912	100.0
Steam.....	25	8.8	3,000	8.3	900	11.4
Electric.....	260	91.2	33,200	91.7	7,012	88.6

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers

only, the occasional decimals were omitted in making these computations.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	64,642	100.0
3.0 to 3.9 feet.....	560	0.9
4.0 to 4.9 feet.....	912	1.4
5.0 to 5.9 feet.....	500	0.8
6.0 to 6.9 feet.....	500	0.8
7.0 to 7.9 feet.....	.....	.....
8.0 to 8.9 feet.....	.....	.....
8.0 to 9.9 feet.....	1,000	1.5
10 feet.....	47,440	73.4
Not reporting branches.....	13,730	21.2

Maintenance of works.—The drainage district law requires that annually, on or before January 1, the drainage commissioners estimate the cost of maintenance and repair work for the succeeding year and apportion it against the land in the district in proportion to the maximum benefits originally assessed. These assessments are certified to the county auditor and collected with the general taxes. In irrigation enterprises the drainage works are maintained as a part of the irrigation system.

TABLE 11.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	64,642	100.0	\$1,668,569	100.0	\$120,000
By district forces.....	31,920	49.4	876,300	52.5	.....
By contract.....	17,500	27.1	648,359	38.9	10,000
No maintenance provided.....	2,472	3.8	87,880	5.3	.....
Not reporting.....	12,750	19.7	56,000	3.3	110,000

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Idaho earlier than 1912.

DRAINAGE—IDAHO.

TABLE 12.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	64,642	100.0	64,642	100.0
1910 to 1914.....	47,000	72.9	47,000	72.7
1915 to 1919.....	17,642	27.3	17,642	27.3

TABLE 13.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,668,569	100.0	\$120,000
1910 to 1914.....	1,386,389	83.1	10,000
1915 to 1919.....	282,180	16.9	110,000

TABLE 14.—DRAINS AND \*LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	289.2	100.0	3.6	100.0	9.5	100.0
1910 to 1914.....	230.6	79.7	0.8	100.0	9.5	100.0
1915 to 1919.....	58.6	20.3	2.8	100.0	9.5	100.0

Crops.—The principal crops grown upon the drained land in drainage enterprises are alfalfa, grain, and hay other than alfalfa. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.							
	THE STATE.	Ada.	Bannock.	Bear Lake.	Benewah.	Bonner.	Boundary.	
1 Number of all farms in the state or county.....	42,106	2,198	1,719	825	573	1,051	273	
2 Farms reporting land having drainage.....	1,167	90	32	6	21	127	40	
3 Farms reporting land needing drainage.....	2,895	90	176	33	402	272	139	
4 Farms in drainage and levee districts.....	647	44	19	5	15	20	.....	
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the state or county..... acres..	53,346,560	738,560	1,175,680	627,200	503,040	1,118,720	816,640	
6 All land in farms..... acres..	8,375,873	203,651	452,710	202,890	118,649	164,366	66,962	
7 Improved land in farms..... acres..	4,511,680	131,464	270,179	108,466	45,079	35,389	20,311	
8 Woodland in farms..... acres..	820,876	2,272	6,048	3,939	64,082	103,247	34,548	
9 Other unimproved land in farms..... acres..	3,043,317	69,915	177,483	90,485	9,488	25,730	12,108	
10 Farm land reported as provided with drainage..... acres..	64,648	9,024	1,614	561	897	6,161	3,003	
11 Farm land reported as needing drainage..... acres..	199,874	3,271	7,934	1,102	41,446	25,845	14,612	
12 Drainage only..... acres..	37,566	2,335	1,824	748	2,506	802	3,595	
13 Drainage and clearing..... acres..	162,308	936	6,160	354	38,940	25,043	11,217	
	Canyon.	Franklin.	Kootenai.	Minidoka.	Payetta.	Teton.	Twin Falls.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	2,660	910	1,396	1,024	763	541	2,746	25,327
2 Farms reporting land having drainage.....	342	33	61	16	155	12	63	169
3 Farms reporting land needing drainage.....	228	90	205	19	92	41	28	1,080
4 Farms in drainage and levee districts.....	340	8	10	31	19	1	52	83
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county..... acres..	378,880	355,840	801,920	483,840	264,960	206,320	1,252,480	44,532,480
6 All land in farms..... acres..	199,427	173,790	231,151	91,028	72,254	130,756	276,179	6,001,060
7 Improved land in farms..... acres..	157,486	104,241	79,017	68,051	41,054	84,354	232,833	3,134,056
8 Woodland in farms..... acres..	7,365	1,547	118,223	2,540	6,152	4,239	1,491	465,183
9 Other unimproved land in farms..... acres..	34,576	68,002	23,911	20,437	26,048	42,163	42,155	24,011,821
10 Farm land reported as provided with drainage..... acres..	19,249	985	3,231	580	12,219	821	1,049	5,254
11 Farm land reported as needing drainage..... acres..	9,404	2,208	13,022	165	2,312	3,100	349	74,854
12 Drainage only..... acres..	6,480	1,917	1,418	164	1,457	340	284	13,696
13 Drainage and clearing..... acres..	3,924	291	11,604	1	855	2,760	65	61,153

<sup>1</sup> No drainage on farms reported in Butte, Camas, Clark, Custer, and Lincoln Counties.



DRAINAGE—IDAHO.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Ada.	Benehah.	Canyon.	Gem.	Minidoka.	Payette.	Other counties. <sup>1</sup>
<b>LAND AREA.</b>								
1	Approximate land area of the state or county.....acres..	53,346,560	738,560	503,040	378,880	362,880	483,840	2,204,400
2	All land in operating drainage enterprises.....acres..	64,642	5,800	1,912	12,200	6,960	30,000	5,790
3	Improved land.....acres..	62,098	5,655	1,075	12,165	2,000	29,440	1,000
4	Per cent of all improved land in farms.....	1.2	4.3	2.4	7.7	3.6	43.3	2.4
5	Timber and cut-over land.....acres..	87	750	87	35	4,960	560	4,790
6	Other unimproved land.....acres..	12,457	145	750	35	4,960	560	4,790
7	Swampy, subject to overflow, seeped, and alkali in enterprises.....acres..	11,402	145	912	35	4,960	560	4,790
8	Suffering a loss of crops from defective drainage.....acres..	164	100	100	100	100	100	100
9	Assessed acreage.....acres..	64,642	5,800	1,912	12,200	6,960	30,000	5,790
10	Excess over all land in enterprises.....acres..							
<b>DRAINAGE WORKS.</b>								
Open ditches:								
11	Completed.....miles..	274.5	41.5	6.0	91.5	4.0	108.0	3.0
12	Additional under construction.....miles..	14.7	0.4	1.0	0.2	6.7	7.4	20.5
13	Maximum completed in any enterprise.....miles..	108.0	30.6	3.0	77.6	4.0	108.0	2.0
14	Maximum width at bottom of ditch <sup>2</sup> .....feet..	14	8	6	8	14	10	14
15	Maximum of average depths of outlet ditches <sup>3</sup> .....feet..	15.0	10.0	6.0	11.0	10.0	15.0	10.0
16	Mean depth of branch ditches <sup>3</sup> .....feet..	5.7	9.0	4.5	9.0			7.0
Tile drains:								
17	Completed.....miles..	1.8		1.0	0.8			
18	Additional under construction.....miles..	1.8				0.2		1.6
19	Maximum completed in any enterprise.....miles..	1.0			0.8			
20	Maximum size of tile <sup>4</sup> .....inches..	36		18	36			30
Accessory levees and dikes:								
21	Completed.....miles..	9.5		9.5				
22	Additional under construction.....miles..							
Pumping plants:								
23	Engine capacity.....horsepower..	285		135			150	
24	Pump capacity.....gallons per minute..	26,200		13,700			22,500	
25	Area served by pumps.....acres..	7,912		1,912			6,000	
26	Area drained by open ditches only <sup>5</sup> .....acres..	41,392	5,800	1,412	2,200		30,000	1,980
27	Length of these ditches.....miles..	188.5	41.9	4.0	14.1		108.0	10.4
28	Average length per acre.....feet..	24.0	38.1	15.0	33.8		19.0	25.9
29	Length of the accessory levees.....miles..	6.0		6.0				
30	Area drained by open ditches and tile <sup>6</sup> .....acres..	23,250	500	10,000	6,960		5,790	
31	Length of these drains.....miles..	104.3		3.0	78.4		12.0	
32	Average length per acre.....feet..	23.7		31.7	41.4		10.9	
33	Length of the accessory levees.....miles..	3.5		3.5				
<b>DEVELOPMENT OF LAND.</b>								
34	Improved land, 1920.....acres..	62,098	5,655	1,075	12,165	2,000	29,440	1,000
35	Improved land prior to drainage.....acres..	24,650		450		800	23,000	400
36	Increase since drainage.....acres..	27,448	5,655	625	12,165	1,200	6,440	763
37	Per cent of increase.....	111.4		138.9		150.0	28.0	150.0
38	Per cent increase is of all improved land in farms, 1920.....	0.8	4.3	1.4	7.7	2.1	9.5	1.5
39	Timber and cut-over land, 1920.....acres..	87		87				
40	Timber and cut-over land prior to drainage.....acres..	97		97				
41	Decrease since drainage.....acres..	10		10				
42	Per cent of decrease.....							
43	Other unimproved land, 1920.....acres..	12,457	145	750	35	4,960	560	4,790
44	Other unimproved land prior to drainage.....acres..	39,898	5,800	1,365	12,200	6,160	7,000	5,390
45	Decrease since drainage.....acres..	27,438	5,655	615	12,165	1,200	6,440	763
46	Per cent of decrease.....	68.8	97.5	45.1	99.7	19.5	92.0	11.1
47	Swampy, subject to overflow, seeped, and alkali, 1920.....acres..	11,402	145	912	35	4,960	560	4,790
48	Swampy, subject to overflow, seeped, and alkali prior to drainage.....acres..	49,442	5,800	1,912	12,200	6,160	7,000	5,390
49	Decrease since drainage.....acres..	29,040	5,655	1,000	12,165	1,200	6,440	1,980
50	Per cent of decrease.....	71.8	97.5	52.3	99.7	19.5	92.0	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
51	Total capital invested in and required for completion of operating enterprises.....dollars..	1,788,569	234,423	120,000	398,968	80,000	778,000	86,000
52	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	1,668,569	277,565	120,000	395,824	33,333	778,000	22,687
53	Additional capital required to complete these enterprises.....dollars..	120,000	6,858		3,142	46,667		63,313
54	Average cost per acre when completed.....dollars..	27.67	49.04	62.78	32.70	11.49	25.93	14.85
55	Enterprises constructing open ditches only.....dollars..	1,284,171	234,423	60,000	100,568		778,000	41,180
56	Average cost per acre when completed.....dollars..	31.02	49.04	56.66	45.71		25.93	20.80
57	Enterprises constructing open ditches and tile drains.....dollars..	504,398		40,000	298,398	80,000		86,000
58	Average cost per acre when completed.....dollars..	21.69		80.00	29.84	11.49		14.85
<b>CROPS.</b>								
Improved land in enterprises reporting—								
59	Alfalfa as principal crop on drained land.....acres..	33,360	920			2,000	29,440	1,000
60	Grain as principal crop on drained land.....acres..	17,390	4,735	490	12,165			
61	Hay (except alfalfa) as principal crop on drained land.....acres..	1,348	585					763

<sup>1</sup> Includes only Bannock and Bonner Counties.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Includes 1,412 acres having open ditches and levees.

<sup>4</sup> Includes 600 acres having open ditches, tile drains, and levees.

<sup>5</sup> Per cent not shown when base is less than 100.

<sup>6</sup> Includes cost of 6 miles of levees.

<sup>7</sup> Includes cost of 3.5 miles of levees.

## ILLINOIS.

The following pages present the statistics of drainage for Illinois collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

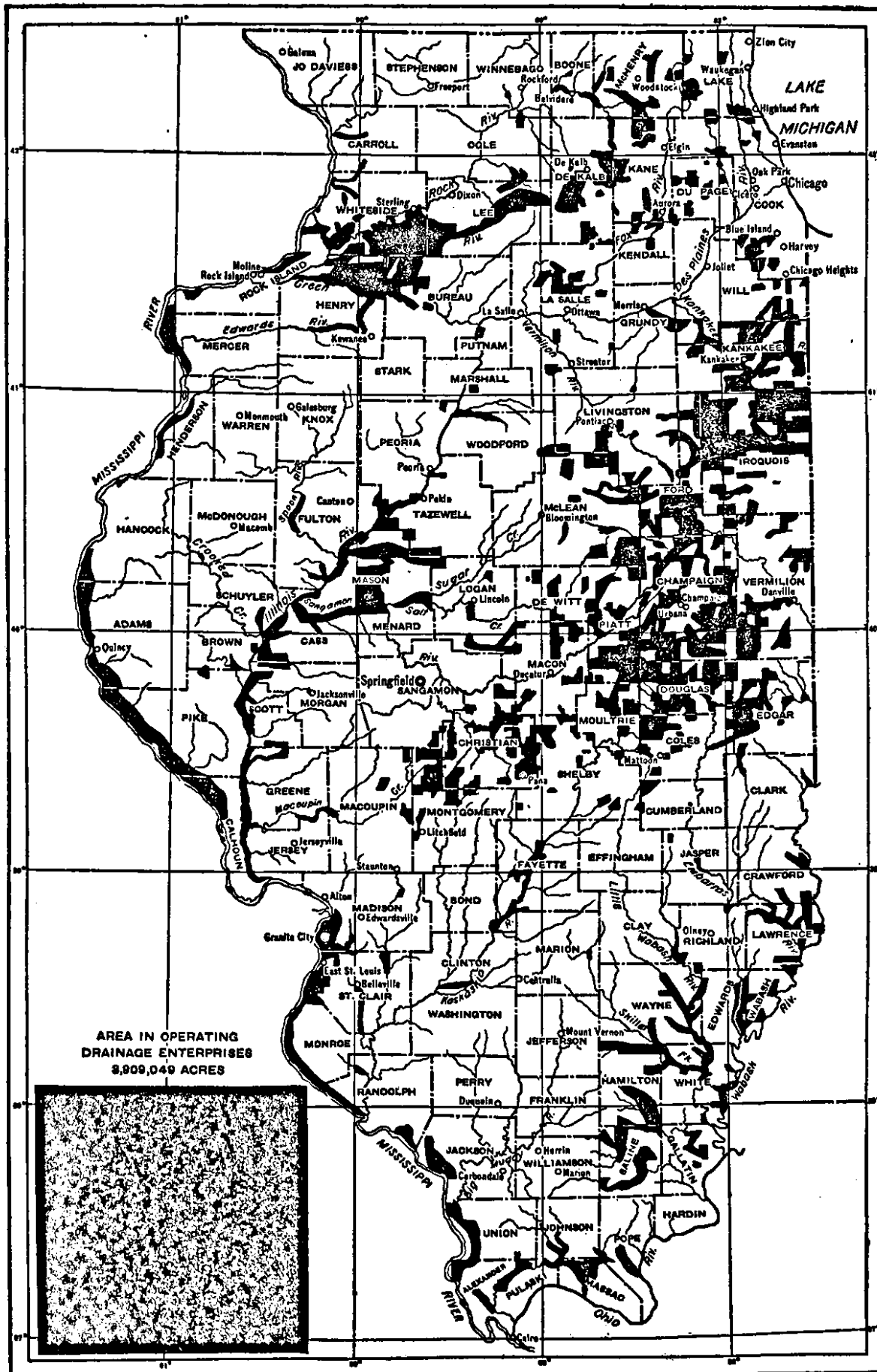
for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	237, 181	100. 0
Farms reporting land having drainage.....	99, 246	41. 8
Farms reporting land needing drainage.....	33, 731	14. 2
All land in farms..... acres..	31, 974, 775	100. 0
Improved land in farms..... acres..	27, 294, 533	85. 4
Farm land reported as provided with drainage..... acres..	11, 247, 637	35. 2
Farm land reported as needing drainage..... acres..	1, 228, 739	3. 8
Needing drainage only..... acres..	641, 493	2. 0
Needing drainage and clearing..... acres..	587, 246	1. 8
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	35, 867, 520	100. 0
All land in operating drainage enterprises..... acres..	3, 909, 049	10. 9
Improved land..... acres..	3, 532, 316	9. 8
Per cent of all improved land in farms.....	12. 9	-----
Timber and cut-over land..... acres..	184, 573	0. 5
Other unimproved land..... acres..	192, 160	0. 5
Swampy, subject to overflow, seeped, or alkali..... acres..	228, 337	0. 6
Suffering a loss of crops from defective drainage..... acres..	229, 065	0. 6
Improved land prior to drainage..... acres..	2, 062, 521	5. 8
Increase since drainage began..... acres..	1, 469, 795	4. 1
Land in nonoperating enterprises..... acres..	72, 984	0. 2
Open ditches in operating enterprises..... miles..	4, 820. 2	100. 0
Completed..... miles..	4, 754. 5	98. 6
Additional under construction..... miles..	65. 7	1. 4
Tile drains in operating enterprises..... miles..	3, 634. 2	100. 0
Completed..... miles..	3, 507. 1	96. 5
Additional under construction..... miles..	127. 1	3. 5
Total capital invested in and required for completion of operating enterprises..	\$51, 393, 244	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	43, 595, 069	84. 8
Additional capital required to complete these enterprises.....	7, 798, 175	15. 2
Average cost per acre when completed.....	13. 15	-----

# ILLINOIS

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of improvement several years ago, but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

**TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.**

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises .....	3,982,033	100.0	\$43,595,069	100.0	\$9,199,841
Operating enterprises.....	3,909,049	98.2	43,595,069	100.0	7,798,175
With works completed.....	3,450,474	86.1	31,424,167	72.1	.....
With works under construction.....	478,575	12.0	12,170,902	27.9	7,798,175
Nonoperating enterprises.....	72,984	1.8	.....	.....	1,401,666

<sup>1</sup>The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

**Location of enterprises.**—The greatest portions of the land in drainage enterprises are in the eastern and northern parts of the state, though there are many enterprises in the central and southeastern parts and along the Mississippi, as shown by the map on page 2. The pumping districts are almost entirely along Illinois and Mississippi Rivers, below Peoria and from near Rock Island to the vicinity of St. Louis.

**TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.**

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	3,982,033	100.0	\$43,595,069	100.0	\$9,199,841
Operating enterprises.....	3,909,049	98.2	43,595,069	100.0	7,798,175
Wabash River.....	834,974	22.2	5,739,404	13.2	303,138
Ohio River.....	173,367	4.3	1,547,559	3.5	56,600
Illinois River.....	1,537,539	38.6	16,121,388	37.0	1,162,039
Rock River.....	488,002	12.3	4,754,557	10.9	369,500
Mississippi River.....	790,198	19.8	15,107,494	34.7	5,906,898
Lake Michigan.....	35,969	0.9	324,667	0.7	.....
Nonoperating enterprises.....	72,984	1.8	.....	.....	1,401,666
Ohio River.....	16,214	0.4	.....	.....	78,000
Illinois River.....	53,490	1.3	.....	.....	1,225,676
Rock River.....	3,280	0.1	.....	.....	97,990

**Condition of land in enterprises.**—The drainage enterprises situated along and near the larger streams have been organized to secure relief for land subject to inundation by overflow waters. These comprise about 28 per cent of the land in all operating enterprises. The other enterprises are for the reclamation of swampy land or the improvement of land too generally wet for profitable cultivation. Approximately 53 per cent of the land was reported as improved land prior to the organization of the enterprises, and 12 per cent as timbered or cut-over.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the land-owners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

**TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.**

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres.)	
	Acreage.	Per cent of all land.			
All land in enterprises.....	3,909,049	100.0	3,430,474	478,575	72,984
Improved land.....	3,532,316	90.4	3,232,337	299,979	44,963
Timber and cut-over land.....	184,573	4.7	101,265	83,303	3,714
Other unimproved land.....	192,160	4.9	96,872	95,288	24,277
Swampy or subject to overflow.....	228,337	5.8	98,635	129,702	29,294
Suffering a loss of crops.....	229,065	5.9	188,167	40,898	13,507

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 1,365 operating drainage enterprises are counted in Illinois, with an average area of 2,997 acres assessed. Of this number, 75 comprise 10,000 acres or more each, 674 comprise 1,000 to 5,000 acres each, and 181 are smaller than 500 acres each. The assessed acreage exceeds the land in enterprises by 181,550 acres, which is the amount of overlapping.

**TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.**

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	3,909,049	4,090,599	100.0
Less than 200 acres.....	2,690	3,951	0.1
200 to 499 acres.....	32,153	50,556	1.2
500 to 999 acres.....	169,207	210,371	5.1
1,000 to 4,999 acres.....	1,447,943	1,547,003	37.8
5,000 to 9,999 acres.....	955,019	976,666	23.9
10,000 to 49,999 acres.....	1,239,709	1,239,719	30.3
50,000 to 99,999 acres.....	62,333	62,333	1.5

The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises.

**Character of enterprises.**—Very nearly all of the drainage enterprises in Illinois are drainage districts organized under either the levee act of 1879 or the farm drainage act of 1885. There are a few other districts organized under similar statutes of earlier dates and under county ditch and sanitary district laws, and there are some drainage undertakings of more than 500 acres each by individual landowners.

The so-called levee act of May 29, 1879, as amended, provides for the formation of "drainage and levee districts" for either drainage or flood protection, or for both. Each enterprise is established by order of the county court upon petition from owners of land to be included in the district, if the improvement works are necessary or will be useful in draining the land for agricultural, sanitary, or mining purposes. Jurisdiction for a district in more than one county lies with the court of the county containing the greatest part of the district. The petition must be signed by a majority of the owners who must own at least one-third of the acreage in the district, or by one-third of the owners who own a majority of the acreage. A preliminary investigation, including surveys and the preparation of a plan of drainage and estimates of cost, is made by three commissioners appointed by the court, who become the corporate authority of the district when the order of establishment has been issued, to secure construction of the drainage works. Public hearings are held by the court to determine the sufficiency of the petition before the commissioners are appointed, and to consider the commissioners' report before the district is established. The order of establishment is appealable to the state supreme court. Benefits and damages are assessed by the commissioners against the tracts of land affected, including railroads, public highways, and municipal corporations, which are confirmed by the county court with any amendments deemed equitable after hearing before a jury impaneled as in eminent domain cases. The cost of the enterprise is apportioned according to the benefits confirmed. Bonds of the district may be issued for not exceeding 90 per cent of the assessments unpaid at the time of issue.

Under the levee act a justice of the peace has concurrent jurisdiction with the county court for districts that will not cost more than \$2,000, but the hearings on objections to the assessments of benefits and damages must be held by the county court. Districts may be established by mutual agreement of the owners of all the land to be included, duly recorded in the county drainage record. The agreement may

determine the location and character of the drains, the awards of damages, the apportionment of the cost, and the selection of the first commissioners. Subdistricts may be established by the county court in any district maintaining a levee as part of the improvement works, upon confirmation of a special report describing the proposed subdistrict, submitted by the commissioners upon their own initiative or upon petition from the landowners in the subdistrict.

As enacted in 1879, the levee act required that the petition for establishment be signed by a majority of the owners owning at least one-third of the acreage to be included in the district; it did not authorize appeal from the county court's order of establishment; it provided for the assessment of damages and benefits by jury; justices of the peace were given jurisdiction in cases where the cost would not exceed \$5,000; and bonds might be issued for the full amount of unpaid assessments.

The act of April 24, 1871, was similar in its principal provisions to the levee act, by which it was repealed in 1879. The districts under it were established by the county court upon petition from the landowners. The court appointed three drainage commissioners to prepare the plan of drainage and estimates of cost, and to secure construction of the drainage works. Benefits and damages were assessed by the commissioners and confirmed by the court after public hearing, or the court might impanel a jury to determine benefits and damages. Small enterprises were established by justices of the peace and administered by the highway commissioners.

The farm drainage act, as it is generally termed, was approved June 27, 1885. As in force on the census date, it provides for the establishment of drainage districts by the town commissioners of highways, upon petition signed as for a district under the levee act, by a majority of the owners who own a third of the land or by a third of the owners who own a majority of the acreage. The highway commissioners secure a survey and estimates for the undertaking. After hearing upon their report, they establish the district if they find favorably or if it then is desired by two-thirds of the owners who own more than half the acreage to be included. The corporate authority after establishment is vested in three drainage commissioners elected by the landowners. These commissioners fix the boundaries of the district, determine the plan of drainage, obtain rights of way by agreement or by proceedings before a justice of the peace, and secure construction of the works. The land is classified according to benefits by the drainage commissioners, the tract to receive greatest benefit being rated 100 per cent and the others in proportion. Hearing upon this classification is held by the commissioners, and their determinations are subject to appeal to the

county court. The cost of the enterprise is apportioned according to the benefits as finally confirmed.

The farm drainage act authorizes the establishment of union drainage districts situated in two towns in one or two counties under township organization, in a manner similar to that for a district in only one town. The petition is filed in the town embracing the greater part of the district, the commissioners before establishment being appointed by the town clerk from the highway commissioners of both towns. Subdistricts may be organized by the landowners in the same manner as main districts, or by the district commissioners upon their own initiative. By petition to the county clerk, the landowners in a subdistrict embracing not less than five sections of land may elect their own commissioners. Subdistricts may be divided by the commissioners into minor subdistricts for assessment purposes. Districts may be formed by mutual agreement duly recorded in the town drainage record, by the same method as districts by mutual agreement under the levee act. A district may be established to maintain any drain previously constructed by voluntary agreement between two or more landowners, upon petition from any user of the drain, in a manner similar to that described for other districts under the farm drainage act.

Special drainage districts may be formed under this act, comprising land in three or more towns in one or more counties, or all or partly in a county or counties not under township organization. The petition is made to the county court of the county containing the greatest part of the proposed district. The preliminary investigation is made by three commissioners appointed by the court. After establishment the district is managed by three commissioners elected by the landowners, or appointed by the court when there are less than 15 landowners in the district. Classification of the land according to benefits is made by the commissioners, and damages are determined by jury in the county court. Special drainage districts may issue bonds for not more than 90 per cent of the unpaid assessments.

The establishment of a private drain across the land of an objecting owner, when necessary, is authorized by the farm drainage act. Petition must be made to a justice of the peace, who assesses the damages to be paid for constructing the drain or impanels a jury to assess those damages.

As enacted in 1885, the farm drainage act provided that the highway commissioners should continue to be the drainage commissioners after the districts were established, and that damages should be assessed by jury, but did not authorize the election of commissioners in subdistricts nor the formation of minor subdistricts.

The establishment of drainage districts, union districts, and special drainage districts was authorized

by a statute approved May 29, 1879, and in force July 1, 1879. The method of organization in each case was very similar to that prescribed by the farm drainage act of 1885, which repealed the earlier law.

County ditches or drains are established in accordance with an act of June 23, 1883. That law provides for the maintenance and improvement of drains constructed by the counties to drain swamp and overflowed land donated to the counties by the state. Each county board is authorized to appoint three district commissioners to divide those drains into proper districts, and to assess the benefits against the land as the basis for apportioning the cost of the work. The county board may also appoint for each district one drainage commissioner to have charge of the work under direction of the board.

Sanitary districts are formed under an act of May 17, 1907. Each must comprise a contiguous area of land subject to overflow within two counties, must include two or more incorporated cities or villages, and must have a population not less than 25,000. Such districts are established by a board of commissioners consisting of the county judge of each county in which the district is located and one circuit judge, after favorable vote by the legal voters of the district. A petition for establishment must be signed by 300 voters in the district. Control of the enterprise is vested in five elected trustees, and the cost is paid by an ad valorem tax on the taxable property in the district.

Circuit courts of the state and superior courts of Cook County were given concurrent jurisdiction with the county courts in all matters relating to farm drainage and levee matters, by an act of June 5, 1909.

The issue of bonds by drainage districts established under any law of the state is authorized by an act of June 15, 1895. Issues made by authority of this act must not exceed 90 per cent of the assessment that has been levied, and petition for the issue must be made by property owners representing a majority of the land in the district.

The first drainage law of Illinois was approved June 22, 1852. It provided for the survey and sale of the swamp land of each county under control of the county court, and the drainage of that land with the proceeds of the sales. An act of February 16, 1865, provided for the establishment of drains by boards of drainage commissioners, consisting of the town commissioners of highways, upon petition from owners of land to be drained. Those commissioners assessed damages and benefits against the land through which the drain would pass, and allotted the work of construction in proportion to the assessed benefits. A large number of other laws relating to drainage have been enacted in this state. Those that affected the character of enterprises have been repealed or are embodied in the foregoing statement.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	3,982,033	100.0	\$43,595,069	100.0	\$9,199,841
Operating enterprises.....	3,909,049	98.2	43,595,069	100.0	7,798,175
Levee drainage districts.....	1,718,628	43.2	23,190,834	53.2	2,583,667
Act of Apr. 24, 1871.....	10,000	0.3	180,780	0.4	28,000
Act of May 29, 1879.....	1,708,628	42.9	23,010,054	52.8	2,555,667
Farm drainage districts.....	2,109,099	53.0	15,388,792	35.3	709,508
Act of May 29, 1879.....	85,724	2.2	439,632	1.0	.....
Act of June 27, 1885.....	2,023,375	50.8	14,949,160	34.3	709,508
Special drainage districts.....	837,454	21.0	7,170,069	16.4	519,800
County ditches.....	3,780	0.1	10,303	(1)	.....
Sanitary districts.....	60,000	1.5	4,500,000	10.3	4,500,000
Individual ownerships.....	17,542	0.4	505,140	1.2	5,000
Nonoperating enterprises.....	72,984	1.8	.....	.....	1,401,666
Levee drainage district.....	69,984	1.8	.....	.....	1,365,905
Act of May 29, 1879.....	69,984	1.8	.....	.....	1,365,905
Farm drainage district.....	3,000	0.1	.....	.....	35,761
Act of June 27, 1885.....	3,000	0.1	.....	.....	35,761

<sup>1</sup> Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 4,754.5 miles of open ditches, 3,507.1 miles of tile drains, and 650.2 miles of levees; the additional lengths under construction were 65.7 miles of open ditches, 127.1 miles of tile drains, and 97.1 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are 49 pumping districts among the operating drainage enterprises in the state, 7 of which comprise land in more than one county. They are all equipped with 107 pumps of 2,843,066 gallons per minute total capacity. All are centrifugal pumps except 2 rotary pumps of 18,000 gallons per minute capacity and 2 of kind not reported having 25,000 gallons per minute estimated capacity.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	3,909,049	100.0	\$43,595,069	100.0	\$7,798,175
Open ditches only.....	1,508,695	38.6	11,280,916	25.9	593,742
Open ditches and levees.....	452,588	11.6	13,344,715	30.6	6,114,536
Tile drains only.....	392,738	10.0	3,080,665	7.1	94,739
Tile drains and levees.....	10,109	0.3	180,000	0.4	.....
Open ditches and tile drains.....	1,327,996	34.0	10,030,005	23.0	611,865
Open ditches, tile drains, and levees.....	216,923	5.5	5,692,768	13.1	383,300

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of

outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both these groups, computed as 3 feet and 10 feet, respectively, would make the mean depth for the state 5.1 instead of 4.8 feet.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	3,909,049	100.0	\$43,595,069	100.0	\$7,798,175
Gravity drainage only.....	3,583,206	91.7	31,533,478	72.3	2,508,699
All drainage by pumping.....	157,360	4.0	6,226,396	14.3	582,986
Part gravity and part pumping..	168,483	4.3	5,835,205	13.4	4,706,500
Total area served by pumps.....	291,816	7.5	.....	.....	.....

TABLE 9.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horsepower.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
Steam.....	5,805	31.9	1,070,900	37.7	137,291	47.0
Electric.....	10,445	57.3	1,529,666	53.8	134,959	46.2
Internal-combustion.....	325	1.8	52,500	1.8	4,243	1.5
Steam and electric.....	1,650	9.1	190,000	6.7	15,323	5.3

<sup>1</sup> Includes 1,250 steam, 250 electric, and 150 horsepower not divided.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	3,909,049	100.0
Less than 3 feet.....	21,657	0.6
3.0 to 3.9 feet.....	108,241	2.8
4.0 to 4.9 feet.....	368,789	9.4
5.0 to 5.9 feet.....	325,637	8.3
6.0 to 6.9 feet.....	395,989	10.1
7.0 to 7.9 feet.....	257,043	6.6
8.0 to 8.9 feet.....	391,984	10.0
9.0 to 9.9 feet.....	46,556	1.2
10 feet and more.....	132,716	3.4
Not reporting branches.....	1,860,407	47.6

**Maintenance of works.**—In districts organized under the levee act of 1879, when assessing the benefits for construction the commissioners assess also, if so directed by the court, the annual amount of benefits to each tract from maintenance of the works and from operation of the pumping plants. These assessments for maintenance and operation are reviewed and confirmed in the same manner as the assessments for construction. The annual assessments for maintenance must not exceed, except in pumping districts, an aggregate equivalent to 30 cents per acre on all land in the district. The maintenance assessments may be made or increased in the same manner as assessments for construction, upon petition from the landowners or from the district commissioners.

The drainage works of districts organized under the farm drainage act of 1885 are to be maintained by the commissioners of the respective districts or subdistricts. The commissioners of drainage districts situated in one town may use the district funds for making repairs, and when necessary may levy additional taxes for maintenance. Commissioners of special drainage districts are required to file each year an estimate of the funds required for maintenance, which are assessed in proportion to the benefits assessed for construction. Maintenance in union drainage districts, in subdistricts, and in minor subdistricts is provided as in drainage districts in one town.

The improvement works in sanitary districts under the statute of 1907 are to be maintained by the respective boards of trustees of the districts, who may levy taxes and issue bonds for this purpose.

TABLE 11.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All operating enterprises.....	3,909,049	100.0	\$43,595,069	100.0	\$7,798,175	
By district forces.....	1,658,434	42.4	22,252,977	51.0	6,335,989	
By contract.....	1,412,552	36.1	12,205,434	28.0	306,464	
By method not specified.....	197,894	5.1	2,637,740	6.1	34,900	
By landowners.....	9,898	0.3	2,347,306	5.4	.....	
No maintenance provided.....	356,097	9.1	3,414,637	7.8	160,463	
Not reporting.....	274,264	7.0	2,736,976	6.3	960,355	

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the orders of establishment were made, since there may be a period of one or more years between the order of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are

tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of drainage was completed.

TABLE 12.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	3,909,049	100.0	4,090,599	100.0
1870 to 1879.....	16,960	0.4	16,960	0.4
1880 to 1889.....	901,087	23.1	925,911	22.6
1890 to 1899.....	766,891	19.6	817,588	20.0
1900 to 1904.....	432,203	11.1	453,287	11.1
1905 to 1909.....	670,892	17.2	941,796	23.0
1910 to 1914.....	622,095	15.9	630,756	15.4
1915 to 1919.....	237,898	6.1	291,958	7.1
Not reported.....	11,023	0.3	12,343	0.3

TABLE 13.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$43,595,069	100.0	\$7,798,175
1870 to 1879.....	202,467	0.5	.....
1880 to 1889.....	9,880,927	22.6	787,000
1890 to 1899.....	5,315,978	12.2	324,500
1900 to 1904.....	4,201,088	9.6	318,722
1905 to 1909.....	13,817,447	31.7	5,142,762
1910 to 1914.....	6,589,847	15.1	199,742
1915 to 1919.....	3,207,754	7.4	1,025,449
Not reported.....	419,581	1.0	.....

TABLE 14.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1870 to 1879.....	13.9	0.3	1.5	(1)	11.0	1.5
1880 to 1889.....	1,316.0	27.3	448.2	12.3	152.0	20.3
1890 to 1899.....	1,001.8	20.8	548.8	15.1	54.2	7.3
1900 to 1904.....	470.0	9.8	435.8	12.0	125.3	16.8
1905 to 1909.....	1,052.2	21.8	1,199.7	33.0	208.5	27.9
1910 to 1914.....	702.2	14.6	599.5	16.5	116.0	15.5
1915 to 1919.....	243.9	5.1	359.0	9.9	67.8	9.1
Not reported.....	20.2	0.4	43.7	1.2	12.5	1.7

<sup>1</sup> Less than one-tenth of 1 per cent.

**Crops.**—The principal crop grown upon the drained land in drainage enterprises is corn, and wheat also is reported as an important crop on this land. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.



DRAINAGE—ILLINOIS.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Adams.	Alexander.	Bond.	Boone.	Brown.	Bureau.	Calhoun.	Carroll.	
1	Number of all farms in the state or county.....	237,181	3,844	731	1,948	1,325	1,352	3,203	1,119	1,769
2	Farms reporting land having drainage.....	99,246	207	58	62	558	193	2,255	21	177
3	Farms reporting land needing drainage.....	33,731	197	279	62	573	52	644	78	206
4	Farms in drainage and levee districts.....	14,586	81	41	.....	27	35	321	20	22
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county.....acres..	35,867,520	538,680	144,640	243,320	187,520	190,080	563,840	163,840	239,920
6	All land in farms.....acres..	31,974,775	496,311	90,642	222,239	173,549	177,844	520,064	151,799	270,996
7	Improved land in farms.....acres..	27,294,533	373,183	62,371	195,493	143,537	123,179	458,676	83,544	224,774
8	Woodland in farms.....acres..	3,102,579	71,016	32,352	19,586	10,386	35,153	43,746	62,845	25,847
9	Other unimproved land in farms.....acres..	1,577,663	51,212	1,919	7,160	19,626	19,512	17,642	5,410	20,375
10	Farm land reported as provided with drainage.....acres..	11,247,637	13,540	4,668	1,914	23,685	12,549	234,991	1,194	5,339
11	Farm land reported as needing drainage.....acres..	1,223,739	10,580	14,282	1,910	17,344	2,278	20,991	4,316	5,466
12	Drainage only.....acres..	641,493	7,332	4,186	850	10,927	563	13,084	1,076	3,992
13	Drainage and clearing.....acres..	587,246	3,248	10,096	1,060	6,417	1,710	7,907	3,240	1,474

	Cass.	Champaign.	Christian.	Clark.	Clay.	Clinton.	Colas.	Cook.	Crawford.	
1	Number of all farms in the county.....	1,104	3,666	2,782	2,801	2,423	1,794	2,332	5,305	2,248
2	Farms reporting land having drainage.....	488	3,088	2,227	422	99	98	1,792	2,975	331
3	Farms reporting land needing drainage.....	157	94	341	401	279	191	392	1,145	413
4	Farms in drainage and levee districts.....	130	540	330	12	9	72	258	277	33
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	237,440	667,520	448,000	315,520	285,680	309,120	336,000	597,120	239,920
6	All land in farms.....acres..	212,416	604,827	416,918	297,153	270,021	266,108	286,191	348,616	248,855
7	Improved land in farms.....acres..	167,688	591,086	393,915	242,257	240,023	219,746	258,958	303,470	220,259
8	Woodland in farms.....acres..	25,217	9,731	18,160	41,573	26,970	28,420	21,736	23,196	21,149
9	Other unimproved land in farms.....acres..	19,521	4,010	4,853	13,323	3,028	17,942	5,497	21,950	7,447
10	Farm land reported as provided with drainage.....acres..	63,544	413,233	287,765	22,840	3,447	7,277	204,282	124,653	23,191
11	Farm land reported as needing drainage.....acres..	8,342	5,459	14,457	7,056	6,990	4,616	10,109	28,089	10,053
12	Drainage only.....acres..	4,681	3,634	5,561	1,640	252	2,479	4,904	21,561	2,301
13	Drainage and clearing.....acres..	3,661	1,826	8,896	5,416	6,738	2,137	5,115	7,128	7,752

	Cumber-land.	De Kalb.	De Witt.	Douglas.	Du Page.	Edgar.	Edwards.	Effing-ham.	Fayette.	
1	Number of all farms in the county.....	1,982	2,400	1,586	1,630	1,756	2,407	1,180	2,223	3,676
2	Farms reporting land having drainage.....	331	2,053	1,399	1,528	1,369	1,788	306	366	612
3	Farms reporting land needing drainage.....	178	613	189	257	838	393	435	178	358
4	Farms in drainage and levee districts.....	22	278	13	473	41	244	63	3	92
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	225,920	408,320	265,600	266,880	220,800	397,440	152,320	327,040	466,560
6	All land in farms.....acres..	200,061	378,360	247,292	256,301	188,092	365,129	140,204	272,699	405,987
7	Improved land in farms.....acres..	178,571	353,691	224,783	245,223	155,663	334,667	126,250	226,414	339,296
8	Woodland in farms.....acres..	16,436	12,277	16,156	9,586	18,511	24,294	12,481	35,335	46,041
9	Other unimproved land in farms.....acres..	5,054	12,392	6,353	1,492	13,918	6,178	1,473	10,950	20,651
10	Farm land reported as provided with drainage.....acres..	14,501	240,170	195,088	229,111	92,500	244,846	15,352	31,284	29,366
11	Farm land reported as needing drainage.....acres..	2,803	18,186	7,088	8,575	25,111	11,725	9,196	3,250	10,927
12	Drainage only.....acres..	405	10,944	3,808	2,651	14,326	2,922	2,664	587	4,436
13	Drainage and clearing.....acres..	2,398	7,242	3,280	5,924	10,785	8,803	6,532	2,663	6,491

	Ford.	Fulton.	Gallatin.	Greene.	Grundy.	Hamilton.	Hancock.	Hender-son.	Henry.	
1	Number of all farms in the county.....	1,655	3,532	1,387	2,143	1,506	2,633	3,463	1,204	3,161
2	Farms reporting land having drainage.....	1,439	1,443	532	797	1,345	148	963	574	1,976
3	Farms reporting land needing drainage.....	124	401	217	139	451	204	128	85	504
4	Farms in drainage and levee districts.....	507	118	181	36	52	4	20	50	416
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	320,000	565,760	216,320	329,600	277,120	291,200	499,200	240,640	527,360
6	All land in farms.....acres..	295,972	509,953	162,157	320,929	250,993	237,087	462,214	214,206	485,150
7	Improved land in farms.....acres..	291,040	384,020	135,678	258,341	224,967	210,798	366,054	172,675	427,642
8	Woodland in farms.....acres..	3,971	79,918	24,018	43,027	11,880	22,242	58,987	30,424	24,157
9	Other unimproved land in farms.....acres..	961	66,015	2,261	19,561	14,146	4,047	37,173	11,107	33,351
10	Farm land reported as provided with drainage.....acres..	256,984	119,605	53,473	77,070	187,164	6,837	74,558	78,935	174,702
11	Farm land reported as needing drainage.....acres..	4,678	14,086	9,255	10,553	23,284	7,143	3,327	3,166	17,713
12	Drainage only.....acres..	3,041	5,976	5,031	8,759	18,031	1,853	2,480	1,832	13,253
13	Drainage and clearing.....acres..	1,637	8,111	4,224	4,794	5,253	5,160	847	1,334	4,430

DRAINAGE—ILLINOIS.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Iroquois.	Jackson.	Jasper.	Jersey.	Jo Daviess.	Johnson.	Kane.	Kankakee.	Kendall.
1	Number of all farms in the county.....	3,953	2,426	2,762	1,368	2,183	1,742	2,248	2,480	1,210
2	Farms reporting land having drainage.....	3,609	118	340	313	194	45	1,459	2,196	981
3	Farms reporting land needing drainage.....	753	276	354	87	250	221	1,003	480	294
4	Farms in drainage and levee districts.....	1,728	126	40	39	1	29	236	546	18
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	717,440	376,320	325,120	234,880	398,720	222,720	337,280	427,520	207,360
6	All land in farms..... acres..	674,323	312,746	296,917	210,688	355,079	193,077	301,574	397,154	190,994
7	Improved land in farms..... acres..	641,080	220,765	268,247	162,002	236,439	138,537	254,383	366,635	173,932
8	Woodland in farms..... acres..	22,496	72,604	26,061	43,857	59,031	45,672	28,587	14,703	10,792
9	Other unimproved land in farms..... acres..	10,737	19,387	3,609	14,829	69,609	8,878	18,604	15,816	6,270
10	Farm land reported as provided with drainage..... acres..	555,813	14,194	20,877	23,387	5,816	1,895	100,126	304,499	130,061
11	Farm land reported as needing drainage..... acres..	64,296	15,676	10,693	3,319	8,644	7,930	32,162	27,866	8,977
12	Drainage only..... acres..	36,744	2,736	3,619	1,236	3,104	2,479	15,447	17,920	4,139
13	Drainage and clearing..... acres..	27,552	12,940	7,074	2,083	5,540	5,451	16,715	9,946	4,838

		Knox.	La Salle.	Lake.	Lawrence.	Lee.	Livingston.	Logan.	McDonough.	McHenry.
1	Number of all farms in the county.....	2,711	4,213	2,220	1,710	2,593	3,726	3,234	2,728	2,874
2	Farms reporting land having drainage.....	1,690	3,496	1,531	431	1,870	3,453	1,902	1,889	778
3	Farms reporting land needing drainage.....	409	897	1,402	444	496	576	324	183	1,399
4	Farms in drainage and levee districts.....	3	193	184	226	362	268	180	6	143
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	455,040	733,440	291,200	229,120	474,880	667,520	394,880	376,320	396,800
6	All land in farms..... acres..	414,434	668,560	234,800	204,679	432,726	636,957	373,253	355,318	368,765
7	Improved land in farms..... acres..	329,408	603,057	166,928	180,568	392,555	616,725	354,995	289,109	264,352
8	Woodland in farms..... acres..	39,383	45,197	33,475	19,156	16,639	15,206	13,463	37,452	32,982
9	Other unimproved land in farms..... acres..	45,673	20,306	34,397	4,955	23,232	5,026	4,795	28,667	71,431
10	Farm land reported as provided with drainage..... acres..	180,506	472,542	66,346	28,430	240,039	559,913	282,513	194,593	94,078
11	Farm land reported as needing drainage..... acres..	14,706	33,500	17,610	17,847	24,375	21,522	16,724	4,460	52,905
12	Drainage only..... acres..	9,622	25,957	22,206	9,007	18,879	12,872	10,507	1,633	31,620
13	Drainage and clearing..... acres..	5,084	7,543	25,404	8,840	5,496	8,650	6,217	2,827	21,288

		McLean.	Macon.	Macoupin.	Madison.	Marion.	Marshall.	Mason.	Massac.	Menard.
1	Number of all farms in the county.....	4,309	2,528	3,771	3,454	3,097	1,231	1,558	1,192	1,033
2	Farms reporting land having drainage.....	3,620	2,120	840	461	66	917	512	39	689
3	Farms reporting land needing drainage.....	476	247	150	270	388	244	222	266	175
4	Farms in drainage and levee districts.....	320	144	28	97	1	10	472	66	28
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	762,240	374,400	550,400	471,680	364,160	253,440	355,200	153,600	202,880
6	All land in farms..... acres..	714,400	350,154	509,046	399,140	330,720	225,635	311,412	121,135	186,514
7	Improved land in farms..... acres..	683,847	333,126	397,029	343,720	280,947	185,195	269,064	94,147	165,987
8	Woodland in farms..... acres..	23,340	12,078	69,361	36,321	38,085	29,068	26,264	23,615	13,756
9	Other unimproved land in farms..... acres..	7,213	4,050	42,656	19,099	11,688	11,372	16,084	3,373	6,821
10	Farm land reported as provided with drainage..... acres..	586,887	285,985	64,322	24,770	1,785	108,722	70,927	1,148	86,335
11	Farm land reported as needing drainage..... acres..	17,406	7,645	4,050	7,776	9,090	10,404	20,025	10,667	4,676
12	Drainage only..... acres..	7,616	2,658	1,851	4,785	705	6,780	12,623	4,033	1,483
13	Drainage and clearing..... acres..	9,790	4,987	2,199	2,991	8,385	3,624	7,402	6,634	3,193

		Mercer.	Monroe.	Montgomery.	Morgan.	Moultrie.	Ogle.	Peoria.	Piatt.	Pike.
1	Number of all farms in the county.....	2,022	1,498	3,037	2,420	1,501	2,784	2,499	1,386	3,381
2	Farms reporting land having drainage.....	1,161	99	646	1,457	1,335	660	1,171	1,310	515
3	Farms reporting land needing drainage.....	449	52	140	189	228	290	296	104	350
4	Farms in drainage and levee districts.....	50	90	171	12	29	21	43	391	224
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	345,600	248,960	440,960	368,640	216,320	483,840	407,040	288,640	503,040
6	All land in farms..... acres..	824,787	215,592	408,165	337,657	206,781	450,722	348,711	262,071	475,116
7	Improved land in farms..... acres..	262,227	164,080	357,691	297,178	190,031	382,446	263,761	252,929	375,036
8	Woodland in farms..... acres..	31,156	43,265	44,323	23,263	12,978	32,053	48,925	7,534	63,633
9	Other unimproved land in farms..... acres..	31,404	8,247	6,151	17,188	3,772	36,223	36,025	1,608	36,442
10	Farm land reported as provided with drainage..... acres..	87,401	5,627	54,535	158,123	167,194	51,452	121,737	243,716	32,335
11	Farm land reported as needing drainage..... acres..	11,737	785	6,502	7,997	6,859	10,689	10,902	3,334	10,914
12	Drainage only..... acres..	5,745	437	4,540	5,675	2,022	4,963	5,027	1,352	5,663
13	Drainage and clearing..... acres..	5,992	348	1,962	2,322	4,837	5,126	5,875	1,962	5,251

## DRAINAGE—ILLINOIS.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Pope.	Pulaski.	Putnam.	Ran- dolph.	Rich- land.	Rock Island.	St. Clair.	Salina.	Sanga- mon.
1 Number of all farms in the county.....	1,587	1,015	533	2,324	1,930	2,045	3,112	2,105	3,425
2 Farms reporting land having drainage.....	31	191	328	66	128	533	386	463	2,340
3 Farms reporting land needing drainage.....	34	263	90	200	290	221	501	246	521
4 Farms in drainage and levee districts.....	9	123	18	56	44	42	81	346	19
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county..... acres..	246,400	121,600	110,720	375,680	228,480	271,360	424,320	255,360	560,640
6 All land in farms..... acres..	192,894	99,787	91,262	823,081	205,939	243,773	356,423	204,183	496,782
7 Improved land in farms..... acres..	130,447	78,806	67,623	247,433	186,161	178,591	304,430	177,288	461,346
8 Woodland in farms..... acres..	52,698	15,688	17,332	58,542	18,961	35,807	39,137	22,420	24,363
9 Other unimproved land in farms..... acres..	9,749	2,393	6,407	17,106	2,817	29,376	12,856	4,485	11,078
10 Farm land reported as provided with drainage..... acres..	977	11,682	35,991	2,448	3,185	29,432	12,144	33,774	314,126
11 Farm land reported as needing drainage..... acres..	749	11,888	3,805	6,045	5,576	6,750	7,593	7,687	26,646
12 Drainage only..... acres..	378	1,789	2,418	676	899	3,731	2,050	3,603	19,205
13 Drainage and clearing..... acres..	371	10,097	1,387	5,169	4,577	3,019	5,543	4,284	7,441
	Schuy- ler.	Scott.	Shelby.	Stark.	Stephenson.	Tazewell.	Union.	Vermillion.	Wabash.
1 Number of all farms in the county.....	1,778	1,089	3,860	1,077	2,794	2,538	2,006	3,587	1,053
2 Farms reporting land having drainage.....	554	298	1,649	751	466	1,443	160	2,959	466
3 Farms reporting land needing drainage.....	256	108	210	115	416	344	127	716	214
4 Farms in drainage and levee districts.....	104	114	83	1	27	184	140	695	185
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county..... acres..	276,480	159,360	494,080	185,600	357,760	414,080	257,920	589,440	140,800
6 All land in farms..... acres..	256,633	150,543	452,369	178,399	337,442	383,512	217,765	519,338	128,184
7 Improved land in farms..... acres..	177,569	123,690	405,582	157,447	291,795	333,857	150,018	479,153	115,878
8 Woodland in farms..... acres..	60,622	16,023	34,978	11,399	20,544	29,976	58,223	31,269	10,696
9 Other unimproved land in farms..... acres..	18,442	10,830	11,809	9,553	25,103	19,679	9,524	8,917	1,910
10 Farm land reported as provided with drainage..... acres..	53,332	31,153	161,443	79,328	16,854	196,825	14,841	417,698	32,570
11 Farm land reported as needing drainage..... acres..	6,260	4,044	6,821	2,895	7,991	10,983	12,824	28,832	4,642
12 Drainage only..... acres..	1,603	2,014	4,289	1,572	4,929	2,794	3,363	19,595	1,369
13 Drainage and clearing..... acres..	4,657	2,030	2,532	1,323	3,062	3,189	9,461	9,237	3,273
	Warren.	Washing- ton.	Wayna.	White.	White- side.	Will.	Winne- bago.	Wood- ford.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	1,899	2,357	3,769	2,419	2,789	3,385	2,185	1,908	11,201
2 Farms reporting land having drainage.....	1,561	18	261	865	879	2,719	299	1,421	28
3 Farms reporting land needing drainage.....	268	48	336	466	336	972	321	221	306
4 Farms in drainage and levee districts.....	2	1	113	263	370	209	14	4	8
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county..... acres..	349,440	359,040	469,120	324,480	424,560	540,160	338,560	337,920	1,365,120
6 All land in farms..... acres..	318,984	330,136	390,343	283,849	415,559	488,230	292,325	292,978	1,070,915
7 Improved land in farms..... acres..	270,602	268,233	349,079	260,061	369,529	431,039	248,081	252,716	891,981
8 Woodland in farms..... acres..	80,826	48,060	38,026	17,390	17,829	25,608	28,973	28,891	146,406
9 Other unimproved land in farms..... acres..	17,556	13,843	3,238	6,388	28,201	31,583	15,271	13,871	32,529
10 Farm land reported as provided with drainage..... acres..	195,371	568	18,408	75,905	73,498	305,211	11,693	196,052	851
11 Farm land reported as needing drainage..... acres..	9,720	1,398	29,817	14,711	11,598	34,578	10,215	6,383	11,018
12 Drainage only..... acres..	6,771	244	12,661	7,954	8,659	22,194	5,127	1,981	2,469
13 Drainage and clearing..... acres..	2,949	1,154	17,256	6,757	2,939	12,384	5,088	4,402	8,549

<sup>1</sup> No drainage on farms reported in Jefferson and Perry Counties.

DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Adams.	Alexander.	Boons.	Brown.	Bureau.	Calhoun.	Carroll.	Cass.	
<b>LAND AREA.</b>										
1	Approximate land area of the state or county.....acres..	35,867,520	538,880	144,640	187,520	190,080	563,840	163,840	289,920	237,440
2	All land in operating drainage enterprises.....acres..	3,909,049	56,843	18,875	4,052	7,890	64,788	33,000	4,690	35,109
3	Improved land.....acres..	3,532,316	39,831	13,319	3,955	6,122	63,360	29,700	3,646	26,022
4	Per cent of all improved land in farms.....	12.9	10.7	21.4	2.8	5.0	13.8	35.6	1.8	15.5
5	Timber and cut-over land.....acres..	184,573	15,269	3,886	965	963	1,650	170	1,292	7,795
6	Other unimproved land.....acres..	192,160	1,743	1,670	97	803	735	1,650	874	7,795
7	Swampy or subject to overflow, in enterprises.....acres..	228,337	16,028	2,330	194	1,070	2,046	3,300	469	7,219
8	Suffering a loss of crops from defective drainage.....acres..	229,065	3,456	2,330	194	1,070	2,046	3,300	469	939
9	Assessed acreage.....acres..	4,090,599	56,853	18,885	4,052	7,890	64,788	33,000	4,690	35,109
10	Excess over all land in operating enterprises.....acres..	181,650	10	10						
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....miles..	4,754.5	71.5	32.6	11.0	16.0	105.4	18.0	10.0	52.6
12	Additional under construction.....miles..	65.7	6.5				4.0			1.0
13	Maximum completed in any enterprise.....miles..	80.0	47.0	12.0	8.0	9.0	15.0	18.0	6.0	14.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	100	80	50	25	70	80	80	30	80
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	42.0	20.0	10.0	10.0	12.0	12.0	12.0	12.0	18.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	4.8	7.0	7.2	6.0	4.9	5.0	8.0	4.3	5.6
<b>Tile drains:</b>										
17	Completed.....miles..	3,507.1	2.5		5.0	33.3	16.5			2.1
18	Additional under construction.....miles..	127.1				9.6	2.0			
19	Maximum completed in any enterprise.....miles..	200.0	2.5		3.0	23.3	2.7			1.0
20	Maximum size of tile <sup>1</sup> .....inches..	48	16		22	24	24			18
<b>Accessory levees and dikes:</b>										
21	Completed.....miles..	650.2	22.6	19.1		14.3			12.9	9.4
22	Additional under construction.....miles..	97.1	23.4						2.1	
<b>Pumping plants:</b>										
23	Engine capacity.....horsepower..	18,225	1,450	50		225			150	475
24	Pump capacity.....gallons per minute..	2,843,066	141,000	5,500		38,000			31,000	136,000
25	Area served by pumps.....acres..	201,816	38,476	200		7,750			2,800	13,480
26	Area drained by open ditches only <sup>1</sup> .....acres..	1,508,695	14,667		1,940		27,185	33,000		22,476
27	Length of these ditches.....miles..	2,406.7	8.0		8.0		38.8	18.0		29.9
28	Average length per acre.....feet..	8.4	2.9		21.8		7.5	2.9		7.0
29	Area having open ditches and levees <sup>1</sup> .....acres..	452,588	31,976	18,875		1,900			4,690	3,640
30	Length of these ditches.....miles..	559.7	23.0	32.6		5.0			10.0	7.2
31	Average length per acre.....feet..	6.5	5.5	9.1		13.9			11.3	10.4
32	Length of the accessory levees.....miles..	469.1	23.0	19.1		5.0			15.0	6.9
33	Area drained by tile only <sup>1</sup> .....acres..	392,738			712		815			
34	Length of these tile.....miles..	2,208.9			3.0		2.7			
35	Average length per acre.....feet..	16.2			22.2		17.5			
36	Area having tile drains and levees <sup>1</sup> .....acres..	10,109								
37	Length of these tile.....miles..	2.0								
38	Average length per acre.....feet..	1.0								
39	Length of the accessory levees.....miles..	16.0								
40	Area drained by open ditches and tile <sup>1</sup> .....acres..	1,327,996			1,400		36,783			3,000
41	Length of these drains.....miles..	3,012.4			5.0		86.4			6.5
42	Average length per acre.....feet..	12.0			18.9		12.4			11.4
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres..	216,923	20,200			5,990				5,993
44	Length of these drains.....miles..	1,268.7	49.5			53.9				12.1
45	Average length per acre.....feet..	30.8	12.9			47.5				10.7
46	Length of the accessory levees.....miles..	262.2	23.0			9.3				8.5
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920.....acres..	3,532,316	39,831	13,319	3,955	6,122	63,360	29,700	3,646	26,022
48	Improved land prior to drainage.....acres..	2,082,521	12,433	10,193	528	3,052	25,586	1,650	985	11,812
49	Increase since drainage.....acres..	1,469,795	27,398	3,126	3,427	3,070	37,774	28,050	2,661	14,210
50	Per cent of increase <sup>1</sup> .....	71.3	220.4	30.7	649.1	100.6	147.6		270.2	120.3
51	Per cent increase is of all improved land in farms, 1920.....	8.4	7.3	5.0	2.4	2.5	8.2	33.6	1.2	8.5
52	Timber and cut-over land, 1920.....acres..	184,573	15,269	3,886		965	963	1,650	170	1,292
53	Timber and cut-over land prior to drainage.....acres..	479,498	29,580	5,228		2,036	948	11,550	170	4,082
54	Decrease since drainage.....acres..	294,925	14,311	1,342		1,071	255	9,900		2,790
55	Per cent of decrease.....	61.6	48.4	25.7		52.6	26.9	85.7		68.3
56	Other unimproved land, 1920.....acres..	192,160	1,743	1,670	97	803	735	1,650	874	7,795
57	Other unimproved land prior to drainage.....acres..	1,867,030	14,830	3,454	8,524	3,802	38,254	19,800	3,535	19,215
58	Decrease since drainage.....acres..	1,174,870	13,087	1,784	3,427	1,999	37,519	18,150	2,661	11,420
59	Per cent of decrease.....	62.9	88.2	51.7	97.2	71.3	98.1	91.7	75.3	59.4
60	Swampy or subject to overflow, 1920.....acres..	228,337	16,028	2,330	194	1,070	2,046	3,300	469	7,219
61	Swampy or subject to overflow prior to drainage.....acres..	1,864,138	23,740	9,913	3,275	7,378	80,307	16,500	3,535	24,591
62	Decrease since drainage.....acres..	1,635,801	7,712	7,583	3,081	6,308	28,261	13,200	3,066	17,372
63	Per cent of decrease.....	87.8	32.5	76.6	84.1	85.5	83.2	80.0	86.7	70.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises.....dollars..	51,393,244	2,133,995	371,484	40,500	301,150	893,120	733,488	133,000	850,068
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	43,595,069	1,436,995	371,484	40,500	284,250	787,120	733,488	114,000	845,068
66	Additional capital required to complete these enterprises.....dollars..	7,798,175	697,000			16,900	96,000		19,000	5,000
67	Average cost per acre when completed.....dollars..	13.16	37.54	16.68	10.00	38.17	13.63	22.33	28.36	24.21
68	Enterprises constructing open ditches only.....dollars..	11,874,658	325,965		20,000		468,194	733,488		645,036
69	Average cost per acre when completed.....dollars..	7.87	22.23		10.31		17.22	22.23		28.61
70	Enterprises constructing open ditches and levees.....dollars..	19,450,251	1,141,000	371,484		130,000			133,000	86,050
71	Average cost per acre when completed.....dollars..	43.60	61.92	16.68		68.42			28.36	23.64
72	Enterprises constructing tile drains only.....dollars..	3,181,397			5,500		10,758			
73	Average cost per acre when completed.....dollars..	8.10			7.72		18.20			
74	Enterprises constructing tile drains and levees.....dollars..	160,000								
75	Average cost per acre when completed.....dollars..	15.83								
76	Enterprises constructing open ditches and tile drains.....dollars..	10,841,870			15,000		404,168			35,249
77	Average cost per acre when completed.....dollars..	8.01			10.71		10.99			11.75
78	Enterprises constructing open ditches, tile drains, and levees.....dollars..	6,076,068	667,000			171,150				85,724
79	Average cost per acre when completed.....dollars..	28.01	33.02			28.57				14.30
<b>CROPS.</b>										
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres..	3,404,489	39,831	13,319	3,955	6,122	63,360	29,700	3,646	18,298
81	Wheat as principal crop on drained land.....acres..	88,520								7,764
82	Potatoes as principal crop on drained land.....acres..	28,723								
83	Vegetables as principal crop on drained land.....acres..	5,380								
84	Not reporting principal crop on drained land.....acres..	5,204								

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

## DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Cham- paign.	Chris- tian.	Clark.	Clay.	Clinton.	Coles.	Cook.	Craw- ford.	Cumber- land.	De Kalb.	
<b>LAND AREA.</b>												
1	Approximate land area of the county.....	acres..	687,520	448,000	315,520	295,680	309,120	336,000	597,120	280,920	225,920	408,320
2	All land in operating drainage enterprises.....	acres..	331,846	110,129	5,344	6,080	8,303	65,695	37,532	17,589	7,207	46,900
3	Improved land.....	acres..	327,787	108,690	4,810	5,350	7,955	65,132	35,373	15,604	6,494	38,100
4	Per cent of all improved land in farms.....	.....	55.5	27.6	2.0	2.2	3.6	25.2	11.7	7.1	3.6	10.8
5	Timber and cut-over land.....	acres..	1,899	174	730	348	450	531	1,985	43	.....	.....
6	Other unimproved land.....	acres..	1,960	1,439	360	.....	13	1,628	.....	670	.....	8,800
7	Swampy or subject to overflow, in enterprises.....	acres..	2,527	2,503	736	3,648	1,060	695	2,340	6,055	10	1,222
8	Suffering a loss of crops from defective drainage.....	acres..	1,678	2,503	736	3,648	1,060	695	2,340	6,055	10	563
9	Assessed acreage.....	acres..	441,367	110,129	5,344	6,080	8,303	66,145	37,532	17,589	7,207	46,900
10	Excess over all land in operating enterprises.....	acres..	109,721	.....	.....	.....	650	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>												
11	Open ditches:											
12	Completed.....	miles..	408.7	112.8	6.3	8.1	20.5	24.9	65.4	23.8	11.7	72.9
13	Additional under construction.....	miles..	6.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	Maximum completed in any enterprise.....	miles..	27.5	16.0	2.5	8.1	16.0	4.5	9.0	9.5	8.0	10.0
15	Maximum width at bottom of ditch <sup>1</sup> .....	feet..	50	100	16	16	12	20	30	10	10	40
16	Maximum of average depths of outlet ditches <sup>2</sup> .....	feet..	12.0	12.0	9.0	12.0	6.0	10.0	11.0	15.0	6.0	8.0
17	Mean depth of branch ditches <sup>1</sup> .....	feet..	6.0	3.9	4.4	.....	3.0	4.0	4.7	7.0	4.3	6.0
18	Tile drains:											
19	Completed.....	miles..	386.1	243.8	7.4	.....	36.5	44.4	13.5	2.7	45.8	.....
20	Additional under construction.....	miles..	11.1	.....	.....	.....	2.1	.....	.....	.....	.....	.....
21	Maximum completed in any enterprise.....	miles..	41.0	9.8	7.1	.....	6.6	9.0	10.1	1.7	6.0	.....
22	Maximum size of tile <sup>1</sup> .....	inches..	32	30	12	.....	36	32	24	16	30	.....
23	Accessory levees and dikes:											
24	Completed.....	miles..	.....	3.5	0.8	11.5	.....	.....	.....	.....	.....	.....
25	Additional under construction.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Pumping plants:											
27	Engine capacity.....	horsepower..	.....	.....	.....	.....	50	.....	.....	.....	.....	.....
28	Pump capacity.....	gallons per minute..	.....	.....	.....	10,000	.....	.....	.....	.....	.....	.....
29	Area served by pumps.....	acres..	.....	.....	.....	600	.....	.....	.....	.....	.....	.....
30	Area drained by open ditches only <sup>1</sup> .....	acres..	130,190	11,438	1,820	6,080	46,066	12,282	6,850	3,236	35,833	.....
31	Length of these ditches.....	miles..	233.8	32.0	2.1	8.1	12.6	24.9	10.8	5.1	54.8	.....
32	Average length per acre.....	feet..	9.5	14.8	6.1	7.0	1.4	9.9	8.3	8.3	8.1	.....
33	Area having open ditches and levees <sup>1</sup> .....	acres..	.....	.....	.....	8,303	.....	.....	.....	.....	.....	.....
34	Length of these ditches.....	miles..	.....	.....	.....	29.5	.....	.....	.....	.....	.....	.....
35	Average length per acre.....	feet..	.....	.....	.....	18.8	.....	.....	.....	.....	.....	.....
36	Length of the accessory levees.....	miles..	.....	.....	.....	11.5	.....	.....	.....	.....	.....	.....
37	Area drained by tile only <sup>1</sup> .....	acres..	30,167	42,225	.....	.....	2,928	3,645	.....	.....	3,300	.....
38	Length of these tiles.....	miles..	212.4	139.4	.....	.....	11.6	30.8	.....	.....	27.0	.....
39	Average length per acre.....	feet..	37.2	17.4	.....	.....	20.9	44.6	.....	.....	48.2	.....
40	Area having tile drains and levees <sup>1</sup> .....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
41	Length of these tile drains.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	Average length per acre.....	feet..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
43	Area drained by open ditches and tile <sup>1</sup> .....	acres..	171,289	55,966	1,624	.....	16,611	20,605	10,739	3,971	7,767	.....
44	Length of these drains.....	miles..	365.7	181.5	2.0	.....	39.3	54.1	26.5	9.3	36.9	.....
45	Average length per acre.....	feet..	11.3	17.1	6.5	.....	12.5	13.9	13.0	12.4	25.1	.....
46	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres..	.....	500	1,900	.....	.....	.....	.....	.....	.....	.....
47	Length of these drains.....	miles..	.....	3.7	9.6	.....	.....	.....	.....	.....	.....	.....
48	Average length per acre.....	feet..	.....	39.1	26.7	.....	.....	.....	.....	.....	.....	.....
49	Length of the accessory levees.....	miles..	.....	3.5	0.8	.....	.....	.....	.....	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>												
50	Improved land in operating enterprises, 1920.....	acres..	327,787	108,690	4,810	5,350	7,955	65,132	35,373	15,604	6,494	38,100
51	Improved land prior to drainage.....	acres..	250,271	66,603	2,341	4,864	3,947	64,045	18,384	10,247	5,489	22,099
52	Increase since drainage.....	acres..	77,516	42,087	2,469	486	4,008	1,087	16,489	5,257	1,005	16,001
53	Per cent of increase.....	.....	21.6	63.2	105.5	10.0	101.5	1.7	67.3	52.3	18.3	72.4
54	Per cent increase is of all improved land in farms, 1920.....	.....	13.1	10.7	1.0	0.2	1.8	0.4	5.4	2.4	0.6	4.5
55	Timber and cut-over land, 1920.....	acres..	1,899	174	730	348	450	531	1,985	43	.....	.....
56	Timber and cut-over land prior to drainage.....	acres..	11,026	407	1,216	1,150	1,420	705	5,906	133	.....	.....
57	Decrease since drainage.....	acres..	9,727	233	486	802	970	174	3,921	90	.....	.....
58	Per cent of decrease.....	.....	83.7	57.2	40.0	69.7	68.3	24.7	66.4	67.7	.....	.....
59	Other unimproved land, 1920.....	acres..	1,960	1,439	360	.....	13	1,628	.....	670	.....	8,800
60	Other unimproved land prior to drainage.....	acres..	69,749	43,526	2,596	.....	130	17,943	1,436	1,585	.....	24,801
61	Decrease since drainage.....	acres..	67,789	42,087	2,236	.....	3,206	117	16,315	1,436	.....	16,001
62	Per cent of decrease.....	.....	97.2	96.7	86.1	.....	100.0	90.0	100.0	57.7	.....	64.5
63	Swampy or subject to overflow, 1920.....	acres..	2,527	2,503	736	3,648	1,060	695	2,340	6,055	10	1,222
64	Swampy or subject to overflow prior to drainage.....	acres..	111,904	44,900	4,125	4,864	6,239	26,495	16,223	9,637	3,114	20,496
65	Decrease since drainage.....	acres..	109,277	42,403	3,389	1,216	4,179	25,500	13,883	3,582	3,104	19,274
66	Per cent of decrease.....	.....	97.7	94.4	82.2	25.0	79.8	97.4	85.6	37.2	99.7	94.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
67	Total capital invested in and required for completion of operating enterprises.....	dollars..	2,151,982	601,798	57,562	38,677	158,894	371,410	366,169	139,909	45,161	385,667
68	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	2,057,536	601,798	57,562	38,677	158,894	332,512	386,169	139,909	45,161	385,667
69	Additional capital required to complete these enterprises.....	dollars..	94,396	.....	.....	.....	38,898	.....	.....	.....	.....	.....
70	Average cost per acre when completed.....	dollars..	6.49	5.46	10.77	6.36	19.14	5.66	9.76	7.95	6.27	8.22
71	Enterprises constructing open ditches only.....	dollars..	634,785	46,200	10,180	38,677	.....	102,712	115,500	41,000	19,527	236,067
72	Average cost per acre when completed.....	dollars..	4.88	4.04	5.59	6.36	.....	2.23	8.70	5.99	6.03	6.60
73	Enterprises constructing open ditches and levees.....	dollars..	.....	.....	.....	.....	153,894	.....	.....	.....	.....	.....
74	Average cost per acre when completed.....	dollars..	.....	.....	.....	.....	19.14	.....	.....	.....	.....	.....
75	Enterprises constructing tile drains only.....	dollars..	481,473	241,890	.....	.....	.....	48,909	63,920	.....	.....	56,000
76	Average cost per acre when completed.....	dollars..	15.96	5.73	.....	.....	.....	16.70	17.54	.....	.....	16.97
77	Enterprises constructing tile drains and levees.....	dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78	Average cost per acre when completed.....	dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79	Enterprises constructing open ditches and tile drains.....	dollars..	1,035,675	293,708	7,382	.....	219,789	186,749	98,909	25,634	93,000	.....
80	Average cost per acre when completed.....	dollars..	6.05	5.25	4.55	.....	13.23	9.06	9.21	6.46	11.07	.....
81	Enterprises constructing open ditches, tile drains, and levees.....	dollars..	.....	90,000	40,000	.....	.....	.....	.....	.....	.....	.....
82	Average cost per acre when completed.....	dollars..	.....	40.00	21.05	.....	.....	.....	.....	.....	.....	.....
<b>CROPS.</b>												
83	Improved land in enterprises reporting—											
84	Corn as principal crop on drained land.....	acres..	284,212	108,690	4,810	.....	4,863	65,132	32,993	9,192	6,494	38,100
85	Wheat as principal crop on drained land.....	acres..	14,852	.....	.....	.....	3,062	.....	.....	6,412	.....	.....
86	Potatoes as principal crop on drained land.....	acres..	28,723	.....	.....	.....	.....	.....	.....	.....	.....	.....
87	Vegetables as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	2,380	.....	.....	.....
88	Not reporting principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup>When works under construction have been completed.

DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	De Witt.	Douglas.	Du Page.	Edgar.	Edwards.	Fayette.	Ford.	Fulton.	Gallatin.	Greene.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	265,600	266,880	220,800	397,440	152,320	466,560	320,000	565,760	216,320	329,600
2	All land in operating drainage enterprises.....	86,200	155,823	15,019	63,442	9,011	40,562	136,175	27,194	22,176	36,548
3	Improved land.....	36,184	155,525	13,915	60,531	7,752	28,543	113,953	17,354	19,947	28,699
4	Per cent of all improved land in farms.....	16.1	63.4	8.9	18.1	6.1	8.4	39.2	4.8	14.7	11.1
5	Timber and cut-over land.....	16	298	1,104	2,386	1,259	11,885	722	3,290	2,229	2,409
6	Other unimproved land.....	16	298	1,104	2,386	1,259	11,885	722	3,290	2,229	2,409
7	Swampy or subject to overflow, in enterprises.....	466	236	1,157	7,752	7,363	2,111	8,444	1,715	525	525
8	Suffering a loss of crops from defective drainage.....	466	236	1,157	7,752	7,363	2,111	8,444	1,715	525	525
9	Assessed acreage.....	86,200	164,823	15,019	63,442	9,011	40,562	137,095	27,194	22,176	36,548
10	Excess over all land in operating enterprises.....		9,000				920				
<b>DRAINAGE WORKS.</b>											
11	Open ditches:										
12	Completed.....	10.4	127.1	13.2	44.9	18.9	50.9	117.7	42.7	32.5	54.5
13	Additional under construction.....								8.8		
14	Maximum completed in any enterprise.....	5.5	12.5	6.0	7.6	12.6	11.0	24.0	7.0	14.0	19.0
15	Maximum width at bottom of ditch <sup>1</sup> .....	20	24	20	6	35	30	60	40	25	60
16	Maximum of average depths of outlet ditches <sup>1</sup> .....	8.0	10.0	7.0	9.0	12.0	10.0	11.0	12.0	20.0	12.0
17	Mean depth of branch ditches <sup>1</sup> .....		6.3		3.7	5.8	7.1	5.6	7.1	5.9	7.3
18	Tile drains:										
19	Completed.....	44.9	197.4	28.6	92.5	22.3	64.1	108.8	2.1	335.0	
20	Additional under construction.....			4.9				1.5			
21	Maximum completed in any enterprise.....	9.5	9.2	5.6	11.2	10.0	13.0	75.0	2.1	200.0	
22	Maximum size of tile <sup>1</sup> .....	40	30	30	30	24	48	32	14	18	
23	Accessory levees and dikes:										
24	Completed.....					19.0	5.0	35.3		57.4	
25	Additional under construction.....							17.8		1.2	
26	Pumping plants:										
27	Engine capacity.....							1,175		3,140	
28	Pump capacity.....							204,500		424,000	
29	Area served by pumps.....							22,885		35,733	
30	Area drained by open ditches only <sup>1</sup> .....	1,600	29,160	3,300	6,139	9,011	9,623	26,405		21,359	1,260
31	Length of these ditches.....	2.6	60.2	11.0	9.3	18.9	14.3	36.7		32.5	1.5
32	Average length per acre.....	8.6	10.9	17.6	8.0	11.1	7.8	7.3		8.0	6.3
33	Area having open ditches and levees <sup>1</sup> .....						15,000	9,900	7,500		20,325
34	Length of these ditches.....						11.0	9.5	13.5		26.0
35	Average length per acre.....						3.9	5.1	9.5		6.8
36	Length of the accessory levees.....						15.0	5.0	16.2		35.0
37	Area drained by tile only <sup>1</sup> .....	28,093	44,563	8,608	12,411			7,330		817	
38	Length of these tile.....	30.6	104.8	25.9	29.0			13.5		2.1	
39	Average length per acre.....	8.4	12.4	15.9	12.3			9.7		13.6	
40	Area having tile drains and levees <sup>1</sup> .....										
41	Length of these tile.....										
42	Average length per acre.....										
43	Length of the accessory levees.....										
44	Area drained by open ditches and tile drains <sup>1</sup> .....	11,507	82,100	3,116	44,892		11,200	92,540	3,600		
45	Length of these drains.....	16.1	159.5	9.8	99.1		32.9	122.1	8.9		
46	Average length per acre.....	7.4	10.3	16.6	11.7		15.5	7.0	5.7		
47	Area having open ditches, tile drains, and levees <sup>1</sup> .....						4,739		16,094		14,963
48	Length of these drains.....						15.0		139.4		362.0
49	Average length per acre.....						16.7		45.7		127.7
50	Length of the accessory levees.....						4.0		36.9		23.6
<b>DEVELOPMENT OF LAND.</b>											
51	Improved land in operating enterprises, 1920.....	36,184	155,525	13,915	60,531	7,752	28,543	113,953	17,354	19,947	28,699
52	Improved land prior to drainage.....	34,375	116,393	7,139	50,324	8,662	11,868	36,463	4,036	13,234	9,472
53	Increase since drainage.....	1,809	39,132	6,776	10,207	4,090	16,675	27,490	13,318	6,713	19,227
54	Per cent of increase.....	5.3	33.6	94.9	20.8	111.7	140.5	31.8	330.0	50.7	203.0
55	Per cent increase is of all improved land in farms, 1920.....	0.8	16.0	4.4	8.0	3.2	4.9	9.4	8.7	4.9	7.4
56	Timber and cut-over land, 1920.....	16	298	1,104	2,386	1,259	11,885	722	3,290	2,229	2,409
57	Timber and cut-over land prior to drainage.....	160	884		1,941	5,349	25,958	848	8,934	8,942	11,019
58	Decrease since drainage.....	144	884		1,416	4,090	14,073	126	5,644	6,713	8,610
59	Per cent of decrease.....	90.0	100.0		73.0	76.5	54.2	14.9	63.2	75.1	78.1
60	Other unimproved land, 1920.....		298	1,104	2,386	1,259	11,885	722	3,290	2,229	2,409
61	Other unimproved land prior to drainage.....	1,065	38,546	7,880	11,177		2,736	48,864	14,224	16,057	16,057
62	Decrease since drainage.....	1,065	38,248	6,776	8,791		2,602	27,364	7,774	10,617	10,617
63	Per cent of decrease.....	100.0	99.2	86.0	78.7		95.1	56.0	54.0	66.1	66.1
64	Swampy or subject to overflow, 1920.....	466	236	1,157	7,752	7,363	2,111	8,444	1,715	525	525
65	Swampy or subject to overflow prior to drainage.....	8,585	78,492	5,532	29,135	9,011	25,394	66,205	18,808	8,823	18,604
66	Decrease since drainage.....	8,119	78,256	4,375	29,135	1,259	18,031	64,094	10,364	8,108	18,079
67	Per cent of decrease.....	94.6	99.7	79.1	100.0	14.0	71.0	96.8	55.1	82.5	97.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
68	Total capital invested in and required for completion of operating enterprises.....	240,839	732,899	188,192	439,310	83,542	525,994	780,272	1,601,950	92,503	1,087,928
69	Capital invested in these enterprises to Dec. 31, 1919.....	240,839	732,899	188,192	439,310	83,542	525,994	780,272	1,178,450	92,503	1,059,928
70	Additional capital required to complete these enterprises.....			68,000					423,500		28,000
71	Average cost per acre when completed.....	6.65	4.70	12.53	6.92	9.27	12.97	5.78	58.91	4.17	29.77
72	Enterprises constructing open ditches only.....	10,000	132,502	22,000	23,977	83,542	77,213	131,151		89,803	40,534
73	Average cost per acre when completed.....	6.25	4.54	6.67	3.91	9.27	8.02	4.97		4.20	32.41
74	Enterprises constructing open ditches and levees.....						325,845	18,050	645,500		612,092
75	Average cost per acre when completed.....						21.72	1.82	72.73		30.12
76	Enterprises constructing tile drains only.....	180,385	225,468	69,949	83,440			49,019		2,700	
77	Average cost per acre when completed.....	7.83	5.06	8.13	6.72			6.69		3.30	
78	Enterprises constructing tile drains and levees.....										
79	Average cost per acre when completed.....										
80	Enterprises constructing open ditches and tile drains.....	49,954	374,929	96,243	331,884		77,959	582,052	23,500		
81	Average cost per acre when completed.....	4.34	4.57	30.89	7.39		6.96	6.29	6.53		
82	Enterprises constructing open ditches, tile drains, and levees.....						44,977		1,032,950		435,000
83	Average cost per acre when completed.....						9.49		64.18		29.07
<b>CROPS.</b>											
84	Improved land in enterprises reporting—										
85	Corn as principal crop on drained land.....	36,184	155,525	13,915	60,531	7,752	28,200	113,953	15,224	19,947	20,392
86	Wheat as principal crop on drained land.....						343		1,800		8,307
87	Potatoes as principal crop on drained land.....										
88	Vegetables as principal crop on drained land.....										
89	Not reporting principal crop on drained land.....							330			

<sup>1</sup>When works under construction have been completed.

DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Grundy.	Hamilton.	Hancock.	Henderson.	Henry.	Iroquois.	Jackson.	Jersey.	Johnson.	Kane.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	277,120	291,200	499,200	240,640	527,360	717,440	376,320	234,890	222,720	337,280
2	All land in operating drainage enterprises.....	11,360	50,470	17,100	17,500	84,560	283,159	19,078	12,412	15,896	48,626
3	Improved land.....	3,296	24,240	15,550	15,773	78,135	278,159	16,083	10,842	7,663	48,829
4	Per cent of all improved land in farms.....	1.5	11.5	4.2	9.1	13.3	43.4	7.3	7.1	5.5	18.4
5	Timber and cut-over land.....	8,064	26,230	1,550	967	1,105	950	1,570	5,283	51	51
6	Other unimproved land.....	8,064	8,064	780	780	5,320	4,050	2,995	2,950	1,746	1,746
7	Swampy or subject to overflow, in enterprises.....	8,064	5,958	1,550	967	1,313	4,082	2,995	3,940	1,465	1,465
8	Suffering a loss of crops from defective drainage.....	11,360	11,208	8,875	944	1,320	4,217	.....	6,268	716	716
9	Assessed acreage.....	11,360	50,470	17,100	17,500	84,560	283,159	19,078	12,412	15,896	48,626
10	Excess over all land in operating enterprises.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>											
11	Open ditches:										
12	Completed.....	4.3	65.8	14.0	35.0	155.8	337.4	53.0	16.5	18.1	60.7
13	Additional under construction.....	.....	9.9	.....	2.4	.....	.....	.....	.....	.....	.....
14	Maximum completed in any enterprise.....	4.3	33.0	12.0	30.0	32.0	35.0	35.0	10.5	7.0	8.0
15	Maximum width at bottom of ditch <sup>1</sup> .....	13	80	35	40	80	30	23	30	50	40
16	Maximum of average depths of outlet ditches <sup>1</sup> .....	8.0	14.0	10.0	12.0	12.0	10.0	10.0	11.0	42.0	11.0
17	Mean depth of branch ditches <sup>1</sup> .....	.....	7.8	6.0	4.9	4.2	4.9	6.8	5.0	4.2	5.9
18	Tile drains:										
19	Completed.....	5.8	.....	.....	31.0	42.4	172.5	.....	0.8	.....	26.1
20	Additional under construction.....	15.2	.....	0.3	0.2	.....	.....	.....	.....	.....	.....
21	Maximum completed in any enterprise.....	5.0	.....	.....	31.0	20.0	20.0	.....	0.5	.....	8.5
22	Maximum size of tile <sup>1</sup> .....	26	.....	42	14	18	36	.....	14	.....	32
23	Accessory levees and dikes:										
24	Completed.....	.....	11.5	27.0	5.8	.....	.....	2.8	5.0	.....	.....
25	Additional under construction.....	.....	.....	1.0	5.5	.....	.....	.....	.....	.....	.....
26	Pumping plants:										
27	Engine capacity.....	.....	70	800	.....	.....	.....	( <sup>2</sup> )	.....	.....	.....
28	Pump capacity.....	.....	6,000	153,500	.....	.....	.....	( <sup>2</sup> )	.....	.....	.....
29	Area served by pumps.....	.....	2,500	17,500	.....	.....	.....	9,540	.....	.....	.....
30	Area drained by open ditches only <sup>1</sup> .....	.....	50,470	.....	26,410	65,190	19,078	2,322	9,993	36,781	.....
31	Length of these ditches.....	.....	75.7	.....	62.0	128.0	53.0	3.3	12.1	51.8	.....
32	Average length per acre.....	.....	7.9	.....	12.4	10.4	14.7	7.5	6.4	7.4	.....
33	Area having open ditches and levees <sup>1</sup> .....	.....	15,500	.....	3,750	.....	.....	.....	5,903	.....	.....
34	Length of these ditches.....	.....	12.0	.....	5.5	.....	.....	.....	6.0	.....	.....
35	Average length per acre.....	.....	4.1	.....	7.7	.....	.....	.....	5.4	.....	.....
36	Length of the accessory levees.....	.....	11.0	.....	11.0	.....	.....	.....	5.0	.....	.....
37	Area drained by tile only <sup>1</sup> .....	2,400	.....	.....	.....	17,820	.....	.....	.....	3,445	.....
38	Length of these tile.....	5.0	.....	.....	.....	34.9	.....	.....	.....	11.0	.....
39	Average length per acre.....	11.0	.....	.....	.....	10.3	.....	.....	.....	16.9	.....
40	Area having tile drains and levees <sup>1</sup> .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
41	Length of these tile.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	Average length per acre.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
43	Area drained by open ditches and tile drains <sup>1</sup> .....	8,960	.....	.....	50,800	200,149	.....	9,540	.....	8,400	.....
44	Length of these drains.....	20.3	.....	.....	119.1	247.0	.....	11.0	.....	24.0	.....
45	Average length per acre.....	12.0	.....	.....	12.4	9.2	.....	6.1	.....	15.1	.....
46	Area having open ditches, tile drains, and levees <sup>1</sup> .....	.....	1,600	17,500	3,600	.....	.....	550	.....	.....	.....
47	Length of these drains.....	.....	2.3	66.2	14.0	.....	.....	2.8	.....	.....	.....
48	Average length per acre.....	.....	7.6	20.0	20.5	.....	.....	26.9	.....	.....	.....
49	Length of the accessory levees.....	.....	0.5	28.0	0.3	.....	.....	2.8	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>											
50	Improved land in operating enterprises, 1920.....	3,296	24,240	15,550	15,773	78,135	278,159	16,083	10,842	7,663	48,829
51	Improved land prior to drainage.....	896	14,292	2,055	1,520	33,551	181,490	3,760	3,044	5,388	5,006
52	Increase since drainage.....	2,400	9,948	13,495	14,253	44,584	96,679	12,323	7,798	2,275	41,823
53	Per cent of increase.....	267.9	69.6	656.7	937.7	132.9	53.3	327.7	256.2	42.2	835.5
54	Per cent increase is of all improved land in farms, 1920.....	1.1	4.7	3.7	8.3	10.4	15.1	5.6	5.1	1.6	16.4
55	Timber and cut-over land, 1920.....	26,230	1,550	967	1,105	950	.....	1,570	5,283	51	51
56	Timber and cut-over land prior to drainage.....	36,178	11,625	4,790	2,205	2,662	5,646	8,818	7,558	261	261
57	Decrease since drainage.....	9,948	10,075	3,823	1,100	1,712	5,646	7,248	2,275	200	200
58	Per cent of decrease.....	27.5	86.7	79.8	49.9	64.3	100.0	82.2	30.1	79.7	79.7
59	Other unimproved land, 1920.....	8,064	.....	780	5,320	4,050	2,995	.....	2,950	1,746	1,746
60	Other unimproved land prior to drainage.....	10,464	3,420	11,190	45,804	99,017	9,672	550	2,950	48,369	48,369
61	Decrease since drainage.....	2,400	3,420	43,484	94,967	6,677	550	.....	41,623	.....	41,623
62	Per cent of decrease.....	22.9	100.0	93.2	89.1	95.9	100.0	.....	96.0	.....	96.0
63	Swampy or subject to overflow, 1920.....	8,064	5,958	1,550	967	1,313	4,082	2,995	3,940	1,465	1,465
64	Swampy or subject to overflow prior to drainage.....	9,984	16,467	4,700	11,420	25,535	111,258	6,672	10,297	7,649	30,283
65	Decrease since drainage.....	1,920	10,529	3,150	10,453	24,222	107,176	6,677	10,297	3,709	28,818
66	Per cent of decrease.....	19.2	63.9	67.0	91.5	94.9	96.3	69.0	100.0	48.5	95.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
67	Total capital invested in and required for completion of operating enterprises.....	198,612	623,901	250,000	650,000	1,009,750	1,629,378	253,000	344,166	107,448	291,671
68	Capital invested in these enterprises to Dec. 31, 1919.....	122,444	433,901	245,000	600,000	965,750	1,629,378	253,000	344,166	107,448	291,671
69	Additional capital required to complete these enterprises.....	76,168	190,000	5,000	50,000	44,000	.....	.....	.....	.....	.....
70	Average cost per acre when completed.....	17.48	12.36	14.62	37.14	11.94	5.75	13.26	27.73	6.76	6.00
71	Enterprises constructing open ditches only.....	.....	623,901	.....	.....	225,750	351,178	253,000	15,000	68,550	148,075
72	Average cost per acre when completed.....	.....	12.36	.....	.....	8.55	5.39	13.26	6.46	6.86	4.03
73	Enterprises constructing open ditches and levees.....	.....	.....	200,000	.....	118,000	.....	.....	.....	38,898	.....
74	Average cost per acre when completed.....	.....	.....	12.90	.....	31.47	.....	.....	.....	6.59	.....
75	Enterprises constructing tile drains only.....	16,000	.....	.....	.....	123,576	.....	.....	.....	.....	39,096
76	Average cost per acre when completed.....	6.67	.....	.....	.....	6.93	.....	.....	.....	.....	11.35
77	Enterprises constructing tile drains and levees.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78	Average cost per acre when completed.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79	Enterprises constructing open ditches and tile drains.....	182,612	.....	.....	.....	621,000	1,154,624	.....	309,166	.....	104,500
80	Average cost per acre when completed.....	20.38	.....	.....	.....	12.22	5.77	.....	32.41	.....	12.44
81	Enterprises constructing open ditches, tile drains, and levees.....	.....	.....	50,000	650,000	45,000	.....	20,000	.....	.....	.....
82	Average cost per acre when completed.....	.....	.....	31.25	37.14	12.50	.....	36.36	.....	.....	.....
<b>CROPS.</b>											
83	Improved land in enterprises reporting—										
84	Corn as principal crop on drained land.....	3,296	24,240	15,550	15,773	78,135	278,159	16,083	10,842	7,663	48,829
85	Wheat as principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,000
86	Potatoes as principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
87	Vegetables as principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
88	Not reporting principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Pumping plant located in Greene County.



DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Kanka- ree.	Kandall.	La Salle.	Lake.	Law- rence.	Lee.	Living- ston.	Logan.	McHenry.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	acres.	427,520	207,360	733,440	291,200	229,120	474,880	667,520	394,880	396,800
2	All land in operating drainage enterprises.....	acres.	125,344	7,414	41,861	14,430	61,592	85,460	47,379	22,030	48,325
3	Improved land.....	acres.	115,704	7,264	40,812	14,430	48,838	84,026	46,314	21,850	45,650
4	Per cent of all improved land in farms.....		31.6	4.2	6.8	8.6	27.0	21.4	7.5	6.2	17.3
5	Timber and cut-over land.....	acres.				90	5,812	263		180	
6	Other unimproved land.....	acres.	9,640	150	1,049		6,942	1,171	1,065		2,675
7	Swampy or subject to overflow, in enterprises.....	acres.	8,991	150	1,049		5,902	2,886	6,747		1,075
8	Suffering a loss of crops from defective drainage.....	acres.	15,411	150	19	1,915	9,085	9,181	1,484	666	204
9	Assessed acreage.....		125,344	7,414	41,861	14,430	61,592	97,635	47,379	25,260	48,325
10	Excess over all land in operating enterprises.....	acres.						12,175	3,220		
<b>DRAINAGE WORKS.</b>											
<b>Open ditches:</b>											
11	Completed.....	miles.	125.3	15.6	35.4	23.4	85.3	130.4	24.2	25.8	39.6
12	Additional under construction.....	miles.					1.5	0.8	4.0		
13	Maximum completed in any enterprise.....	miles.	12.0	5.5	8.0	4.5	13.5	43.8	7.5	13.0	12.0
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet.	60	16	16	12	30	70	30	25	30
15	Maximum average depths of outlet ditches <sup>1</sup> .....	feet.	10.0	11.0	8.0	10.0	15.0	12.0	8.0	30.0	9.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet.	6.0		4.7	5.0	6.3	6.9	6.0	7.0	6.3
<b>Tile drains:</b>											
17	Completed.....	miles.	141.6	7.6	42.0	15.6		22.9	42.2	19.3	98.6
18	Additional under construction.....	miles.			2.3			3.1	11.1		10.9
19	Maximum completed in any enterprise.....	miles.	11.0	4.0	7.0	4.7		13.0	5.3	7.5	22.4
20	Maximum size of tile <sup>1</sup> .....	inches.	40	24	36	30		30	26	24	32
<b>Accessory levees and dikes:</b>											
21	Completed.....	miles.	5.5					7.0			
22	Additional under construction.....	miles.									
<b>Pumping plants:</b>											
23	Engine capacity.....	horsepower.									
24	Pump capacity.....	gallons per minute.									
25	Area served by pumps.....	acres.									
26	Area drained by open ditches only <sup>1</sup> .....	acres.	30,980	5,431	13,481	6,730	61,592	30,230	8,050	16,466	
27	Length of these ditches.....	miles.	33.8	14.8	23.0	17.0	86.8	57.1	14.0	22.8	
28	Average length per acre.....	feet.	5.8	14.4	9.0	13.3	7.4	10.0	9.2	7.3	
29	Area having open ditches and levees <sup>1</sup> .....	acres.	11,511					(*)			
30	Length of these ditches.....	miles.	12.0					1.0			
31	Average length per acre.....	feet.	5.5								
32	Length of the accessory levees.....	miles.	5.0					1.0			
33	Area drained by tile only <sup>1</sup> .....	acres.	20,635	1,900	8,490	3,000		1,100	24,209	3,044	2,980
34	Length of these tile.....	miles.	71.6	7.0	19.1	7.7		2.5	43.5	15.4	10.1
35	Average length per acre.....	feet.	18.3	19.5	11.9	13.6		12.0	9.5	26.7	17.9
36	Area having tile drains and levees <sup>1</sup> .....	acres.									
37	Length of these tile.....	miles.									
38	Average length per acre.....	feet.									
39	Length of the accessory levees.....	miles.									
40	Area drained by open ditches and tile <sup>1</sup> .....	acres.	50,298	83	19,890	4,790		19,330	15,120	2,520	45,345
41	Length of these drains.....	miles.	128.2	1.4	37.6	14.3		59.8	24.0	6.9	139.0
42	Average length per acre.....	feet.	13.5	89.1	10.0	15.8		10.8	8.4	14.5	16.2
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres.	11,920					34,750			
44	Length of these drains.....	miles.	21.3					56.8			
45	Average length per acre.....	feet.	9.4					8.6			
46	Length of the accessory levees.....	miles.	0.5					6.0			
<b>DEVELOPMENT OF LAND.</b>											
47	Improved land in operating enterprises, 1920.....	acres.	115,704	7,264	40,812	14,430	48,838	84,026	46,314	21,850	45,650
48	Improved land prior to drainage.....	acres.	67,794	1,416	34,441	4,667	15,290	30,376	43,290	1,863	11,434
49	Increase since drainage.....	acres.	47,910	5,848	6,371	9,763	33,548	53,650	3,024	19,982	34,216
50	Per cent of increase <sup>2</sup> .....		70.7	413.0	18.5	209.2	219.4	178.6	7.0		259.2
51	Per cent increase is of all improved land in farms, 1920.....		13.1	3.4	1.1	5.8	18.6	13.7	0.5	5.6	12.9
52	Timber and cut-over land, 1920.....	acres.				90	5,812	263		180	
53	Timber and cut-over land prior to drainage.....	acres.	5,471			674	28,268	263		1,380	300
54	Decrease since drainage.....	acres.	5,471			684	22,454			1,200	300
55	Per cent of decrease.....		100.0			86.6	79.4			87.0	100.0
56	Other unimproved land, 1920.....	acres.	9,640	150	1,049		6,942	1,171	1,065		2,675
57	Other unimproved land prior to drainage.....	acres.	52,079	5,998	7,420	9,179	18,036	54,821	4,089	18,782	35,591
58	Decrease since drainage.....	acres.	42,439	5,848	6,371	9,179	11,094	53,650	3,024	18,782	33,916
59	Per cent of decrease.....		81.5	97.5	85.9	100.0	61.5	97.9	74.0	100.0	92.7
60	Swampy or subject to overflow, 1920.....	acres.	8,991	150	1,049		5,902	2,886	6,747		1,075
61	Swampy or subject to overflow prior to drainage.....	acres.	55,154	6,047	8,225	6,400	32,120	59,357	17,826	18,782	26,191
62	Decrease since drainage.....	acres.	46,163	5,897	7,176	6,400	26,218	56,471	11,079	18,782	25,116
63	Per cent of decrease.....		83.7	97.5	87.2	100.0	81.6	95.1	62.2	100.0	95.9
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
64	Total capital invested in and required for completion of operating enterprises.....	dollars.	932,234	80,392	312,436	140,650	304,734	1,339,563	426,782	193,905	530,070
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.	932,234	80,392	294,936	140,650	304,734	1,284,563	312,304	193,905	479,570
66	Additional capital required to complete these enterprises.....	dollars.			17,500			55,000	114,458		50,500
67	Average cost per acre when completed.....	dollars.	7.44	10.84	7.46	9.69	4.95	15.67	9.01	8.80	10.97
68	Enterprises constructing open ditches only.....	dollars.	156,019	49,362	65,800	62,300	304,734	463,333	28,700	139,478	
69	Average cost per acre when completed.....	dollars.	5.04	9.09	4.86	6.26	4.95	15.33	3.57	8.47	
70	Enterprises constructing open ditches and levees.....	dollars.	19,800					1,422			
71	Average cost per acre when completed.....	dollars.	1.69								
72	Enterprises constructing tile drains only.....	dollars.	126,115	24,780	51,110	26,350		7,000	196,062	48,420	32,000
73	Average cost per acre when completed.....	dollars.	6.11	13.04	6.03	8.78		6.36	8.10	15.91	10.74
74	Enterprises constructing tile drains and levees.....	dollars.									
75	Average cost per acre when completed.....	dollars.									
76	Enterprises constructing open ditches and tile drains.....	dollars.	534,600	6,250	195,526	82,000		108,508	202,000	6,007	498,078
77	Average cost per acre when completed.....	dollars.	10.43	75.30	9.83	10.86		5.34	13.36	2.38	10.93
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars.	108,000					784,300			
79	Average cost per acre when completed.....	dollars.	8.89					21.99			
<b>CROPS.</b>											
<b>Improved land in enterprises reporting—</b>											
80	Corn as principal crop on drained land.....	acres.	111,784	7,264	40,812	14,430	38,606	84,026	46,314	13,030	45,650
81	Wheat as principal crop on drained land.....	acres.					10,232			8,820	
82	Potatoes as principal crop on drained land.....	acres.									
83	Vegetables as principal crop on drained land.....	acres.	3,000								
84	Not reporting principal crop on drained land.....	acres.	920								

<sup>1</sup> When works under construction have been completed.    <sup>2</sup> Area included in "open ditches, tile drains, and levees."    <sup>3</sup> Per cent not shown when more than 1,000.



DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	McLean.	Macon.	Macou-pin.	Madison.	Mason.	Massac.	Menard.	Mercer.	Monroe.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	762,240	374,400	560,400	471,680	355,200	153,600	202,880	345,600	248,960
2	All land in operating drainage enterprises.....	116,861	52,026	7,575	28,119	118,620	28,800	16,788	22,320	24,880
3	Improved land.....	113,161	51,688	7,500	16,335	108,762	7,200	14,988	19,369	22,726
4	Per cent of all improved land in farms.....	16.5	15.5	1.9	4.8	40.4	7.6	9.0	7.4	13.9
5	Timber and cut-over land.....	3,700	178	75	2,400	1,989	21,600	600	1,040	2,134
6	Other unimproved land.....	4,460	289	75	9,384	7,869	1,200	1,040	1,911	2,134
7	Swampy or subject to overflow, in enterprises.....	4,460	289	75	9,384	7,869	1,200	1,040	1,911	2,134
8	Suffering a loss of crops from defective drainage.....	132,703	61,686	7,575	28,119	118,620	28,800	16,788	23,840	24,880
9	Assessed acreage.....	132,703	61,686	7,575	28,119	118,620	28,800	16,788	23,840	24,880
10	Excess over all land in operating enterprises.....	15,842	9,640	7,575	28,119	118,620	28,800	16,788	1,620	1,620
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....	87.2	43.0	3.2	22.3	154.9	54.6	27.5	24.0	45.9
12	Additional under construction.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	Maximum completed in any enterprise.....	15.5	15.2	2.8	12.0	32.0	54.6	9.0	18.0	18.0
14	Maximum width at bottom of ditch <sup>1</sup> .....	35	20	10	80	75	50	40	30	22
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	9.5	8.0	11.0	9.0	40.0	42.0	40.0	5.5	7.0
16	Mean depth of branch ditches <sup>1</sup> .....	7.7	4.6	.....	3.3	4.6	.....	7.0	3.9	3.7
<b>Tile drains:</b>										
17	Completed.....	34.3	71.3	15.4	.....	5.3	.....	2.5	.....	.....
18	Additional under construction.....	5.5	.....	.....	.....	1.2	.....	.....	.....	.....
19	Maximum completed in any enterprise.....	6.8	6.3	8.2	.....	2.8	.....	2.5	.....	.....
20	Maximum size of tile <sup>1</sup> .....	36	40	30	.....	30	.....	12	.....	.....
<b>Accessory levees and dikes:</b>										
21	Completed.....	.....	.....	2.7	2.3	12.2	7.7	17.5	15.4	26.3
22	Additional under construction.....	.....	.....	.....	7.7	.....	1.9	.....	7.6	.....
<b>Pumping plants:</b>										
23	Engine capacity.....	.....	.....	.....	( <sup>3</sup> ) 60	.....	.....	50	1,150	.....
24	Pump capacity.....	.....	.....	.....	( <sup>2</sup> ) 16,000	.....	.....	8,400	225,000	.....
25	Area served by pumps.....	.....	.....	.....	20,000	1,320	.....	2,000	20,230	.....
26	Area drained by open ditches only <sup>1</sup> .....	50,861	25,088	.....	8,119	110,233	.....	11,000	1,520	8,700
27	Length of these ditches.....	44.0	33.2	.....	147.3	.....	.....	15.0	( <sup>4</sup> ) 21.0	.....
28	Average length per acre.....	3.9	7.0	.....	6.7	7.1	.....	7.2	.....	12.7
29	Area having open ditches and levees <sup>1</sup> .....	.....	.....	.....	20,000	1,800	.....	2,288	20,800	16,160
30	Length of these ditches.....	.....	.....	.....	12.0	4.0	.....	54.6	7.0	24.0
31	Average length per acre.....	.....	.....	.....	3.2	11.7	.....	16.2	6.1	8.1
32	Length of the accessory levees.....	.....	.....	.....	10.0	3.7	.....	9.0	23.0	26.3
33	Area drained by tile only <sup>1</sup> .....	11,360	26,958	3,020	.....	.....	.....	.....	.....	.....
34	Length of these tiles.....	16.1	62.9	3.1	.....	.....	.....	.....	.....	.....
35	Average length per acre.....	7.5	12.3	5.4	.....	.....	.....	.....	.....	.....
36	Area having tile drains and levees <sup>1</sup> .....	.....	.....	.....	.....	.....	.....	.....	.....	.....
37	Length of these tile.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
38	Average length per acre.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
39	Length of the accessory levees.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	Area drained by open ditches and tile <sup>1</sup> .....	45,640	( <sup>1</sup> ) 25,088	4,005	.....	3,087	.....	.....	.....	.....
41	Length of these drains.....	66.9	18.2	12.6	.....	6.0	.....	.....	.....	.....
42	Average length per acre.....	7.7	.....	16.6	.....	10.3	.....	.....	.....	.....
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....	.....	.....	550	.....	3,500	.....	3,500	.....	.....
44	Length of these drains.....	.....	.....	2.9	.....	8.0	.....	8.0	.....	.....
45	Average length per acre.....	.....	.....	27.8	.....	12.1	.....	12.1	.....	.....
46	Length of the accessory levees.....	.....	.....	2.7	.....	8.5	.....	8.5	.....	.....
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920.....	113,161	51,688	7,500	16,335	108,762	7,200	14,988	19,369	22,726
48	Improved land prior to drainage.....	103,811	38,045	35	14,643	24,990	2,880	4,500	337	12,388
49	Increase since drainage.....	9,350	13,043	7,465	1,692	83,772	4,320	10,488	19,032	10,338
50	Per cent of increase <sup>4</sup> .....	9.0	33.8	11.6	11.6	335.2	150.0	233.1	.....	83.5
51	Per cent increase is of all improved land in farms, 1920.....	1.4	3.9	1.9	0.5	31.1	4.6	6.3	7.3	6.3
52	Timber and cut-over land, 1920.....	3,700	178	75	2,400	1,989	21,600	600	1,040	2,134
53	Timber and cut-over land prior to drainage.....	13,050	13,085	7,540	10,504	81,933	.....	11,088	10,893	10,226
54	Decrease since drainage.....	9,350	12,907	7,465	1,120	74,064	.....	9,888	9,822	8,092
55	Per cent of decrease.....	71.6	98.6	99.0	10.7	90.4	.....	89.2	82.5	79.1
56	Swampy or subject to overflow, 1920.....	4,460	289	75	9,384	7,869	.....	1,200	1,040	2,134
57	Swampy or subject to overflow prior to drainage.....	40,496	20,374	7,540	13,067	107,565	14,400	16,788	14,312	11,036
58	Decrease since drainage.....	36,036	20,085	7,540	5,111	100,201	5,760	16,139	12,347	8,832
59	Per cent of decrease.....	89.0	98.6	100.0	39.1	93.2	40.0	96.1	86.3	78.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises.....	633,994	238,151	64,483	3,048,500	1,363,190	621,600	176,500	975,400	738,446
65	Capital invested in these enterprises to Dec. 31, 1919.....	573,781	238,151	64,483	2,048,500	1,153,190	609,600	176,500	558,600	738,446
66	Additional capital required to complete these enterprises.....	60,213	.....	.....	1,000,000	200,000	12,000	.....	416,800	.....
67	Average cost per acre when completed.....	5.43	4.58	8.51	*108.41	11.41	21.58	10.51	43.70	29.70
68	Enterprises constructing open ditches only.....	145,710	72,427	.....	48,500	1,236,882	.....	98,000	14,000	245,000
69	Average cost per acre when completed.....	2.43	2.89	.....	5.97	11.22	.....	8.91	9.21	28.16
70	Enterprises constructing open ditches and levees.....	.....	.....	.....	3,000,000	41,808	621,600	51,000	961,400	483,446
71	Average cost per acre when completed.....	.....	.....	.....	*150.00	23.23	21.58	22.29	46.22	30.54
72	Enterprises constructing tile drains only.....	134,119	151,326	19,630	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed.....	11.81	5.61	8.50	.....	.....	.....	.....	.....	.....
74	Enterprises constructing tile drains and levees.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
75	Average cost per acre when completed.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
76	Enterprises constructing open ditches and tile drains.....	354,165	14,398	24,853	.....	47,060	.....	.....	.....	.....
77	Average cost per acre when completed.....	7.76	.....	6.21	.....	15.23	.....	.....	.....	.....
78	Enterprises constructing open ditches, tile drains, and levees.....	.....	.....	20,000	.....	27,500	.....	27,500	.....	.....
79	Average cost per acre when completed.....	.....	.....	36.36	.....	7.86	.....	7.86	.....	.....
<b>CROPS.</b>										
<b>Improved land in enterprises reporting—</b>										
80	Corn as principal crop on drained land.....	113,161	51,688	7,275	11,760	102,376	7,200	14,988	19,369	22,726
81	Wheat as principal crop on drained land.....	.....	.....	225	4,575	6,386	.....	.....	.....	.....
82	Potatoes as principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
83	Vegetables as principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Not reporting principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> When works under construction have been completed.  
<sup>2</sup> Pumping plant located in St. Clair County.  
<sup>3</sup> Ditches reported in Rock Island County.

<sup>4</sup> Area included in "open ditches only."  
<sup>5</sup> Per cent not shown when more than 1,000.  
<sup>6</sup> Not for drainage of agricultural land only.

DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Montgomery.	Morgan.	Montrie.	Ogle.	Peoria.	Piatt.	Pike.	Pope.	Pulaski.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	440,960	368,640	216,320	483,840	407,040	288,640	503,040	246,400	121,600
2	All land in operating drainage enterprises.....	48,521	10,013	20,250	12,820	6,100	123,384	67,683	12,500	19,298
3	Improved land.....	46,135	8,946	19,966	12,738	5,465	121,934	60,379	9,835	13,829
4	Per cent of all improved land in farms.....	13.5	3.0	10.5	3.3	2.1	48.2	16.1	7.5	17.5
5	Timber and cut-over land.....	886	49	284	38	210	3,385	2,665	5,469	
6	Other unimproved land.....	886	1,018		44	425	3,919			
7	Swampy or subject to overflow, in enterprises.....	800	1,664	375		850	450	1,070	700	90
8	Suffering a loss of crops from defective drainage.....	790	1,724	1,494	2,270	850	450	7,303	2,965	7,660
9	Assessed acreage.....	48,521	10,013	20,250	12,820	6,100	123,969	67,683	12,500	19,298
10	Excess over all land in operating enterprises.....					585				
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed.....	62.1	14.8	22.7	18.3	9.5	117.2	43.0	14.9	26.6
13	Additional under construction.....				1.7				0.7	
14	Maximum completed in any enterprise.....	9.5	6.0	7.0	9.0	5.0	14.0	34.0	14.3	10.0
15	Maximum width at bottom of ditch <sup>1</sup> .....	30	18	20	40	20	40	80	50	50
16	Maximum of average depths of outlet ditches <sup>1</sup> .....	12.0	8.0	9.0	7.0	12.0	17.0	12.0	42.0	42.0
17	Mean depth of branch ditches <sup>1</sup> .....	4.1	4.0	6.0	6.7	8.0	5.0	7.8	5.0	4.0
18	Tile drains:									
19	Completed.....	144.4	2.4	32.8	7.9	45.9	142.6	34.3		
20	Additional under construction.....	2.0						10.8	7.0	
21	Maximum completed in any enterprise.....	16.5	1.5	9.5	6.0	40.0	10.0	34.3		
22	Maximum size of tile <sup>1</sup> .....	33	20	30	20	30	33	24	16	
23	Accessory levees and dikes:									
24	Completed.....		20.6			9.3		59.2		2.8
25	Additional under construction.....								0.1	0.1
26	Pumping plants:									
27	Engine capacity.....		325			515		450		
28	Pump capacity.....		54,000			62,666		97,000		
29	Area served by pumps.....		2,462			4,400		5,350		
30	Area drained by open ditches only <sup>1</sup> .....	1,957		7,626	7,500		40,864			7,481
31	Length of these ditches.....	9.5		10.5	13.0		57.4			12.0
32	Average length per acre.....	25.6		7.3	9.2		7.4			8.5
33	Area having open ditches and levees <sup>1</sup> .....		6,859			2,100		62,333	300	11,817
34	Length of these ditches.....		10.8			4.5		34.0	0.6	14.6
35	Average length per acre.....		8.3			11.3		2.9	10.6	6.5
36	Length of the accessory levees.....		4.6			4.3		53.0	0.1	2.9
37	Area drained by tile only <sup>1</sup> .....	12,091	800	4,527	920	1,700	30,270			
38	Length of these tile.....	44.5	1.5	17.4	1.8	5.9	66.4			
39	Average length per acre.....	19.4	15.8	20.3	10.3	18.3	11.6			
40	Area having tile drains and levees <sup>1</sup> .....									
41	Length of these tile.....									
42	Average length per acre.....									
43	Area drained by open ditches and tile <sup>1</sup> .....	34,473		8,097	4,400		51,250		12,200	
44	Length of these drains.....	154.5		27.6	13.0		136.0		22.0	
45	Average length per acre.....	23.7		18.0	15.6		14.0		9.5	
46	Area having open ditches, tile drains, and levees <sup>1</sup> .....		2,654			2,300		5,350		
47	Length of these drains.....		4.9			45.0		54.1		
48	Average length per acre.....		9.7			103.8		53.4		
49	Length of the accessory levees.....		16.0			5.0		6.2		
<b>DEVELOPMENT OF LAND.</b>										
50	Improved land in operating enterprises, 1920.....	48,135	8,946	19,966	12,738	5,465	121,934	60,379	9,835	13,829
51	Improved land prior to drainage.....	26,486	7,243	16,163	5,353	1,275	63,102	4,455	9,180	8,351
52	Increase since drainage.....	21,649	1,703	3,784	7,385	4,190	58,832	55,924	655	5,478
53	Per cent of increase <sup>2</sup> .....	81.7	23.5	23.4	138.0	328.6	93.2	7.1	7.1	65.6
54	Per cent increase is of all improved land in farms, 1920.....	6.1	0.6	2.0	1.9	1.6	23.3	14.9	0.5	7.0
55	Timber and cut-over land, 1920.....	886	49	284	38	210	3,385	2,665	5,469	
56	Timber and cut-over land prior to drainage.....	133	133	618	38	8,075	4,651	23,153	3,320	10,947
57	Decrease since drainage.....	84	334			2,865	4,651	19,788	655	6,478
58	Per cent of decrease.....	63.2	54.0			93.2	100.0	85.4	19.7	50.0
59	Other unimproved land, 1920.....	386	1,018		44	425	450	3,919		
60	Other unimproved land prior to drainage.....	22,035	2,637	8,450	7,429	1,750	64,631	40,075		
61	Decrease since drainage.....	21,649	1,619	8,450	7,385	1,325	54,181	38,156		
62	Per cent of decrease.....	98.2	61.4	100.0	99.4	75.7	99.2	90.2		
63	Swampy or subject to overflow, 1920.....	800	1,664	375		850	450	1,070	700	90
64	Swampy or subject to overflow prior to drainage.....	22,035	5,516	4,349	12,038	2,175	61,560	30,283	1,370	8,382
65	Decrease since drainage.....	21,235	3,852	3,974	12,038	1,325	61,110	29,213	670	8,292
66	Per cent of decrease.....	96.4	69.8	91.4	100.0	60.9	99.3	96.5	48.9	98.9
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
67	Total capital invested in and required for completion of operating enterprises.....	386,965	156,932	159,901	141,900	246,760	885,364	1,549,627	101,550	218,595
68	Capital invested in these enterprises to Dec. 31, 1919.....	383,853	156,932	159,901	113,900	246,760	885,364	1,532,727	60,350	218,395
69	Additional capital required to complete these enterprises.....	3,112			28,000			16,900	35,200	200
70	Average cost per acre when completed.....	7.98	15.67	7.90	11.07	40.45	7.07	22.90	8.12	11.33
71	Enterprises constructing open ditches only.....	12,000		44,275	72,000		265,701			47,045
72	Average cost per acre when completed.....	6.13		5.81	9.60		6.50			6.29
73	Enterprises constructing open ditches and levees.....		128,500			147,000		1,393,477	6,550	171,550
74	Average cost per acre when completed.....		18.73			70.00		22.36	21.83	14.52
75	Enterprises constructing tile drains only.....	85,738	6,000	82,886	6,000	32,760	178,110			
76	Average cost per acre when completed.....	7.09	12.00	18.31	6.52	19.27	5.72			
77	Enterprises constructing tile drains and levees.....									
78	Average cost per acre when completed.....									
79	Enterprises constructing open ditches and tile drains.....	289,227		32,740	63,900		426,553		95,000	
80	Average cost per acre when completed.....	8.39		4.04	14.52		8.32		7.79	
81	Enterprises constructing open ditches, tile drains, and levees.....		22,432			67,000		158,150		
82	Average cost per acre when completed.....		8.45			29.13		29.19		
<b>CROPS.</b>										
83	Improved land in enterprises reporting—									
84	Corn as principal crop on drained land.....	48,135	2,574	19,966	12,738	5,465	120,649	60,379	9,835	11,100
85	Wheat as principal crop on drained land.....		6,372							
86	Potatoes as principal crop on drained land.....									
87	Vegetables as principal crop on drained land.....									
88	Not reporting principal crop on drained land.....						1,235			2,669

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Randolph.	Rock Island.	St. Clair.	Saline.	Sangamon.	Schuyler.	Scott.	Shelby.	Tazewell.
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres.. 375,680	271,360	424,320	255,360	560,640	278,480	159,360	494,080	414,080
2	All land in operating drainage enterprises.....	acres.. 18,949	23,908	55,242	66,251	7,097	16,080	32,393	81,834	34,240
3	Improved land.....	acres.. 16,418	23,221	33,337	57,640	7,097	15,899	30,740	31,834	34,167
4	Per cent of all improved land in farms.....	6.6	13.0	11.0	32.5	1.5	9.0	24.9	7.8	10.2
5	Timber and cut-over land.....	acres.. 1,510	282	5,575	8,321	79	301	801	301	78
6	Other unimproved land.....	acres.. 1,021	403	16,330	290	102	1,352	1,352	1,352	78
7	Swampy or subject to overflow, in enterprises.....	acres.. 1,526	1,608	13,107	5,425	.....	.....	1,537	400	.....
8	Suffering a loss of crops from defective drainage.....	acres.. 1,205	479	10,209	21,758	.....	204	1,135	400	1,147
9	Assessed acreage.....	18,949	27,186	55,242	67,251	7,097	16,080	32,393	81,834	34,240
10	Excess over all land in operating enterprises.....	acres.. 3,280	.....	.....	1,000	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed.....	miles.. 12.6	27.6	33.4	109.3	.....	30.3	44.2	17.1	83.0
13	Additional under construction.....	miles.. 0.5	0.4	4.0	2.3	.....	.....	.....	.....	.....
14	Maximum completed in any enterprise.....	miles.. 6.0	7.5	14.0	20.0	.....	11.5	17.2	9.0	10.0
15	Maximum width at bottom of ditch <sup>1</sup> .....	feet.. 15	40	80	80	.....	28	60	35	75
16	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet.. 8.0	8.0	35.0	14.0	.....	12.0	15.0	16.0	12.5
17	Mean depth of branch ditches <sup>1</sup> .....	feet.. 3.5	4.7	7.0	5.7	.....	7.3	5.0	.....	7.6
18	Tile drains:									
19	Completed.....	miles.. 2.0	1.8	.....	.....	6.8	18.0	202.9	71.7	15.2
20	Additional under construction.....	miles.. 2.0	1.8	.....	.....	6.2	15.0	200.0	35.0	2.6
21	Maximum completed in any enterprise.....	miles.. 2.0	1.8	.....	.....	6.2	15.0	200.0	35.0	14.6
22	Maximum size of tile <sup>1</sup> .....	inches.. 8	15	.....	.....	20	30	18	40	15
23	Accessory levees and dikes:									
24	Completed.....	miles.. 17.7	10.2	1.5	.....	.....	26.6	50.2	.....	22.9
25	Additional under construction.....	miles.. 1.0	5.0	10.0	.....	.....	2.4	.....	.....	.....
26	Pumping plants:									
27	Engine capacity.....	horsepower.. 495	3,900	.....	.....	.....	850	980	.....	1,715
28	Pump capacity.....	gallons per minute.. 75,000	675,000	.....	.....	.....	114,500	137,000	.....	201,000
29	Area served by pumps.....	acres.. 9,168	10,000	.....	.....	.....	16,380	27,352	.....	13,861
30	Area drained by open ditches only <sup>1</sup> .....	acres.. 4,700	13,718	13,042	66,251	.....	.....	.....	17,710	19,419
31	Length of these ditches.....	miles.. 8.2	13.1	18.9	111.6	.....	.....	.....	14.6	37.5
32	Average length per acre.....	feet.. 9.2	5.0	7.7	8.9	.....	.....	.....	4.4	10.2
33	Area having open ditches and levees <sup>1</sup> .....	acres.. 4,140	9,168	42,200	.....	.....	4,186	1,854	.....	12,843
34	Length of these ditches.....	miles.. 4.9	14.9	18.5	.....	.....	8.8	5.0	.....	37.5
35	Average length per acre.....	feet.. 6.2	8.6	2.3	.....	.....	11.1	14.2	.....	15.4
36	Length of the accessory levees.....	miles.. 2.7	15.2	11.5	.....	.....	9.5	3.0	.....	17.7
37	Area drained by tile only <sup>1</sup> .....	acres.. 1,020	.....	.....	.....	7,097	.....	.....	8,739	.....
38	Length of these tile.....	miles.. 1.8	.....	.....	.....	6.3	.....	.....	62.2	.....
39	Average length per acre.....	feet.. 9.3	.....	.....	.....	4.7	.....	.....	37.6	.....
40	Area having tile drains and levees <sup>1</sup> .....	acres.. 10,109	.....	.....	.....	.....	.....	.....	.....	.....
41	Length of these tile.....	miles.. 2.0	.....	.....	.....	.....	.....	.....	.....	.....
42	Average length per acre.....	feet.. 1.0	.....	.....	.....	.....	.....	.....	.....	.....
43	Length of the accessory levees.....	miles.. 16.0	.....	.....	.....	.....	.....	.....	.....	.....
44	Area drained by open ditches and tile <sup>1</sup> .....	acres.. 5,385	.....	.....	.....	.....	.....	.....	5,385	960
45	Length of these drains.....	miles.. 12.0	.....	.....	.....	.....	.....	.....	12.0	4.6
46	Average length per acre.....	feet.. 11.8	.....	.....	.....	.....	.....	.....	11.8	25.3
47	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres.. 11,894	.....	.....	.....	.....	11,894	30,539	.....	1,018
48	Length of these drains.....	miles.. 39.5	.....	.....	.....	.....	39.5	242.1	.....	21.2
49	Average length per acre.....	feet.. 17.5	.....	.....	.....	.....	17.5	41.9	.....	110.0
50	Length of the accessory levees.....	miles.. 19.5	.....	.....	.....	.....	19.5	47.2	.....	6.2
<b>DEVELOPMENT OF LAND.</b>										
51	Improved land in operating enterprises, 1920.....	acres.. 16,418	23,221	33,337	57,640	7,097	15,899	30,740	31,834	34,167
52	Improved land prior to drainage.....	acres.. 13,476	801	28,000	45,070	43	8,282	14,563	21,955	5,547
53	Increase since drainage.....	acres.. 2,942	22,420	7,337	12,570	7,054	12,617	16,177	9,879	28,620
54	Per cent of increase <sup>2</sup> .....	21.8	28.2	27.9	27.9	111.1	384.4	111.1	45.0	516.0
55	Per cent increase is of all improved land in farms, 1920.....	1.2	13.6	2.4	7.1	1.5	7.1	13.1	2.4	8.6
56	Timber and cut-over land, 1920.....	acres.. 1,510	282	5,575	8,321	79	301	801	301	78
57	Timber and cut-over land prior to drainage.....	acres.. 1,724	1,072	7,636	20,601	.....	6,035	3,608	.....	9,331
58	Decrease since drainage.....	acres.. 214	790	2,061	12,280	.....	5,956	3,307	.....	9,331
59	Per cent of decrease.....	12.4	73.7	27.0	59.6	.....	98.7	91.7	.....	100.0
60	Other unimproved land, 1920.....	acres.. 1,021	403	16,330	290	102	1,352	1,352	1,352	78
61	Other unimproved land prior to drainage.....	acres.. 3,749	22,033	21,606	580	7,054	6,763	14,222	9,879	19,362
62	Decrease since drainage.....	acres.. 2,728	21,630	5,276	290	7,054	6,661	12,870	9,879	19,289
63	Per cent of decrease.....	72.8	98.2	24.4	50.0	100.0	98.5	90.5	100.0	99.6
64	Swampy or subject to overflow, 1920.....	acres.. 1,526	1,608	13,107	5,425	.....	.....	1,537	400	.....
65	Swampy or subject to overflow prior to drainage.....	acres.. 14,408	17,636	17,606	40,519	7,054	14,416	22,547	11,091	21,147
66	Decrease since drainage.....	acres.. 12,882	16,028	4,499	35,094	7,054	14,416	21,010	10,691	21,147
67	Per cent of decrease.....	89.4	90.9	25.6	86.6	100.0	100.0	63.2	96.4	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
68	Total capital invested in and required for completion of operating enterprises.....	dollars.. 293,554	526,700	6,201,572	405,835	8,100	678,980	893,545	114,187	1,023,963
69	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 283,554	411,500	2,701,572	396,835	8,100	658,794	893,545	114,187	1,016,463
70	Additional capital required to complete these enterprises.....	dollars.. 10,000	115,200	3,500,000	9,000	.....	20,186	.....	.....	7,500
71	Average cost per acre when completed.....	dollars.. 15.49	22.03	*112.26	6.13	1.14	42.23	27.58	3.59	29.91
72	Enterprises constructing open ditches only.....	dollars.. 55,000	96,400	168,572	406,835	.....	.....	.....	19,169	224,963
73	Average cost per acre when completed.....	dollars.. 11.70	7.08	12.77	6.13	.....	.....	.....	1.08	11.58
74	Enterprises constructing open ditches and levees.....	dollars.. 78,564	428,600	6,035,000	.....	.....	271,140	26,000	.....	616,500
75	Average cost per acre when completed.....	dollars.. 18.97	46.20	*143.01	.....	.....	64.77	14.02	.....	48.00
76	Enterprises constructing tile drains only.....	dollars.. 6,700	.....	.....	.....	8,100	.....	.....	75,107	.....
77	Average cost per acre when completed.....	dollars.. 6.57	.....	.....	.....	1.14	.....	.....	8.59	.....
78	Enterprises constructing tile drains and levees.....	dollars.. 160,000	.....	.....	.....	.....	.....	.....	.....	.....
79	Average cost per acre when completed.....	dollars.. 15.83	.....	.....	.....	.....	.....	.....	.....	.....
80	Enterprises constructing open ditches and tile drains.....	dollars.. 19,911	.....	.....	.....	.....	.....	.....	19,911	15,000
81	Average cost per acre when completed.....	dollars.. 8.70	.....	.....	.....	.....	.....	.....	8.70	15.63
82	Enterprises constructing open ditches, tile drains, and levees.....	dollars.. 407,840	.....	.....	.....	.....	407,840	867,545	.....	167,500
83	Average cost per acre when completed.....	dollars.. 34.29	.....	.....	.....	.....	34.29	28.41	.....	164.54
<b>CROPS.</b>										
84	Improved land in enterprises reporting--									
85	Corn as principal crop on drained land.....	acres.. 16,418	23,221	33,337	57,640	7,097	15,899	30,740	31,834	34,167
86	Wheat as principal crop on drained land.....	acres.. ..	.....	.....	.....	.....	.....	.....	.....	.....
87	Potatoes as principal crop on drained land.....	acres.. ..	.....	.....	.....	.....	.....	.....	.....	.....
88	Vegetables as principal crop on drained land.....	acres.. ..	.....	.....	.....	.....	.....	.....	.....	.....
89	Not reporting principal crop on drained land.....	acres.. ..	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

\* Not for drainage of agricultural land only.

DRAINAGE—ILLINOIS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Union.	Ver- million.	Wabash.	Wayna.	White.	White- side.	Will.	Wood- ford.	Other counties. <sup>1</sup>		
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	acres	257,930	589,440	140,800	469,120	324,490	434,560	540,160	337,920	2,245,120
2	All land in operating drainage enterprises.....	acres	94,713	121,075	26,661	42,930	33,724	138,170	46,042	8,500	17,896
3	Improved land.....	acres	21,369	112,843	23,751	35,195	26,762	130,909	40,526	6,400	14,141
4	Per cent of all improved land in farms.....		14.2	23.6	20.6	10.1	11.1	35.4	9.4	2.5	0.8
5	Timber and cut-over land.....	acres	18,124	3,996	2,750	6,288	4,225	391	5,516	2,100	1,371
6	Other unimproved land.....	acres	220	4,236	160	1,447	737	6,870	5,516	2,100	2,384
7	Swampy or subject to overflow, in enterprises.....	acres	1,229	706	2,206	2,278	1,029	3,698	5,184	5,300	3,021
8	Suffering a loss of crops from defective drainage.....	acres	308	408	1,957	10,961	4,692	3,043	225	.....	2,869
9	Assessed acreage.....	acres	34,713	124,110	27,896	42,930	34,507	147,184	46,042	8,500	17,896
10	Excess over all land in operating enterprises.....	acres	.....	3,035	1,235	.....	783	9,014	.....	.....	.....
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....	miles	49.1	104.7	83.1	89.7	65.3	236.8	58.1	13.2	45.7
12	Additional under construction.....	miles	.....	.....	.....	1.1	1.8	6.3	.....	.....	0.3
13	Maximum completed in any enterprise.....	miles	15.0	13.0	9.5	19.9	8.0	80.0	9.0	10.0	8.0
14	Maximum width at bottom of ditch.....	feet	50	28	35	50	50	80	40	22	60
15	Maximum of average depths of outlet ditches.....	feet	42.0	12.0	12.0	15.0	8.0	12.0	11.0	9.0	10.0
16	Mean depth of branch ditches.....	feet	7.5	6.0	6.5	7.3	6.3	4.5	4.6	7.5	6.7
Tile drains:											
17	Completed.....	miles	.....	182.2	6.7	.....	1.8	4.9	43.4	.....	7.7
18	Additional under construction.....	miles	.....	7.0	.....	.....	.....	1.0	10.2	.....	2.0
19	Maximum completed in any enterprise.....	miles	.....	12.2	8.0	.....	1.7	1.7	10.0	.....	4.5
20	Maximum size of tile.....	inches	.....	42	30	.....	24	16	30	.....	30
Accessory levees and dikes:											
21	Completed.....	miles	29.7	.....	.....	.....	.....	31.0	.....	2.0	7.0
22	Additional under construction.....	miles	2.9	.....	.....	.....	.....	2.9	.....	4.0	0.5
Pumping plants:											
23	Engine capacity.....	horsepower	( <sup>2</sup> )	.....	.....	.....	.....	( <sup>2</sup> )	.....	.....	150
24	Pump capacity.....	gallons per minute	( <sup>2</sup> )	.....	.....	.....	.....	( <sup>2</sup> )	.....	.....	30,000
25	Area served by pumps.....	acres	500	.....	.....	.....	.....	4,319	.....	.....	3,000
26	Area drained by open ditches only.....	acres	4,967	14,152	23,501	42,930	31,133	91,215	20,310	.....	10,604
27	Length of these ditches.....	miles	21.0	26.7	70.1	90.8	62.7	171.0	28.1	.....	30.1
28	Average length per acre.....	feet	22.3	10.0	15.7	11.2	10.6	9.9	7.3	.....	15.0
29	Area having open ditches and levees.....	acres	29,746	.....	.....	.....	.....	20,521	.....	2,100	3,800
30	Length of these ditches.....	miles	28.1	.....	.....	.....	.....	28.2	.....	10.0	9.0
31	Average length per acre.....	feet	5.0	.....	.....	.....	.....	7.3	.....	25.1	12.5
32	Length of the accessory levees.....	miles	32.6	.....	.....	.....	.....	33.7	.....	6.0	7.0
33	Area drained by tile only.....	acres	.....	8,101	872	.....	659	.....	5,272	.....	.....
34	Length of these tile.....	miles	.....	32.6	2.7	.....	1.7	.....	13.4	.....	.....
35	Average length per acre.....	feet	.....	21.2	16.3	.....	13.6	.....	13.4	.....	.....
36	Area having tile drains and levees.....	acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
37	Length of these tile.....	miles	.....	.....	.....	.....	.....	.....	.....	.....	.....
38	Average length per acre.....	feet	.....	.....	.....	.....	.....	.....	.....	.....	.....
39	Length of the accessory levees.....	miles	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	Area drained by open ditches and tile.....	acres	.....	96,822	2,288	.....	1,932	11,640	20,460	6,400	2,967
41	Length of these drains.....	miles	.....	234.6	17.0	.....	4.5	22.9	70.2	9.5	11.1
42	Average length per acre.....	feet	.....	12.5	39.2	.....	12.3	10.4	18.1	7.8	19.8
43	Area having open ditches, tile drains, and levees.....	acres	.....	.....	.....	.....	.....	14,794	.....	.....	525
44	Length of these drains.....	miles	.....	.....	.....	.....	.....	26.9	.....	.....	5.5
45	Average length per acre.....	feet	.....	.....	.....	.....	.....	9.6	.....	.....	55.3
46	Length of the accessory levees.....	miles	.....	.....	.....	.....	.....	0.2	.....	.....	0.5
<b>DEVELOPMENT OF LAND.</b>											
47	Improved land in operating enterprises, 1920.....	acres	21,369	112,843	23,751	35,195	26,762	130,909	40,526	6,400	14,141
48	Improved land prior to drainage.....	acres	13,954	100,760	9,508	23,862	21,052	68,009	23,070	6,400	7,150
49	Increase since drainage.....	acres	7,415	12,083	14,243	11,333	7,710	62,900	17,456	.....	6,991
50	Per cent of increase.....		53.1	12.0	149.8	47.5	36.6	90.8	75.7	.....	97.8
51	Per cent increase is of all improved land in farms, 1920.....		4.9	2.5	12.2	3.2	3.0	16.9	4.0	.....	0.4
52	Timber and cut-over land, 1920.....	acres	13,124	3,996	2,750	6,288	4,225	391	.....	.....	1,371
53	Timber and cut-over land prior to drainage.....	acres	16,661	5,943	15,379	17,605	11,018	401	635	.....	4,214
54	Decrease since drainage.....	acres	3,537	1,947	12,629	11,317	6,793	10	635	.....	2,843
55	Per cent of decrease.....		21.2	32.8	82.1	64.3	61.7	2.5	100.0	.....	67.5
56	Other unimproved land, 1920.....	acres	220	4,236	160	1,447	737	6,870	5,516	2,100	2,384
57	Other unimproved land prior to drainage.....	acres	4,093	14,372	1,774	1,463	1,654	69,160	22,337	2,100	6,532
58	Decrease since drainage.....	acres	3,878	10,136	1,614	16	917	62,290	16,831	.....	4,148
59	Per cent of decrease.....		94.6	70.5	91.0	1.1	55.4	90.1	75.3	.....	63.5
60	Swampy or subject to overflow, 1920.....	acres	1,229	706	2,206	2,278	1,029	3,698	5,184	5,300	3,021
61	Swampy or subject to overflow prior to drainage.....	acres	10,672	57,701	14,324	16,660	15,142	52,730	19,626	5,300	9,154
62	Decrease since drainage.....	acres	9,443	56,995	12,118	14,382	14,113	49,032	14,442	.....	6,133
63	Per cent of decrease.....		88.5	98.8	84.6	86.3	93.2	93.0	73.6	.....	67.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
64	Total capital invested in and required for completion of operating enterprises.....	dollars	522,530	1,011,498	296,945	282,959	240,844	993,704	338,681	171,000	504,886
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	497,850	973,498	296,945	282,959	233,402	833,204	334,849	147,750	487,886
66	Additional capital required to complete these enterprises.....	dollars	24,700	38,000	.....	.....	7,242	110,500	53,832	23,250	17,000
67	Average cost per acre when completed.....	dollars	15.05	8.35	11.14	6.59	7.14	7.19	8.44	20.12	28.21
68	Enterprises constructing open ditches only.....	dollars	101,500	80,659	285,495	282,959	221,778	532,052	81,774	.....	66,799
69	Average cost per acre when completed.....	dollars	20.43	5.70	10.02	6.59	7.12	5.83	4.03	.....	6.30
70	Enterprises constructing open ditches and levees.....	dollars	421,050	.....	.....	.....	.....	212,092	.....	93,000	366,240
71	Average cost per acre when completed.....	dollars	14.15	.....	.....	.....	.....	10.34	.....	44.29	96.38
72	Enterprises constructing tile drains only.....	dollars	.....	97,718	6,613	.....	6,338	.....	78,824	.....	.....
73	Average cost per acre when completed.....	dollars	.....	12.06	7.58	.....	9.62	.....	14.95	.....	.....
74	Enterprises constructing tile drains and levees.....	dollars	.....	.....	.....	.....	.....	.....	.....	.....	.....
75	Average cost per acre when completed.....	dollars	.....	.....	.....	.....	.....	.....	.....	.....	.....
76	Enterprises constructing open ditches and tile drains.....	dollars	.....	833,121	54,837	.....	12,528	72,560	228,083	78,000	68,347
77	Average cost per acre when completed.....	dollars	.....	8.43	23.97	.....	6.48	6.23	11.15	12.19	23.04
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars	.....	.....	.....	.....	.....	177,000	.....	.....	3,500
79	Average cost per acre when completed.....	dollars	.....	.....	.....	.....	.....	11.96	.....	.....	6.67
<b>CROPS.</b>											
80	Improved land in enterprises reporting—	acres	21,369	112,843	23,751	35,195	26,762	130,909	40,526	6,400	14,141
81	Corn as principal crop on drained land.....	acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
82	Wheat as principal crop on drained land.....	acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
83	Potatoes as principal crop on drained land.....	acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Vegetables as principal crop on drained land.....	acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Not reporting principal crop on drained land.....	acres	.....	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> Includes only Bond, Jasper, McDonough, Marion, Marshall, Putnam, Richland, and Winnebago Counties.  
<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Pumping plant located in Alexander County.  
<sup>4</sup> Pumping plant located in Rock Island County.

# INDIANA.

The following pages present the statistics of drainage for Indiana collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

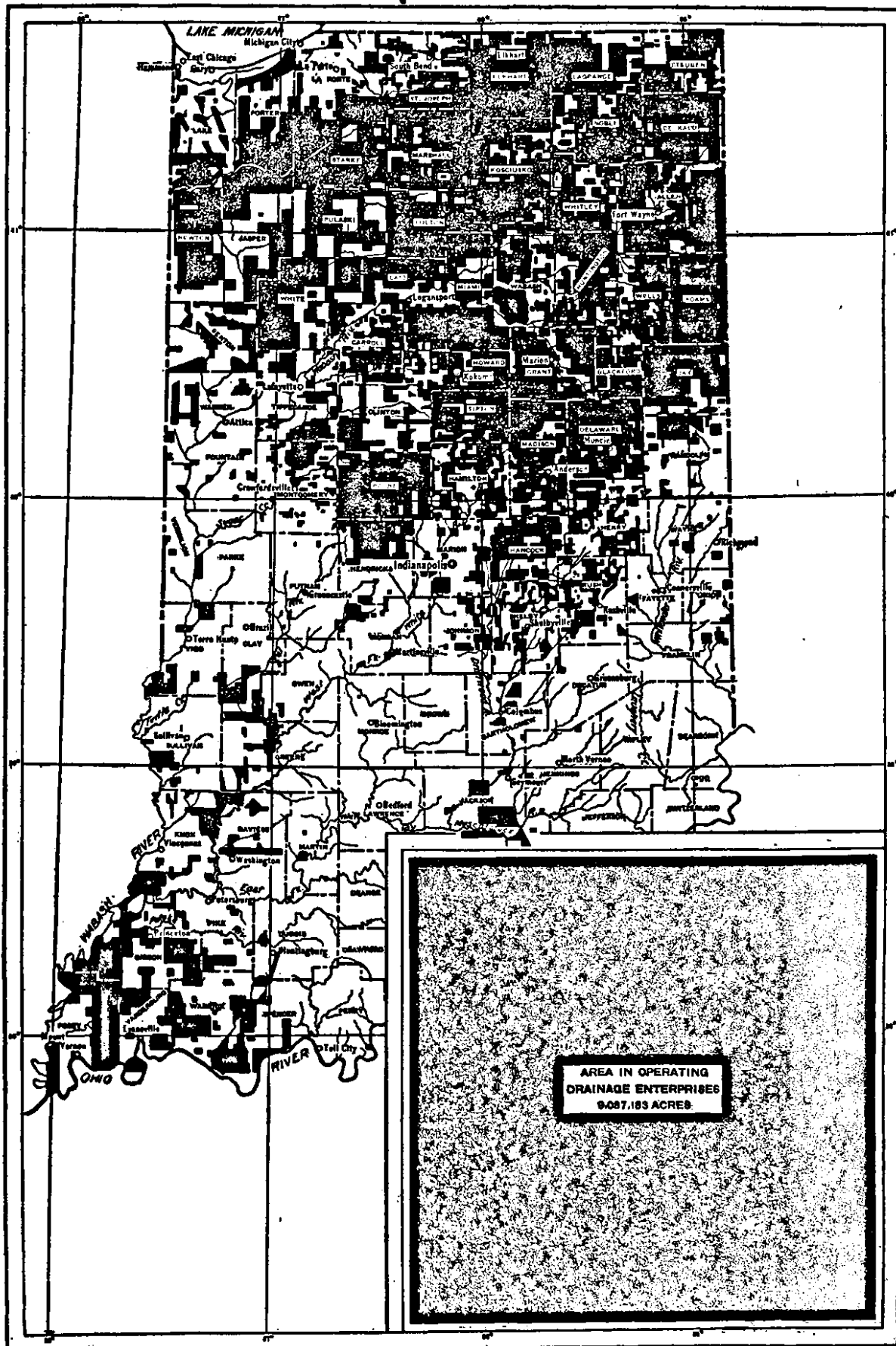
for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	205, 128	100.0
Farms reporting land having drainage.....	111, 435	54.3
Farms reporting land needing drainage.....	66, 413	32.4
All land in farms..... acres..	21, 063, 332	100.0
Improved land in farms..... acres..	16, 680, 212	79.2
Farm land reported as provided with drainage..... acres..	8, 308, 844	39.4
Farm land reported as needing drainage..... acres..	1, 717, 068	8.2
Needing drainage only..... acres..	673, 952	3.2
Needing drainage and clearing..... acres..	1, 043, 116	5.0
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	23, 068, 800	100.0
All land in operating drainage enterprises..... acres..	9, 087, 183	39.4
Improved land..... acres..	7, 605, 565	33.0
Per cent of all improved land in farms.....	45.6	
Timber and cut-over land..... acres..	942, 378	4.1
Other unimproved land..... acres..	539, 240	2.3
Swampy, subject to overflow, seeped, or alkali..... acres..	386, 320	1.7
Suffering a loss of crops from defective drainage..... acres..	210, 678	0.9
Improved land prior to drainage..... acres..	5, 396, 387	23.4
Increase since drainage began..... acres..	2, 209, 178	9.6
Land in nonoperating enterprises..... acres..	288, 724	1.3
Open ditches in operating enterprises..... miles..	17, 594.1	100.0
Completed..... miles..	17, 470.7	99.3
Additional under construction..... miles..	123.4	0.7
Tile drains in operating enterprises..... miles..	8, 413.3	100.0
Completed..... miles..	8, 227.6	97.8
Additional under construction..... miles..	185.7	2.2
Total capital invested in and required for completion of operating enterprises..	\$31, 943, 858	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	31, 147, 682	97.5
Additional capital required to complete these enterprises.....	796, 176	2.5
Average cost per acre when completed.....	3.52	

# INDIANA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include enterprises that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also others for which the order of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises....	9,375,907	100.0	\$31,301,517	100.0	\$2,729,055
Operating enterprises.....	9,087,183	96.9	31,147,682	99.8	796,176
With works completed.....	8,867,674	94.6	30,154,296	96.6	796,176
With works under construction.	219,509	2.3	993,386	3.2	796,176
Nonoperating enterprises.....	288,724	3.1	53,835	0.2	1,932,879

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—A large portion of the central and northern parts of Indiana has been included in drainage enterprises, and there is a considerable area in such enterprises in the southwest corner.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	9,375,907	100.0	\$31,301,517	100.0	\$2,729,055
Operating enterprises.....	9,087,183	96.9	31,147,682	99.8	796,176
Miami River.....	28,238	0.3	113,256	0.4	1,125
Wabash River.....	5,978,848	63.8	20,081,675	64.4	574,533
Ohio River.....	230,317	2.5	804,875	2.6	.....
Illinois River.....	1,273,240	13.0	5,325,712	17.1	107,021
Lake Michigan.....	877,831	9.4	2,356,527	7.6	23,941
Lake Erie.....	608,709	7.5	2,485,637	7.9	89,556
Nonoperating enterprises.....	288,724	3.1	53,835	0.2	1,932,879
Wabash River.....	41,531	0.4	12,066	( <sup>1</sup> )	431,727
Illinois River.....	217,573	2.3	41,789	0.1	1,271,555
Lake Michigan.....	27,824	0.3	.....	.....	60,699
Lake Erie.....	1,797	0.1	.....	.....	168,868

<sup>1</sup> Less than one-tenth of 1 per cent.

In the southern and southeastern parts of the state, however, are groups of counties in which

there has been very little or no drainage except that done by individual farm owners.

Condition of land in enterprises.—Three-fourths of the drainage enterprises in this state, in number and in area of land included, are reported as having been organized for the purpose of draining land that was swampy or so generally wet as to interfere with profitable cultivation. A comparatively few were organized to secure protection against stream overflow, but for nearly a fourth of the enterprises the condition that necessitated drainage was not reported. The statistics show approximately 60 per cent of the land in operating enterprises to have been improved before the drainage enterprises were organized, and 25 per cent to have been timber and cut-over land.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	9,087,183	100.0	8,867,674	219,509	288,724
Improved land.....	7,605,565	83.7	7,442,870	162,695	192,190
Timber and cut-over land.....	942,378	10.4	900,167	42,211	51,212
Other unimproved land.....	539,240	5.9	524,637	14,603	45,322
Swampy or subject to overflow ..	386,320	4.3	362,159	24,161	64,677
Suffering a loss of crops.....	210,678	2.3	188,007	22,671	38,456

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 12,004 operating drainage enterprises are counted in Indiana, with an average area of 1,251 acres assessed. Of this number, 174 comprise 10,000 acres or more each, 2,611 comprise 1,000 to 5,000 acres, and 2,345 are smaller than 200 acres each. The assessed acreage exceeds the land in enterprises by 5,928,038 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises. The amount of overlapping could be only estimated, however, in a great many cases, so for several counties the figures for land in enterprises are only rough approximations.



TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	9,087,183	15,015,221	100.0
Less than 200 acres.....	194,640	255,985	1.7
200 to 499 acres.....	873,821	1,218,792	8.1
500 to 999 acres.....	1,528,423	2,098,534	14.0
1,000 to 4,999 acres.....	3,528,421	5,017,315	33.4
5,000 to 9,999 acres.....	1,059,216	1,718,075	11.4
10,000 to 49,999 acres.....	1,486,965	2,917,817	19.4
50,000 to 99,999 acres.....	391,248	1,032,904	6.9
100,000 to 499,999 acres.....	21,449	755,799	5.0

**Character of enterprises.**—The drainage enterprises in Indiana have been classified as incorporated associations, county commissioners' drains, circuit court drains, and drainage districts. The information secured concerning a considerable part of the enterprises, however, was not sufficiently definite to permit classification with reasonable certainty. The statistics include also a very few commercial developments and private undertakings.

Incorporated associations for the construction of levees and drains and the reclamation of wet and overflowed land have been organized under statutes of 1852 (ch. 29), 1869 (ch. 38), 1873 (ch. 68), 1889 (ch. 67), and 1913 (ch. 165); only the last two are still in effect. Each of these laws has required that the owners of the land to be drained or protected sign articles of association and file them with the county recorder. The minimum number of incorporators required has varied from 15 under the first law to 3 and 5, respectively, under the laws of 1889 and 1913. The associations are governed by directors elected by the members. Assessments of damages and of benefits to accrue from construction are assessed by appraisers, who were selected by the directors under the law of 1852 but now are appointed by the county commissioners upon petition signed by a majority of the landowners or by the owners of two-thirds of the land that will be affected. After public hearing by the appraisers to equalize the assessments, as provided by the statutes still in force, the cost of the enterprise is apportioned against all the land in proportion to the benefits confirmed. Appeals regarding assessments may be taken to the circuit court or the court of common pleas. The county commissioners may issue bonds to finance the construction of drainage works undertaken by associations formed under the act of 1913 and, since 1905, under the act of 1889.

County commissioners' drains, to enable owners of wet land to drain and reclaim it when that could not be done without affecting the land of others, have been established under acts of 1867 (ch. 99), 1875 (approved Mar. 9), 1879 (ch. 121), 1881 (ch. 44), and 1891 (ch. 196), all of which have been repealed. The

act of 1867, like one of 1863 which it repealed, required that application for the proposed drain be made to the county board, who would appoint appraisers to assess both damages and benefits against all land that would be affected. The applicant must pay the damages assessed before construction of the drain was begun, and might demand payment of the benefits assessed when construction had been completed. The act of 1875 provided for reviewers to review the work of the first viewers or appraisers of damages and benefits, if remonstrance was made by landowners affected, and for control of construction by the county board. Each landowner might construct the portion of ditch allotted to him, or the county auditor would let the work by contract and charge the cost to the landowners in proportion to the benefits assessed. The act of 1879 related only to drains not exceeding 3 miles in length. It provided that appeal might be taken to the circuit court regarding assessments of damages and benefits confirmed by the county commissioners. Construction was secured by the petitioners, who were authorized to collect the benefits assessed by suit at law. The statute of 1881 was similar to that of 1875, but provided that appeal from decisions of the county commissioners might be taken to the circuit court, and that the county auditor should let contracts for construction, collect the assessments, and pay the accounts rendered against the enterprise. The act of 1891 related to drains not less than 5 miles in length, and required that the petition for establishment be signed by 10 or more owners of land to be benefited. It authorized the county commissioners also to issue bonds for drainage. The statutes of 1875, 1881, and 1891 provided for drains to be located in more than one county, to be established by joint action of the county commissioners of the counties affected.

The circuit court drains are those that have been established under laws of 1881 (ch. 43), 1885 (ch. 40), 1905 (ch. 157), and 1907 (ch. 252). Each of these acts repealed the preceding one, and only that of 1907 is now in effect. The act of 1881 (ch. 43) provided for a board of drainage commissioners for each enterprise established under the law, to consist of the county surveyor and two other persons appointed by the court. The later acts have provided that each board of county commissioners shall appoint a county drainage commissioner, and that the drainage commissioners for each drain established under these acts shall consist of the county drainage commissioner, the county surveyor, and a third commissioner specially appointed by the court. The following provisions are alike in all of the circuit court drain acts: A petition for establishment must be submitted to the circuit or superior court, signed by one or more owners of land to be benefited by the proposed work. After public hearing, the court refers the petition to the board of drainage commissioners, who investigate the utility and practica-



bility of the project, plan the drainage improvements, estimate the cost of the undertaking, and assess the damages and the benefits that will accrue if the enterprise is carried out. Public hearing upon the drainage commissioners' report is held by the court, and the assessments are equalized and confirmed. Decisions of this court are subject to appeal to the supreme court of the state. Construction of the drainage works is secured by a commissioner appointed by the court. This commissioner also assesses the cost according to the confirmed benefits, collects the assessments, and disburses the funds. The laws of 1905 and 1907 provide that for a drain to be located in more than one county, proceedings shall be before the court of that county having the greatest length of the drain, and for an enterprise in only one county proceedings may be before the county commissioners instead of the circuit or superior court. These two acts also authorize the issue of county bonds for drainage, to be paid from the assessments against the land in the drainage enterprises.

Drainage districts were authorized by acts of 1893 (ch. 146) and 1915 (ch. 88); the former was repealed in 1905 and the latter in 1917. The earlier act provided for establishment by proceedings before the county commissioners' court. A petition for the district must be signed by a majority of the landowners who must own at least one-third of the acreage in the proposed district, or by one-third of the owners owning a major part of the acreage. After ordering the district established, the court appointed three drainage commissioners to administer the affairs of the district until other commissioners should be elected. The commissioners determined the plan of drainage, classified the land according to benefits, assessed the damages that should be paid, and let contracts for construction of the works. Classification of the land and assessments of damages were subject to confirmation by the commissioners' court and appeal to the circuit court. The cost of the enterprise was apportioned by the county auditor according to the confirmed benefits, and collected like general county taxes. No provision was made for issuing bonds. For a district to be situated in more than one county, proceedings were in the county embracing the greater part of the district. The same statute authorized the formation of subdistricts within an original district, by similar proceedings, to be administered by the commissioners of the original district. Drainage districts might also be formed by mutual agreement of two-thirds of the landowners owning two-thirds of the acreage. Classification of the land in a mutual agreement district was made by the county surveyor, and confirmed by the commissioners' court.

The act of 1915 (ch. 88) provided for the establishment of drainage, sanitary, and reclamation districts

by the circuit or superior courts, after filing of articles of association signed by a majority of the resident landowners to be affected, in number or in acreage. Three or five supervisors were elected by the landowners, or appointed by the court upon petition, to be the executive board of the district. They adopted a plan of reclamation and secured construction of the work. Hearing upon the plan of reclamation was required if the proposed work would affect land of owners that had not signed the articles of association. Damages and benefits were assessed by three commissioners appointed by the judge of the court upon petition from the district supervisors, and confirmed by the court after public hearing. Appeal might be taken to the state supreme court. The drainage taxes were apportioned like the confirmed benefits, or the supervisors might levy a uniform acreage tax of not exceeding 50 cents per acre per year. Bonds of the district might be issued by the supervisors.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises . . . . .	9,375,907	100.0	\$31,201,517	100.0	\$2,729,055
Operating enterprises . . . . .	9,087,183	96.9	31,147,682	99.8	798,176
Incorporated associations . . . . .	722,942	7.7	2,175,073	7.0	21,000
Laws of 1852, ch. 29 . . . . .	29,358	0.3	55,704	0.2	.....
Laws of 1859, ch. 33 . . . . .	38,692	0.4	61,551	0.2	.....
Laws of 1873, ch. 68 . . . . .	40,647	0.4	89,839	0.3	.....
Laws of 1889, ch. 87 . . . . .	490,399	5.2	1,376,989	4.4	.....
Laws of 1913, ch. 165 . . . . .	123,746	1.3	591,010	1.9	21,000
County commissioners' drains . . . . .	2,096,992	22.4	5,148,191	16.5	.....
Laws of 1837, ch. 99 . . . . .	85,500	0.9	226,173	0.7	.....
Laws of 1875 (Mar. 9) . . . . .	840,592	9.0	1,495,706	4.8	.....
Laws of 1879, ch. 121 . . . . .	49,241	0.5	99,428	0.3	.....
Laws of 1881, ch. 44 . . . . .	962,911	10.3	2,875,084	9.2	.....
Laws of 1891, ch. 196 . . . . .	158,748	1.7	451,800	1.4	.....
Circuit court drains . . . . .	3,264,920	34.8	14,502,720	46.5	753,421
Laws of 1881, ch. 43 . . . . .	332,810	3.5	682,524	2.2	.....
Laws of 1885, ch. 40 . . . . .	308,258	3.3	809,131	2.6	.....
Laws of 1905, ch. 157 . . . . .	435,331	4.6	1,744,802	5.6	.....
Laws of 1907, ch. 252 . . . . .	2,190,471	23.4	11,260,233	36.1	753,421
Drainage districts . . . . .	179,657	1.9	963,016	3.1	12,150
Laws of 1893, ch. 146 . . . . .	74,461	0.8	325,683	1.0	.....
Laws of 1915, ch. 88 . . . . .	96,196	1.0	637,333	2.0	12,150
Not identified . . . . .	2,793,682	29.8	7,775,994	24.9	9,805
Laws of 1881 . . . . .	2,541,239	27.1	6,776,281	21.7	445
Laws of 1901 . . . . .	124,881	1.3	347,495	1.1	.....
Laws of 1911 . . . . .	127,582	1.4	652,218	2.1	9,160
Commercial and individual . . . . .	5,623	0.1	398,519	1.3	.....
Not reported . . . . .	32,367	0.3	184,169	0.6	.....
Nonoperating enterprises <sup>1</sup> . . . . .	288,724	3.1	53,835	0.2	1,932,879

<sup>1</sup> All are circuit court drains under Laws of 1907 (ch. 252), except 600 acres under individual ownership.

The first drainage law of Indiana was approved May 29, 1852, providing for the sale of swamp land by the county auditors and treasurers, and the appointment by the governor of a drainage commissioner for each county. That commissioner was authorized to plan the drainage of the land and let contracts for construction, the cost to be paid from the proceeds of the sale of the land. This act was repealed in 1869 (ch. 38). A great many other laws

relating to drainage and flood protection have been enacted, several of them being still operative. Most of these relate only to construction of levees and the protection of land in cities, or to the maintenance and repair of works constructed under earlier laws. Only those already mentioned affect the character of the enterprises reported.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 17,470.7 miles of open ditches, 8,227.6 miles of tile drains, and 165.8 miles of accessory levees; the additional lengths under construction were 123.4 miles of open ditches, 185.7 miles of tile drains, and 9.2 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are four pumping districts among the operating drainage enterprises in the state, equipped with 5 centrifugal pumps and 1 rotary pump, and all operated by steam power. The pumps have a total capacity of 55,348 gallons per minute, and the engines 625 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	9,087,183	100.0	\$31,147,682	100.0	\$796,176
Open ditches only.....	5,133,620	56.5	14,405,334	46.2	160,656
Open ditches and levees.....	270,784	3.0	895,236	2.9	25,740
Tile drains only.....	1,234,320	13.6	6,171,216	19.8	103,952
Open ditches and tile drains.....	2,423,949	26.7	9,336,171	30.0	475,828
Open ditches, tile drains, and levees.....	24,510	0.3	339,725	1.1	30,000

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,087,183	100.0	\$31,147,682	100.0	\$796,176
Gravity drainage only.....	9,078,072	99.9	30,964,618	99.4	750,176
All drainage by pumping.....	311	( <sup>1</sup> )	5,289	( <sup>1</sup> )	.....
Part gravity and part pumping.....	8,800	0.1	176,775	0.6	46,000
Total area served by pumps.....	5,611	0.1	.....	.....	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum

depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 5.2 instead of 5.1 feet.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	9,087,183	100.0
Less than 3 feet.....	162,513	1.8
3.0 to 3.9 feet.....	428,560	4.7
4.0 to 4.9 feet.....	929,258	10.2
5.0 to 5.9 feet.....	587,320	6.5
6.0 to 6.9 feet.....	692,507	7.6
7.0 to 7.9 feet.....	320,915	3.5
8.0 to 8.9 feet.....	237,242	2.6
9.0 to 9.9 feet.....	33,471	0.4
10 feet and more.....	143,084	1.6
Not reporting branches.....	5,552,313	61.1

**Maintenance of works.**—The township trustees are required, by an act passed in 1915 (ch. 100), to clean and repair biennially all ditches or drains, except dredged ditches, constructed in their respective townships under any law of the state. The trustees employ engineers to make necessary surveys and let contracts for the work, but landowners may pay their assessments in labor. For cleaning an open ditch, the cost is paid from a tax levied at a uniform rate per acre upon all land benefited, but each town lot is assessed as one acre. The cost of repairing a tile drain is paid by the land benefited in the same proportion as the cost of original construction.

Open ditches other than dredged ditches may be repaired by petition to the county commissioners, in accordance with an act of 1917 (ch. 82). The petition must be signed by owners of 20 per cent of the acreage to be affected, and must be dismissed if remonstrance is made by owners of a major part of the acreage.

The work is allotted to the individual landowners by the county surveyor, or apportioned according to the allotments made for original construction, and is performed under the supervision of the township trustees.

Ditches constructed wholly or partly with a dredge are to be repaired by proceedings somewhat similar to those for establishing a new drain. A petition from five or more owners of real estate that was assessed for the original construction of the drain must be submitted to the court or county commissioners who established the original enterprise. After public hearing and favorable finding, the petition is referred to the drainage commissioner of the county, who makes the survey, assesses damages and benefits, and apportions the cost according to the benefits. His findings are subject to review by the court or county commissioners before contracts are let for construction. Bonds may be issued if the contracts exceed \$5,000.

Drains established under the act of 1889 (ch. 67) are to be kept in repair by the directors of the respective enterprises, the cost to be borne by the land in the same proportion as the cost of original construction, according to an act of 1911 (ch. 127).

A number of laws relating to the repair of ditches have been enacted, which have been repealed or superseded by those mentioned.

TABLE 10.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,087,183	100.0	\$31,147,682	100.0	\$796,176
By district forces.....	1,787,614	19.5	4,942,336	15.9	51,203
By contract.....	1,734,516	19.1	6,608,791	21.2	96,107
By method not specified.....	31,058	0.3	154,858	0.5	.....
By landowners.....	2,780,623	30.6	8,037,234	27.8	174,753
No maintenance provided.....	2,690,086	29.6	10,490,412	33.7	457,536
Not reported.....	63,288	0.9	293,951	0.9	16,577

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when they were established by orders of the courts or county commissioners or otherwise as provided by law, since there may be a period of one or more years between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	9,087,183	100.0	15,015,221	100.0
Before 1860.....	6,466	0.1	6,466	(1)
1860 to 1869.....	49,025	0.5	54,486	0.4
1870 to 1879.....	618,718	6.8	700,290	4.7
1880 to 1889.....	2,148,153	23.6	2,753,722	18.3
1890 to 1899.....	1,662,573	18.3	2,531,548	16.9
1900 to 1904.....	1,378,712	15.2	2,301,705	15.3
1905 to 1909.....	997,537	11.0	2,191,494	14.6
1910 to 1914.....	1,419,381	15.6	2,493,866	16.6
1915 to 1919.....	800,709	8.8	1,966,739	13.1
Not reported.....	5,908	0.1	14,905	0.1

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 12.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$31,147,682	100.0	\$796,176
Before 1860.....	18,014	0.1	.....
1860 to 1869.....	63,460	0.2	.....
1870 to 1879.....	1,165,221	3.7	.....
1880 to 1889.....	4,877,163	15.7	.....
1890 to 1899.....	5,015,664	16.1	.....
1900 to 1904.....	3,993,652	12.8	281
1905 to 1909.....	4,358,197	14.0	.....
1910 to 1914.....	6,248,435	20.1	256,438
1915 to 1919.....	5,325,766	17.1	539,467
Not reported.....	82,110	0.3	.....

TABLE 13.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	17,694.1	100.0	8,413.8	100.0	175.0	100.0
Before 1860.....	7.5	(1)	.....	.....	.....	.....
1860 to 1869.....	79.8	0.5	1.0	(1)	.....	.....
1870 to 1879.....	1,822.7	10.4	54.6	0.6	.....	.....
1880 to 1889.....	5,960.8	33.9	827.3	9.8	25.2	14.4
1890 to 1899.....	3,580.4	20.4	1,543.6	18.3	9.8	5.6
1900 to 1904.....	1,893.1	10.8	1,394.6	16.6	21.5	12.3
1905 to 1909.....	1,580.3	9.0	1,420.7	16.9	17.5	10.0
1910 to 1914.....	1,623.9	9.2	1,842.5	21.9	70.2	40.1
1915 to 1919.....	1,013.5	5.8	1,317.9	15.7	30.8	17.6
Not reported.....	22.1	0.2	11.1	0.1	.....	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, wheat, and hay. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—INDIANA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adams.	Allen.	Bartholomew.	Benton.	Blackford.	Boone.	Brown.
1	Number of all farms in the state or county.....	205,128	2,328	4,221	2,043	1,255	1,126	3,011	1,458
2	Farms reporting land having drainage.....	111,435	2,197	3,877	1,037	1,174	1,061	2,886	52
3	Farms reporting land needing drainage.....	60,413	1,423	2,644	815	202	762	1,224	80
4	Farms in drainage and levee districts.....	14,839	17	360	72	59	404	50	.....
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres	23,068,800	215,680	423,040	260,480	261,120	107,520	273,280	207,360
6	All land in farms..... acres	21,063,332	206,981	391,772	242,768	253,194	101,489	255,620	159,867
7	Improved land in farms..... acres	16,680,212	181,678	321,262	196,389	239,857	87,604	223,674	81,389
8	Woodland in farms..... acres	3,141,042	21,574	53,767	33,719	5,529	12,640	29,793	57,412
9	Other unimproved land in farms..... acres	1,242,078	3,729	16,743	12,660	7,808	1,225	2,153	21,066
10	Farm land reported as provided with drainage..... acres	3,308,844	155,678	257,396	80,447	223,867	75,702	214,310	664
11	Farm land reported as needing drainage..... acres	1,717,068	26,663	66,689	23,135	12,976	19,076	24,021	1,803
12	Drainage only..... acres	673,952	9,224	22,305	6,778	10,362	7,950	4,701	428
13	Drainage and clearing..... acres	1,043,116	17,444	44,384	16,357	2,614	11,126	19,320	1,375

		Carroll.	Cass.	Clark.	Clay.	Clinton.	Davies.	Decatur.	De Kalb.	Delaware.
1	Number of all farms in the county.....	2,075	2,395	2,002	2,414	2,389	2,602	1,910	2,461	2,808
2	Farms reporting land having drainage.....	1,610	1,965	128	545	2,029	599	1,205	2,358	2,447
3	Farms reporting land needing drainage.....	787	998	216	411	747	513	664	1,767	1,196
4	Farms in drainage and levee districts.....	385	503	2	117	29	164	12	228	147
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres	241,280	266,240	240,000	231,040	261,120	277,120	241,920	236,800	250,880
6	All land in farms..... acres	226,389	250,078	212,414	204,441	248,433	256,892	231,113	220,815	237,295
7	Improved land in farms..... acres	195,457	207,694	141,149	161,703	226,600	223,446	188,384	181,510	205,652
8	Woodland in farms..... acres	23,597	33,742	51,052	30,666	30,027	24,829	28,616	29,378	24,729
9	Other unimproved land in farms..... acres	7,335	8,652	20,213	12,072	1,806	8,617	14,113	9,927	6,914
10	Farm land reported as provided with drainage..... acres	138,092	154,443	3,030	16,442	189,214	26,502	126,886	148,022	175,208
11	Farm land reported as needing drainage..... acres	15,807	23,624	6,867	7,670	12,094	13,445	21,749	35,723	22,585
12	Drainage only..... acres	5,604	7,783	1,852	1,810	1,997	7,566	12,321	11,398	7,757
13	Drainage and clearing..... acres	10,203	15,841	4,915	5,860	10,097	5,879	9,428	24,325	15,828

		Dubois.	Elkhart.	Fayette.	Floyd.	Fountain.	Franklin.	Fulton.	Gibson.	Grant.
1	Number of all farms in the county.....	2,261	3,131	1,081	1,252	1,915	2,067	2,241	2,563	2,950
2	Farms reporting land having drainage.....	178	1,410	711	43	1,310	583	1,955	1,117	2,707
3	Farms reporting land needing drainage.....	136	1,166	548	142	791	425	1,387	356	1,478
4	Farms in drainage and levee districts.....	9	492	6	1	21	76	402	205	169
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres	273,280	295,680	138,240	94,720	252,800	252,160	234,880	311,040	270,720
6	All land in farms..... acres	258,735	262,300	133,437	82,574	236,904	248,193	222,778	280,532	251,655
7	Improved land in farms..... acres	178,056	220,263	104,587	52,260	194,071	158,093	187,339	236,709	219,414
8	Woodland in farms..... acres	64,920	31,820	19,017	23,497	30,556	50,172	20,365	16,845	26,506
9	Other unimproved land in farms..... acres	15,759	10,187	9,833	6,817	12,277	39,928	15,074	6,978	5,736
10	Farm land reported as provided with drainage..... acres	5,789	68,519	43,922	682	106,805	31,137	138,424	72,566	198,700
11	Farm land reported as needing drainage..... acres	4,642	21,546	10,802	2,093	26,980	8,116	30,216	10,337	30,575
12	Drainage only..... acres	1,432	9,712	2,795	128	14,654	1,314	12,227	5,862	9,974
13	Drainage and clearing..... acres	3,160	11,834	8,007	1,965	12,326	6,802	18,089	4,475	20,601

		Greene.	Hamilton.	Hancock.	Harrison.	Henricks.	Henry.	Howard.	Huntington.	Jackson.
1	Number of all farms in the county.....	3,441	2,868	2,038	3,048	2,526	2,540	2,164	2,637	2,617
2	Farms reporting land having drainage.....	417	2,260	1,965	174	2,190	2,334	2,040	2,354	540
3	Farms reporting land needing drainage.....	270	1,066	1,024	262	1,305	1,414	1,164	1,521	184
4	Farms in drainage and levee districts.....	104	64	190	4	80	253	141	332	82
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres	347,520	255,360	186,480	311,040	261,120	254,080	190,080	247,040	331,520
6	All land in farms..... acres	309,198	242,165	187,218	287,333	242,235	239,709	182,150	234,105	294,173
7	Improved land in farms..... acres	237,795	209,869	166,994	183,033	197,844	211,054	162,102	196,094	266,826
8	Woodland in farms..... acres	53,681	27,864	17,089	78,331	33,895	24,337	16,247	29,579	73,372
9	Other unimproved land in farms..... acres	17,722	4,432	3,135	25,969	10,496	4,318	3,601	8,432	13,975
10	Farm land reported as provided with drainage..... acres	27,605	149,612	153,842	12,113	163,420	179,265	145,473	162,122	20,475
11	Farm land reported as needing drainage..... acres	8,746	19,187	17,157	4,867	35,900	26,260	17,527	27,250	5,157
12	Drainage only..... acres	5,104	6,721	3,048	413	12,225	6,085	4,042	6,351	2,477
13	Drainage and clearing..... acres	3,642	12,466	14,109	4,454	23,675	20,175	13,485	20,899	2,680

# DRAINAGE—INDIANA.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Jasper.	Jay.	Jennings.	Johnson.	Knox.	Kosciusko.	Lagrange.	Lake.	LaPorte.
1	Number of all farms in the county.....	1,736	2,532	2,023	2,051	2,458	3,355	2,044	1,718	2,431
2	Farms reporting land having drainage.....	1,359	2,166	255	1,789	900	2,522	908	1,114	560
3	Farms reporting land needing drainage.....	856	1,246	471	859	515	1,851	624	876	290
4	Farms in drainage and levee districts.....	111	268	2	178	316	461	253	298	318
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	359,680	240,000	245,120	206,080	326,400	346,240	247,680	314,880	380,800
6	All land in farms..... acres.....	322,369	233,534	221,146	196,932	299,751	313,245	221,305	225,415	338,998
7	Improved land in farms..... acres.....	249,596	201,452	159,415	164,550	261,428	249,460	177,332	181,713	280,328
8	Woodland in farms..... acres.....	42,320	27,927	49,875	24,395	27,573	35,189	23,884	25,116	27,523
9	Other unimproved land in farms..... acres.....	30,453	4,155	11,855	7,967	10,750	28,596	20,069	18,586	31,147
10	Farm land reported as provided with drainage..... acres.....	198,318	161,422	6,963	134,434	57,789	137,099	31,389	87,141	71,070
11	Farm land reported as needing drainage..... acres.....	85,778	31,104	13,291	16,908	15,523	42,346	12,062	38,585	15,667
12	Drainage only..... acres.....	49,595	11,777	5,361	4,993	10,084	17,676	6,176	20,996	11,057
13	Drainage and clearing..... acres.....	36,183	19,327	7,930	11,915	5,439	24,671	5,886	15,589	4,610
<b>Lawrence. Madison. Marion. Marshall. Martin. Miami. Monroe. Montgomery. Morgan.</b>										
1	Number of all farms in the county.....	2,332	3,173	2,855	2,720	1,661	2,205	2,232	2,564	2,492
2	Farms reporting land having drainage.....	17	2,830	1,992	1,827	137	1,929	142	2,134	660
3	Farms reporting land needing drainage.....	19	1,228	943	1,371	199	1,222	199	775	278
4	Farms in drainage and levee districts.....		427	154	194	19	129	2	138	69
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	291,840	288,000	254,080	282,240	216,960	243,840	266,240	320,640	259,840
6	All land in farms..... acres.....	251,658	266,203	198,970	265,296	196,490	220,066	228,170	301,398	240,808
7	Improved land in farms..... acres.....	160,265	236,504	166,799	186,770	119,493	186,930	142,944	247,692	162,728
8	Woodland in farms..... acres.....	66,931	25,110	26,302	29,586	54,110	29,599	69,013	46,520	66,804
9	Other unimproved land in farms..... acres.....	24,452	4,589	8,869	26,932	22,887	9,527	16,213	7,186	11,281
10	Farm land reported as provided with drainage..... acres.....	685	213,579	115,254	105,437	4,816	141,711	4,849	211,168	29,640
11	Farm land reported as needing drainage..... acres.....	340	24,205	17,933	36,051	5,578	29,178	6,218	92,517	7,333
12	Drainage only..... acres.....	124	9,010	4,123	14,097	2,299	7,821	2,188	8,725	1,509
13	Drainage and clearing..... acres.....	216	15,185	13,810	21,954	3,277	30,357	4,030	16,792	5,829
<b>Newton. Noble. Orange. Owen. Parks. Perry. Pike. Porter. Posey.</b>										
1	Number of all farms in the county.....	1,011	2,450	2,315	1,968	2,228	1,836	2,159	1,791	2,071
2	Farms reporting land having drainage.....	738	1,902	98	60	1,041	178	306	765	1,169
3	Farms reporting land needing drainage.....	204	1,310	230	78	650	174	377	520	740
4	Farms in drainage and levee districts.....	47	740			28	1	77	267	186
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	259,200	266,880	260,480	251,520	266,080	245,760	216,320	265,600	257,280
6	All land in farms..... acres.....	226,508	250,169	236,302	225,471	252,544	215,246	185,994	233,828	239,500
7	Improved land in farms..... acres.....	183,416	198,848	144,761	144,132	163,139	106,558	154,110	187,068	211,752
8	Woodland in farms..... acres.....	26,623	30,158	67,092	62,529	66,422	88,423	17,604	25,855	19,197
9	Other unimproved land in farms..... acres.....	16,469	21,163	24,449	18,810	22,983	19,265	14,280	20,806	8,641
10	Farm land reported as provided with drainage..... acres.....	145,245	103,539	2,130	1,917	55,466	3,893	10,710	42,195	77,859
11	Farm land reported as needing drainage..... acres.....	27,658	32,508	5,968	8,096	16,538	3,998	9,510	16,730	22,061
12	Drainage only..... acres.....	12,652	12,800	1,010	891	6,805	2,318	6,677	8,926	12,115
13	Drainage and clearing..... acres.....	15,006	19,708	4,958	2,115	9,733	1,680	2,633	7,804	9,946
<b>Pulaski. Putnam. Randolph. Ripley. Rush. St. Joseph. Scott. Shelby. Spencer.</b>										
1	Number of all farms in the county.....	1,763	2,682	3,226	2,836	2,044	2,678	1,104	2,660	2,662
2	Farms reporting land having drainage.....	1,606	1,553	2,906	227	1,910	1,051	331	2,353	764
3	Farms reporting land needing drainage.....	954	675	1,663	650	980	610	327	1,146	402
4	Farms in drainage and levee districts.....	861	32	692	25	98	223	89	196	207
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	276,480	309,120	266,080	286,720	261,760	294,400	121,600	260,480	257,920
6	All land in farms..... acres.....	253,924	288,452	276,572	269,401	252,997	257,983	105,422	245,756	231,746
7	Improved land in farms..... acres.....	203,293	192,374	241,259	199,515	222,687	215,250	76,755	221,781	183,647
8	Woodland in farms..... acres.....	36,652	79,443	29,483	42,524	25,274	26,542	23,794	19,731	27,206
9	Other unimproved land in farms..... acres.....	13,979	16,635	5,830	27,362	5,036	16,191	4,943	7,244	16,893
10	Farm land reported as provided with drainage..... acres.....	172,900	85,866	215,218	6,705	201,649	58,805	11,339	174,114	30,736
11	Farm land reported as needing drainage..... acres.....	48,744	17,883	38,051	16,141	22,617	15,265	9,107	20,345	9,512
12	Drainage only..... acres.....	18,524	6,113	9,179	2,439	6,097	7,248	2,092	6,069	5,477
13	Drainage and clearing..... acres.....	30,220	11,770	28,872	12,702	16,520	8,017	7,015	14,286	4,035

## DRAINAGE—INDIANA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Starke.	Steuben.	Sullivan.	Tippecanoe.	Tipton.	Union.	Vanderburg.	Ver-milion.	Vigo.
1	Number of all farms in the county.....	1,402	1,787	2,837	2,401	1,857	796	1,680	1,058	2,770
2	Farms reporting land having drainage.....	1,032	996	603	1,550	1,545	563	542	467	570
3	Farms reporting land needing drainage.....	610	685	281	590	787	323	302	214	292
4	Farms in drainage and levee districts.....	252	221	81	34	21	56	3	85	
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	195,200	195,200	294,400	321,920	166,400	103,680	149,120	162,560	261,760
6	All land in farms.....acres..	168,178	183,072	252,861	299,228	153,969	100,269	132,538	132,357	222,285
7	Improved land in farms.....acres..	122,419	140,560	210,676	262,341	142,340	77,927	113,611	102,463	180,023
8	Woodland in farms.....acres..	27,226	22,439	24,213	27,206	16,192	11,624	10,632	21,789	25,925
9	Other unimproved land in farms.....acres..	18,533	20,073	17,972	9,682	437	10,718	8,295	8,105	16,337
10	Farm land reported as provided with drainage.....acres..	87,839	50,567	31,516	160,879	125,287	51,904	25,114	41,700	28,348
11	Farm land reported as needing drainage.....acres..	30,901	19,892	10,061	13,313	13,350	6,206	4,991	6,387	7,408
12	Drainage only.....acres..	11,997	8,302	5,942	4,283	2,532	1,349	3,214	1,693	3,530
13	Drainage and clearing.....acres..	18,904	11,590	4,109	9,030	10,818	4,857	1,777	4,694	3,878
		Wabash.	Warren.	Warrick.	Wash-ington.	Wayne.	Wells.	White.	Whitley.	All other coun-ties. <sup>1</sup>
1	Number of all farms in the county.....	2,529	1,286	2,503	2,549	2,410	2,545	1,991	2,041	8,865
2	Farms reporting land having drainage.....	2,220	845	631	90	1,722	2,457	1,097	1,943	96
3	Farms reporting land needing drainage.....	1,528	323	469	165	1,054	1,741	787	1,326	317
4	Farms in drainage and levee districts.....	620	117	245	1	77	464	193	295	8
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	272,000	235,520	250,880	332,160	263,040	233,600	324,480	216,320	823,680
6	All land in farms.....acres..	249,862	208,204	220,461	304,091	243,777	219,356	314,520	194,917	784,704
7	Improved land in farms.....acres..	205,986	179,162	188,831	208,274	197,717	192,372	276,447	159,653	519,692
8	Woodland in farms.....acres..	30,452	20,727	17,389	81,630	31,756	25,029	20,632	28,026	165,435
9	Other unimproved land in farms.....acres..	13,424	8,315	14,241	14,187	14,304	1,955	17,241	7,238	99,677
10	Farm land reported as provided with drainage.....acres..	159,664	119,148	25,783	3,459	106,457	166,895	209,682	136,110	1,168
11	Farm land reported as needing drainage.....acres..	39,935	14,121	11,782	8,593	26,384	38,190	41,234	28,864	5,814
12	Drainage only.....acres..	16,735	6,144	7,692	5,792	9,654	15,045	26,450	7,772	1,244
13	Drainage and clearing.....acres..	23,200	7,977	4,090	2,801	16,730	23,145	14,784	21,092	4,570

<sup>1</sup> Drainage on farms was reported in all counties in Indiana.

# DRAINAGE—INDIANA

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE	Adams	Allen	Bartholomew	Benton	Blackford	Boone	Carroll	Cass	
<b>LAND AREA.</b>											
1	Approximate land area of the state or county	acres	21,068,800	215,898	422,040	260,480	261,120	367,520	273,280	241,280	268,240
2	All land in operating drainage enterprises	acres	9,087,188	212,644	391,540	18,007	108,574	91,781	252,887	163,494	218,421
3	Improved land	acres	7,605,565	172,400	281,817	14,012	84,313	79,464	220,686	147,087	196,581
4	Per cent of all improved land in farms		45.6	94.9	87.7	7.1	35.3	90.7	98.7	75.2	94.7
5	Timber and cut-over land	acres	942,378	32,801	21,169	2,133	9,867	11,283	31,598	16,457	21,840
6	Other unimproved land	acres	539,240	7,443	78,554	2,862	9,394	984	603		
7	Swampy or subject to overflow, in enterprises	acres	386,320	22,553	5,103	3,157	942	3,092	951	106	227
8	Suffering a loss of crops from defective drainage	acres	210,678	2,119	1,055	3,125	570	732	69		
9	Assessed acreage		15,015,221	781,606	484,619	19,007	105,122	111,397	315,699	164,861	351,088
10	Excess over all land in operating enterprises	acres	5,928,026	568,963	92,079		1,548	19,696	63,012	1,267	122,617
<b>DRAINAGE WORKS.</b>											
<b>Open ditches:</b>											
11	Completed	miles	17,470.7	781.3	1,045.2	64.8	89.0	212.2	268.5	358.1	521.9
12	Additional under construction	miles	123.4		5.9						
13	Maximum completed in any enterprise	miles	100.0	24.9	15.8	8.0	7.5	12.4	17.0	11.7	26.2
14	Maximum width at bottom of ditch	feet	125	125	20	6	30	65	13	12	12
15	Maximum of average depths of outlet ditches	feet	27.5	11.1	21.0	8.0	14.0	18.0	15.0	12.0	10.0
16	Mean depth of branch ditches	feet	5.1	3.5	4.8	3.6	3.4	4.7	4.3	4.6	4.2
<b>Tile drains:</b>											
17	Completed	miles	8,227.6	242.2	264.8	15.3	94.6	102.6	243.7	282.2	258.4
18	Additional under construction	miles	185.7		2.5			0.5		1.6	
19	Maximum completed in any enterprise	miles	100.0	4.5	4.9	7.0	6.0	9.0	9.0	4.6	12.2
20	Maximum size of tile	inches	48	30	20	20	26	24	27	30	30
<b>Accessory levees and dikes:</b>											
21	Completed	miles	165.8			2.5					
22	Additional under construction	miles	9.2								
<b>Pumping plants:</b>											
23	Engine capacity	horsepower	625								
24	Pump capacity	gallons per minute	55,348								
25	Area served by pumps	acres	5,611								
26	Area drained by open ditches only	acres	5,123,490	118,130	285,572	14,917	49,975	46,133	123,146	67,690	123,318
27	Length of these ditches	miles	12,487.2	523.0	883.3	58.6	66.0	112.7	291.8	199.0	332.6
28	Average length per acre	feet	12.8	23.4	15.8	20.7	7.0	12.9	12.5	15.5	14.8
29	Area having open ditches and levees	acres	270,794			640					
30	Length of these ditches	miles	210.5			2.2					
31	Average length per acre	feet	4.1			18.2					
32	Length of the accessory levees	miles	153.6			2.5					
33	Area drained by tile only	acres	1,224,320	12,008	23,310	2,465	23,767	11,774	84,948	54,472	25,698
34	Length of these tile	miles	4,630.5	111.1	150.4	12.8	72.2	53.2	206.6	128.6	129.6
35	Average length per acre	feet	18.8	48.9	35.3	27.4	11.4	22.9	12.8	18.8	26.0
36	Area drained by open ditches and tile	acres	2,423,949	82,506	62,787	965	19,822	22,894	44,792	41,342	69,417
37	Length of these drains	miles	8,461.7	369.4	273.7	6.5	44.4	149.4	115.8	129.3	311.1
38	Average length per acre	feet	18.5	22.6	22.2	34.8	11.8	22.3	13.6	16.5	26.2
39	Area having open ditches, tile drains, and levees	acres	24,510								
40	Length of these drains	miles	188.5								
41	Average length per acre	feet	40.6								
42	Length of the accessory levees	miles	21.4								
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920	acres	7,605,565	172,400	281,817	14,012	84,313	79,464	220,686	147,087	196,581
44	Improved land prior to drainage	acres	5,396,387	117,897	144,101	10,371	74,540	43,150	158,490	132,329	173,327
45	Increase since drainage	acres	2,209,178	54,503	137,716	3,641	9,773	37,314	62,196	14,708	23,254
46	Per cent of increase		41.9	46.2	65.6	35.1	12.1	88.5	39.2	11.1	13.3
47	Per cent increase is of all improved land in farms, 1920		13.2	30.0	48.9	1.9	4.1	42.6	27.8	7.5	11.1
48	Timber and cut-over land, 1920	acres	942,378	32,801	21,169	2,133	9,867	11,283	31,598	16,457	21,840
49	Timber and cut-over land prior to drainage	acres	2,324,978	86,446	119,685	3,494	14,853	47,097	87,117	31,165	44,904
50	Decrease since drainage	acres	1,382,600	53,645	98,516	1,361	4,986	35,814	55,519	14,708	23,064
51	Per cent of decrease		59.5	62.1	74.0	39.0	33.6	76.0	63.7	47.2	51.4
52	Other unimproved land, 1920	acres	539,240	7,443	78,554	2,862	9,394	984	603		
53	Other unimproved land prior to drainage	acres	1,365,819	8,301	127,754	5,142	14,181	2,484	7,280		
54	Decrease since drainage	acres	826,579	858	49,200	2,280	4,787	1,500	6,677		
55	Per cent of decrease		60.5	10.3	28.5	44.3	33.8	60.4	91.7		
56	Swampy or subject to overflow, 1920	acres	386,320	22,553	5,103	3,157	942	3,092	951	106	227
57	Swampy or subject to overflow prior to drainage	acres	2,247,265	83,665	149,005	5,882	16,116	25,654	97,954	36,401	69,793
58	Decrease since drainage	acres	2,860,945	61,112	143,902	2,725	15,174	22,564	97,003	56,295	69,566
59	Per cent of decrease		86.1	73.0	96.6	46.3	94.2	87.9	90.0	90.6	90.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises	dollars	21,943,856	943,698	1,324,245	72,042	208,431	465,578	482,983	543,424	960,900
61	Capital invested in these enterprises to Dec. 31, 1919	dollars	21,147,682	943,698	1,306,669	72,042	208,431	461,628	482,983	530,336	960,900
62	Additional capital required to complete these enterprises	dollars	796,176		17,576			4,950		13,088	
63	Average cost per acre when completed	dollars	2.52	4.44	3.28	3.79	2.96	5.08	1.91	3.32	4.40
64	Enterprises constructing open ditches only	dollars	14,565,990	534,473	853,920	55,153	38,757	186,748	217,753	154,515	217,254
65	Average cost per acre when completed	dollars	2.84	4.52	2.89	3.70	1.18	4.06	1.77	2.28	1.76
66	Enterprises constructing open ditches and levees	dollars	920,976			850					
67	Average cost per acre when completed	dollars	3.40			1.33					
68	Enterprises constructing tile drains only	dollars	6,275,168	120,510	203,530	14,524	174,457	70,822	186,963	263,794	198,675
69	Average cost per acre when completed	dollars	5.08	10.87	8.13	6.01	3.17	6.02	2.34	4.47	7.74
70	Enterprises constructing open ditches and tile drains	dollars	9,811,999	278,715	266,785	1,215	78,237	208,008	66,837	145,185	544,671
71	Average cost per acre when completed	dollars	4.08	3.38	4.25	1.23	2.79	6.15	1.69	3.51	7.85
72	Enterprises constructing open ditches, tile drains, and levees	dollars	369,725								
73	Average cost per acre when completed	dollars	15.10								
<b>CROPS.</b>											
<b>Improved land in enterprises reporting—</b>											
74	Corn as principal crop on drained land	acres	6,943,654	171,086	240,117	14,012	84,313	79,464	220,440	146,276	196,581
75	Wheat as principal crop on drained land	acres	322,459		196				109	761	
76	Hay as principal crop on drained land	acres	121,608		41,514						
77	Oats as principal crop on drained land	acres	64,647								
78	Vegetables as principal crop on drained land	acres	2,296	412					146		
79	Not reporting principal crop on drained land	acres	90,901	903							

1 Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 The reported figures have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—INDIANA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Clay.	Clinton.	Davies.	De Kalb.	Dela-ware.	Dubois.	Elkhart.	Fayette.	Foun-tain.	Frank-lin.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....acres..	231,040	261,120	277,120	265,800	250,880	273,280	295,680	138,240	252,800	252,160
2	All land in operating drainage enterprises.....acres..	59,050	87,339	40,276	215,859	248,896	8,389	280,847	6,185	11,213	7,180
3	Improved land.....acres..	49,497	77,982	40,142	141,782	196,985	7,823	217,623	4,785	8,659	6,466
4	Per cent of all improved land in farms.....	20.6	24.4	18.0	78.1	95.8	4.4	98.8	4.6	4.5	4.1
5	Timber and cut-over land.....acres..	8,623	4,983	134	18,625	51,615	566	41,676	990	1,371	569
6	Other unimproved land.....acres..	930	4,394	296	55,452	296	-----	21,548	410	1,183	145
7	Swampy or subject to overflow, in enterprises.....acres..	1,439	5,924	500	228	6,735	166	7,865	89	110	145
8	Suffering a loss of crops from defective drainage.....acres..	-----	332	500	119	2,245	48	7,856	89	110	145
9	Assessed acreage.....acres..	68,050	96,119	41,422	539,899	271,650	8,389	301,680	6,185	11,213	7,180
10	Excess over all land in operating enterprises.....acres..	9,000	8,780	1,146	324,040	22,764	-----	20,833	-----	-----	-----
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....miles..	89.2	44.2	64.5	798.1	320.1	25.7	546.0	-----	9.7	-----
12	Additional under construction.....miles..	0.8	-----	-----	0.2	-----	-----	-----	-----	-----	-----
13	Maximum completed in any enterprise.....miles..	20.7	13.4	34.0	23.1	14.1	15.9	18.1	-----	4.2	-----
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	50	7	60	15	30	27	34	-----	8	-----
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	15.0	8.0	16.0	9.0	6.7	8.0	10.0	-----	9.0	-----
16	Mean depth of branch ditches <sup>3</sup> .....feet..	5.8	4.0	7.1	5.9	3.4	5.0	5.1	-----	-----	-----
Tile drains:											
17	Completed.....miles..	4.4	104.1	1.0	369.4	228.1	0.2	84.6	15.2	22.7	22.1
18	Additional under construction.....miles..	-----	-----	-----	12.0	-----	-----	-----	-----	-----	-----
19	Maximum completed in any enterprise.....miles..	3.0	8.0	0.6	10.5	7.0	0.2	8.0	3.1	5.4	4.5
20	Maximum size of tile <sup>1</sup> .....inches..	24	30	12	30	24	15	36	24	30	24
Accessory levees and dikes:											
21	Completed.....miles..	10.9	-----	-----	-----	-----	0.3	-----	-----	-----	-----
22	Additional under construction.....miles..	3.3	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pumping plants:											
23	Engine capacity.....horsepower..	200	-----	-----	-----	-----	-----	-----	-----	-----	-----
24	Pump capacity.....gallons per minute..	12,000	-----	-----	-----	-----	-----	-----	-----	-----	-----
25	Area served by pumps.....acres..	1,200	-----	-----	-----	-----	-----	-----	-----	-----	-----
26	Area drained by open ditches only <sup>3</sup> .....acres..	32,388	32,357	33,090	77,925	99,464	3,089	206,387	-----	2,162	-----
27	Length of these ditches.....miles..	35.1	35.5	58.0	536.7	212.9	9.8	489.7	-----	9.2	-----
28	Average length per acre.....feet..	5.9	5.8	8.9	36.4	11.3	16.8	11.2	-----	22.5	-----
29	Area having open ditches and levees <sup>3</sup> .....acres..	16,332	-----	-----	-----	-----	-----	-----	-----	-----	-----
30	Length of these ditches.....miles..	35.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
31	Average length per acre.....feet..	11.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
32	Length of the accessory levees.....miles..	14.1	-----	-----	-----	-----	-----	-----	-----	-----	-----
33	Area drained by tile only <sup>1</sup> .....acres..	650	89,827	-----	85,447	47,829	-----	17,082	6,185	5,916	7,180
34	Length of these tile.....miles..	3.0	80.4	-----	185.8	145.0	-----	41.2	15.2	15.4	22.1
35	Average length per acre.....feet..	24.4	10.7	-----	27.6	16.0	-----	12.7	13.0	12.7	16.3
36	Area drained by open ditches and tile <sup>1</sup> .....acres..	8,880	15,155	7,188	102,467	101,608	-----	57,378	-----	3,135	-----
37	Length of these drains.....miles..	17.3	32.4	9.5	457.7	190.3	-----	149.7	-----	7.8	-----
38	Average length per acre.....feet..	10.3	11.3	7.0	23.6	9.9	-----	13.8	-----	13.1	-----
39	Area having open ditches, tile drains, and levees <sup>3</sup> .....acres..	800	-----	-----	-----	-----	5,300	-----	-----	-----	-----
40	Length of these drains.....miles..	2.5	-----	-----	-----	-----	16.1	-----	-----	-----	-----
41	Average length per acre.....feet..	16.5	-----	-----	-----	-----	16.0	-----	-----	-----	-----
42	Length of the accessory levees.....miles..	0.1	-----	-----	-----	-----	0.3	-----	-----	-----	-----
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920.....acres..	49,497	77,982	40,142	141,782	196,985	7,823	217,623	4,785	8,659	6,466
44	Improved land prior to drainage.....acres..	40,885	45,023	32,616	100,709	188,533	5,252	160,821	4,135	5,787	5,739
45	Increase since drainage.....acres..	8,612	32,959	7,526	41,073	8,452	2,571	56,802	650	2,872	727
46	Per cent of increase.....	21.1	73.2	23.5	40.8	4.3	49.0	35.3	15.7	50.9	12.7
47	Per cent increase is of all improved land in farms, 1920.....	5.3	14.5	8.4	22.6	4.0	1.4	25.8	0.6	1.5	0.5
48	Timber and cut-over land, 1920.....acres..	8,623	4,983	134	18,625	51,615	566	41,676	990	1,371	569
49	Timber and cut-over land prior to drainage.....acres..	15,147	81,380	6,078	45,338	59,014	3,119	74,583	1,292	3,048	720
50	Decrease since drainage.....acres..	6,524	26,397	5,944	26,713	7,399	2,553	32,887	302	1,677	151
51	Per cent of decrease.....	43.1	84.2	97.8	58.9	12.5	81.9	44.1	23.4	55.0	21.0
52	Other unimproved land, 1920.....acres..	930	4,394	-----	55,452	296	-----	21,548	410	1,183	145
53	Other unimproved land prior to drainage.....acres..	3,018	10,956	1,682	66,812	1,049	18	45,463	758	2,428	721
54	Decrease since drainage.....acres..	2,088	6,562	1,682	14,360	753	18	23,915	348	1,245	576
55	Per cent of decrease.....	69.2	59.9	100.0	20.6	71.8	100.0	52.6	45.9	51.3	79.9
56	Swampy or subject to overflow, 1920.....acres..	1,439	5,924	500	228	6,735	166	7,865	89	110	145
57	Swampy or subject to overflow prior to drainage.....acres..	9,638	69,880	15,485	22,170	50,294	6,276	75,828	768	1,940	721
58	Decrease since drainage.....acres..	8,199	63,956	14,985	21,942	43,559	6,110	67,963	679	1,830	576
59	Per cent of decrease.....	85.1	90.1	96.8	99.0	88.6	97.4	89.6	88.4	94.3	79.9
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises.....dollars..	391,223	224,420	104,304	879,465	422,035	60,697	523,692	23,484	97,839	49,333
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	380,223	224,420	104,304	841,020	422,035	60,697	523,692	23,484	97,839	49,333
62	Additional capital required to complete these enterprises.....dollars..	11,000	-----	-----	38,445	-----	-----	-----	-----	-----	-----
63	Average cost per acre when completed.....dollars..	6.53	2.57	2.59	4.07	1.70	7.24	1.86	3.80	8.73	6.87
64	Enterprises constructing open ditches only.....dollars..	236,244	48,968	90,960	256,251	119,021	11,643	373,664	-----	23,821	-----
65	Average cost per acre when completed.....dollars..	7.29	1.61	2.75	3.29	1.20	3.77	1.81	-----	11.02	-----
66	Enterprises constructing open ditches and levees.....dollars..	106,661	-----	-----	-----	-----	-----	-----	-----	-----	-----
67	Average cost per acre when completed.....dollars..	6.53	-----	-----	-----	-----	-----	-----	-----	-----	-----
68	Enterprises constructing tile drains only.....dollars..	3,855	127,026	-----	215,219	141,422	-----	35,722	23,494	49,963	49,333
69	Average cost per acre when completed.....dollars..	6.93	3.19	-----	6.07	2.96	-----	2.09	3.80	8.45	6.87
70	Enterprises constructing open ditches and tile drains.....dollars..	37,499	48,426	13,344	407,996	161,592	-----	115,306	-----	24,055	-----
71	Average cost per acre when completed.....dollars..	4.22	3.20	1.86	3.98	1.50	-----	2.01	-----	7.67	-----
72	Enterprises constructing open ditches, tile drains, and levees.....dollars..	6,964	-----	-----	-----	-----	49,054	-----	-----	-----	-----
73	Average cost per acre when completed.....dollars..	8.71	-----	-----	-----	-----	9.26	-----	-----	-----	-----
<b>CROPS.</b>											
74	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres..	49,497	77,586	39,502	106,670	196,985	7,598	217,623	4,785	8,659	6,466
75	Wheat as principal crop on drained land.....acres..	-----	396	640	35,037	-----	-----	-----	-----	-----	-----
76	Hay as principal crop on drained land.....acres..	-----	-----	-----	-----	-----	225	-----	-----	-----	-----
77	Oats as principal crop on drained land.....acres..	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
78	Vegetables as principal crop on drained land.....acres..	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
79	Not reporting principal crop on drained land.....acres..	-----	-----	-----	85	-----	-----	-----	-----	-----	-----

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The reported figures have been reduced by the same acreage as the improved land, 1920.



DRAINAGE—INDIANA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Fulton.	Gibson.	Grant.	Greene.	Hamilton.	Hancock.	Hendricks.	Henry.	Howard.	Huntington.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	234,880	311,040	270,720	347,520	255,360	196,480	261,120	254,080	190,080	247,040
2	All land in operating drainage enterprises.....	221,911	190,403	221,636	51,077	128,591	141,119	106,094	129,478	154,655	210,132
3	Improved land.....	186,287	182,915	193,747	44,960	124,560	133,409	91,116	119,326	139,468	137,851
4	Per cent of all improved land in farms.....	96.4	77.3	88.3	18.9	59.4	79.9	46.1	56.5	86.0	70.3
5	Timber and cut-over land.....	15,482	3,979	21,643	5,380	4,031	7,710	14,978	10,152	15,169	51,379
6	Other unimproved land.....	20,142	3,509	6,246	737					18	20,942
7	Swampy or subject to overflow, in enterprises.....	280	3,740	6,410	12,455	807	393	1,379	11,839	164	20,647
8	Suffering a loss of crops from defective drainage.....	268	1,699	3,210	10,390	319	309		6,301	38	5,183
9	Assessed acreage.....	269,604	212,153	529,753	51,077	130,400	150,020	107,314	151,440	238,818	252,519
10	Excess over all land in operating enterprises.....	47,693	21,750	308,122		1,809	8,901	1,220	21,971	84,163	42,387
<b>DRAINAGE WORKS.</b>											
<b>Open ditches:</b>											
11	Completed.....	323.2	284.2	497.4	101.0	100.6	142.0	191.3	98.0	277.9	335.4
12	Additional under construction.....	1.0		1.1						8.3	10.9
13	Maximum completed in any enterprise.....	9.1	26.3	22.3	10.2	6.6	12.3	10.3	15.0	9.7	8.7
14	Maximum width at bottom of ditch <sup>1</sup> .....	15	30	20	50	10	30	10	12	25	60
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	10.0	11.0	10.5	17.0	6.5	6.0	8.0	6.5	9.0	12.0
16	Mean depth of branch ditches <sup>1</sup> .....	4.3	4.7	5.1	4.4	4.0	3.6	3.9	3.6	5.2	4.6
<b>Tile drains:</b>											
17	Completed.....	152.4	6.5	242.9	57.0	213.5	122.6	67.5	150.4	206.4	216.1
18	Additional under construction.....			3.9	70.0	1.3	2.6	1.8	2.6	0.1	3.5
19	Maximum completed in any enterprise.....	4.0	1.6	6.8	55.0	7.4	6.0	3.0	8.7	5.6	8.8
20	Maximum size of tile <sup>1</sup> .....	20	22	30	20	48	30	33	30	30	27
<b>Accessory levees and dikes:</b>											
21	Completed.....				11.6						
22	Additional under construction.....										
<b>Pumping plants:</b>											
23	Engine capacity.....				400						
24	Pump capacity.....				43,000						
25	Area served by pumps.....				3,200						
26	Area drained by open ditches only <sup>1</sup> .....	100,417	172,841	108,625	45,364	31,442	63,250	61,036	42,090	56,984	113,467
27	Length of these ditches.....	202.0	236.4	291.7	89.0	44.6	98.5	149.7	53.9	158.5	217.8
28	Average length per acre.....	10.6	7.2	14.2	10.4	7.5	8.2	12.9	6.8	14.7	10.1
29	Area having open ditches and levees <sup>1</sup> .....				193						
30	Length of these ditches.....				0.3						
31	Average length per acre.....				8.2						
32	Length of the accessory levees.....				3.6						
33	Area drained by tile only <sup>1</sup> .....	36,917	631	8,516		39,653	33,045	16,441	30,339	38,091	20,908
34	Length of these tile.....	98.1	2.0	127.5		115.8	79.1	41.2	69.0	101.1	108.9
35	Average length per acre.....	14.0	15.7	79.1		15.3	12.6	13.2	12.0	16.1	27.0
36	Area drained by open ditches and tile <sup>1</sup> .....	84,577	16,931	104,495	1,720	57,196	44,824	28,617	57,049	64,580	75,762
37	Length of these drains.....	206.5	52.3	326.1	6.7	155.0	89.6	69.7	128.1	236.1	240.9
38	Average length per acre.....	12.9	16.3	16.5	20.6	14.3	10.6	12.9	11.9	19.3	16.8
39	Area having open ditches, tile drains, and levees <sup>1</sup> .....				3,800						
40	Length of these drains.....				132.0						
41	Average length per acre.....				183.4						
42	Length of the accessory levees.....				8.0						
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920.....	186,287	182,915	193,747	44,960	124,560	133,409	91,116	119,326	139,468	137,851
44	Improved land prior to drainage.....	152,684	118,531	75,931	11,627	121,150	130,621	74,906	115,828	119,338	85,674
45	Increase since drainage.....	33,303	64,384	117,816	33,333	3,410	2,888	16,120	3,498	20,130	52,177
46	Per cent of increase.....	21.8	54.3	155.2	286.7	2.8	2.2	21.5	3.0	16.9	60.9
47	Per cent increase is of all improved land in farms, 1920.....	17.8	27.2	53.7	14.0	1.6	1.7	8.1	1.7	12.4	26.6
48	Timber and cut-over land, 1920.....	15,482	3,979	21,643	5,380	4,031	7,710	14,978	10,152	15,169	51,379
49	Timber and cut-over land prior to drainage.....	29,135	40,647	86,617	20,260	7,441	10,593	31,098	13,650	34,989	103,226
50	Decrease since drainage.....	13,653	36,668	64,974	14,880	3,410	2,883	16,120	3,498	19,820	51,847
51	Per cent of decrease.....	46.9	90.2	75.0	78.4	45.8	27.3	51.8	25.6	56.6	50.3
52	Other unimproved land, 1920.....	20,142	3,509	6,246	737					18	20,942
53	Other unimproved land prior to drainage.....	39,792	31,225	59,088	19,190					328	21,232
54	Decrease since drainage.....	19,650	27,716	52,842	18,453					310	330
55	Per cent of decrease.....	49.4	88.8	89.4	96.2					94.5	1.6
56	Swampy or subject to overflow, 1920.....	280	3,740	6,410	12,455	807	393	1,379	11,839	164	20,647
57	Swampy or subject to overflow prior to drainage.....	96,285	126,694	63,907	35,473	16,295	23,467	17,501	34,018	64,468	81,426
58	Decrease since drainage.....	96,005	122,954	57,497	21,018	15,488	23,074	16,123	22,179	64,304	60,779
59	Per cent of decrease.....	99.7	97.0	90.0	62.8	95.0	98.3	92.1	85.2	99.7	74.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises.....	304,509	576,984	731,674	441,491	272,971	272,631	212,894	355,443	515,217	625,794
61	Capital invested in these enterprises to Dec. 31, 1919.....	364,509	576,984	710,207	411,491	272,700	264,887	205,894	349,243	473,761	498,145
62	Additional capital required to complete these enterprises.....			21,467	30,000	271	7,744	7,000	6,200	41,456	127,649
63	Average cost per acre when completed.....	1.64	8.03	3.30	8.64	2.12	1.93	2.01	2.75	3.33	2.98
64	Enterprises constructing open ditches only.....	137,241	486,810	176,393	271,012	30,128	78,009	88,965	88,102	126,047	272,120
65	Average cost per acre when completed.....	1.37	2.82	1.62	5.97	0.96	1.23	1.46	2.09	2.21	2.40
66	Enterprises constructing open ditches and levees.....				519						
67	Average cost per acre when completed.....				2.69						
68	Enterprises constructing tile drains only.....	78,655	2,035	205,816		120,705	111,185	70,625	121,332	156,151	154,154
69	Average cost per acre when completed.....	2.00	3.23	24.11		3.02	8.36	4.30	4.00	4.72	7.37
70	Enterprises constructing open ditches and tile drains.....	153,613	88,139	349,905	8,960	122,138	83,437	53,304	146,009	233,019	199,520
71	Average cost per acre when completed.....	1.63	8.21	3.35	5.21	2.14	1.86	1.86	2.56	3.61	2.63
72	Enterprises constructing open ditches, tile drains, and levees.....				161,000						
73	Average cost per acre when completed.....				42.37						
<b>CROPS.</b>											
74	Improved land in enterprises reporting—										
75	Corn as principal crop on drained land.....	186,287	182,915	191,709	44,960	124,560	133,409	91,116	119,326	139,468	137,851
76	Wheat as principal crop on drained land.....			2,038							
77	Hay as principal crop on drained land.....										
78	Oats as principal crop on drained land.....										
79	Vegetables as principal crop on drained land.....										
80	Not reporting principal crop on drained land.....										

<sup>1</sup>When works under construction have been completed.

DRAINAGE—INDIANA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Jack-son.	Jasper.	Jay.	Jen-nings.	John-son.	Knob.	Kosciusko.	La-grange.	Lake.	La-Porte.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....acres.	331,520	359,680	240,000	245,120	206,080	326,400	346,240	247,680	314,880	380,800
2	All land in operating drainage enterprises.....acres.	46,281	128,649	179,712	4,000	33,544	112,496	308,708	192,212	112,008	180,843
3	Improved land.....acres.	39,332	105,472	161,252	3,080	31,709	95,299	229,035	141,370	82,614	162,759
4	Per cent of all improved land in farms.....	19.0	42.3	80.0	1.9	19.3	36.5	61.8	79.7	45.5	58.1
5	Timber and cut-over land.....acres.	4,637	20,558	13,090	800	1,835	7,500	47,687	27,991	867	4,192
6	Other unimproved land.....acres.	2,312	619	5,370	120	.....	9,697	31,986	22,851	28,527	13,892
7	Swampy or subject to overflow, in enterprises.....acres.	3	14,616	24	120	1,047	11,809	18,799	17,516	26,755	21,082
8	Suffering a loss of crops from defective drainage.....acres.	3	13,536	10	120	432	10,220	13,765	17,370	26,755	13,450
9	Assessed acreage.....acres.	46,610	762,691	647,694	4,000	33,544	112,496	846,888	193,739	199,545	263,318
10	Excess over all land in operating enterprises.....acres.	329	636,042	468,282	.....	.....	.....	538,178	1,527	87,537	112,475
<b>DRAINAGE WORKS.</b>											
<b>Open ditches:</b>											
11	Completed.....miles.	35.6	434.5	367.2	6.9	50.0	207.7	577.8	317.2	261.0	312.1
12	Additional under construction.....miles.	.....	6.6	.....	.....	.....	.....	.....	.....	2.7	0.3
13	Maximum completed in any enterprise.....miles.	13.0	100.0	21.9	2.9	3.5	43.4	16.6	18.0	23.0	25.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet.	28	100	65	13	8	30	42	46	100	90
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet.	14.0	15.0	11.1	8.0	4.0	12.0	9.0	10.6	27.5	12.0
16	Mean depth of branch ditches <sup>2</sup> .....feet.	8.3	6.8	3.9	.....	.....	6.1	4.5	4.4	5.3	6.0
<b>Tile drains:</b>											
17	Completed.....miles.	.....	226.8	175.2	.....	20.7	9.4	388.0	119.8	21.6	89.2
18	Additional under construction.....miles.	.....	3.8	0.2	.....	.....	.....	1.0	3.5	5.5	0.6
19	Maximum completed in any enterprise.....miles.	.....	100.0	9.3	.....	2.1	7.6	12.6	15.9	3.5	75.0
20	Maximum size of tile <sup>3</sup> .....inches.	.....	30	30	.....	24	24	30	24	36	18
<b>Accessory levees and dikes:</b>											
21	Completed.....miles.	.....	9.9	.....	.....	.....	5.5	.....	.....	12.9	.....
22	Additional under construction.....miles.	.....	1.2	.....	.....	.....	.....	.....	.....	0.3	.....
<b>Pumping plants:</b>											
23	Engine capacity.....horsepower.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	Pump capacity.....gallons per minute.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only <sup>4</sup> .....acres.	46,281	61,988	78,095	4,000	21,238	105,771	181,717	97,783	77,431	176,703
27	Length of these ditches.....miles.	35.6	216.7	204.4	6.9	42.8	194.8	362.9	208.0	203.6	295.8
28	Average length per acre.....feet.	4.1	18.5	14.3	9.1	10.6	9.7	10.5	11.2	13.9	8.3
29	Area having open ditches and levees <sup>4</sup> .....acres.	.....	50,845	.....	.....	.....	1,094	.....	.....	16,173	.....
30	Length of these ditches.....miles.	.....	12.0	.....	.....	.....	5.6	.....	.....	16.6	.....
31	Average length per acre.....feet.	.....	1.2	.....	.....	.....	27.0	.....	.....	5.4	.....
32	Length of the accessory levees.....miles.	.....	11.1	.....	.....	.....	5.5	.....	.....	13.2	.....
33	Area drained by tile only <sup>4</sup> .....acres.	.....	5,278	19,240	.....	6,772	1,151	32,178	12,991	4,183	500
34	Length of these tile.....miles.	.....	80.1	79.3	.....	17.6	7.6	212.0	41.1	8.1	0.6
35	Average length per acre.....feet.	.....	80.1	21.8	.....	13.7	34.9	34.8	16.7	11.1	6.3
36	Area drained by open ditches and tile <sup>4</sup> .....acres.	.....	8,538	84,377	.....	5,534	4,480	94,813	81,438	14,221	3,640
37	Length of these drains.....miles.	.....	362.9	256.9	.....	10.3	9.1	391.9	191.4	61.8	105.3
38	Average length per acre.....feet.	.....	16.1	.....	.....	9.8	10.7	21.8	12.4	22.9	153.5
39	Area having open ditches, tile drains, and levees <sup>4</sup> .....acres.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	Length of these drains.....miles.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
41	Average length per acre.....feet.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	Length of the accessory levees.....miles.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920.....acres.	39,332	105,472	161,252	3,080	31,709	95,299	229,035	141,370	82,614	162,759
44	Improved land prior to drainage.....acres.	20,842	69,202	126,058	2,400	30,552	37,981	180,039	104,797	21,049	31,481
45	Increase since drainage.....acres.	18,490	36,270	35,194	680	1,157	57,318	48,996	36,573	61,565	131,278
46	Per cent of increase.....	88.7	52.4	27.9	23.3	3.8	150.9	27.2	34.9	292.5	417.0
47	Per cent increase is of all improved land in farms, 1920.....	8.9	14.5	17.5	0.4	0.7	21.9	19.6	20.6	33.9	46.8
48	Timber and cut-over land, 1920.....acres.	4,637	20,558	13,090	800	1,835	7,500	47,687	27,991	867	4,192
49	Timber and cut-over land prior to drainage.....acres.	13,883	38,579	41,750	1,200	2,992	17,815	62,383	61,429	1,468	29,716
50	Decrease since drainage.....acres.	9,246	18,021	28,660	400	1,157	10,315	14,696	33,438	601	26,524
51	Per cent of decrease.....	26.6	68.6	68.6	33.3	38.7	57.9	23.6	54.4	40.9	85.9
52	Other unimproved land, 1920.....acres.	2,312	619	5,370	120	.....	9,697	31,986	22,851	28,527	13,892
53	Other unimproved land prior to drainage.....acres.	11,556	18,988	11,904	400	.....	58,700	66,298	25,986	89,491	119,646
54	Decrease since drainage.....acres.	9,244	18,249	6,534	280	.....	47,003	34,300	3,135	60,964	105,754
55	Per cent of decrease.....	80.0	96.7	54.9	70.0	.....	82.9	51.7	12.1	68.1	88.4
56	Swampy or subject to overflow, 1920.....acres.	3	14,616	24	120	1,047	11,809	18,799	17,516	26,755	21,082
57	Swampy or subject to overflow prior to drainage.....acres.	25,410	50,190	51,922	400	3,611	63,289	40,655	60,240	89,481	142,315
58	Decrease since drainage.....acres.	25,407	35,574	51,898	280	2,564	51,480	21,856	42,724	62,726	121,233
59	Per cent of decrease.....	100.0	70.9	100.0	70.0	71.0	81.3	53.8	70.9	70.1	85.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises.....dollars.	141,271	1,346,359	940,294	23,800	42,843	549,729	1,054,797	427,192	527,837	770,362
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	141,271	1,306,633	940,130	23,800	42,843	549,729	1,054,797	416,242	513,174	768,462
62	Additional capital required to complete these enterprises.....dollars.	.....	39,726	164	.....	.....	.....	.....	10,950	14,663	1,900
63	Average cost per acre when completed.....dollars.	3.06	10.63	5.23	5.70	1.28	4.89	3.42	2.22	4.71	4.26
64	Enterprises constructing open ditches only.....dollars.	141,271	483,583	581,282	29,800	14,456	516,992	335,495	127,293	305,349	701,994
65	Average cost per acre when completed.....dollars.	3.05	7.80	7.64	5.70	0.68	4.59	1.85	1.30	3.94	3.97
66	Enterprises constructing open ditches and levees.....dollars.	.....	150,122	.....	.....	.....	3,940	.....	.....	102,351	.....
67	Average cost per acre when completed.....dollars.	.....	2.85	.....	.....	.....	3.60	.....	.....	6.33	.....
68	Enterprises constructing tile drains only.....dollars.	.....	128,768	91,303	.....	18,010	13,047	276,576	40,873	18,121	1,300
69	Average cost per acre when completed.....dollars.	.....	24.40	4.75	.....	2.66	11.34	8.69	3.15	4.33	2.40
70	Enterprises constructing open ditches and tile drains.....dollars.	.....	583,886	267,708	.....	10,377	15,750	442,726	259,026	102,016	67,168
71	Average cost per acre when completed.....dollars.	.....	.....	3.17	.....	1.88	3.52	4.67	3.18	7.17	18.45
72	Enterprises constructing open ditches, tile drains, and levees.....dollars.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed.....dollars.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>CROPS.</b>											
74	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres.	39,332	64,753	161,252	3,080	31,709	90,364	219,505	140,474	20,391	30,100
75	Wheat as principal crop on drained land.....acres.	.....	1,891	.....	.....	.....	4,935	9,186	.....	39,024	132,659
76	Hay as principal crop on drained land.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
77	Oats as principal crop on drained land.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	4,703	.....
78	Vegetables as principal crop on drained land.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	1,614	.....
79	Not reporting principal crop on drained land.....acres.	.....	38,828	.....	.....	.....	.....	220	896	16,882	.....

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Additional area reported under other classifications.  
<sup>4</sup> The reported figures have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—INDIANA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Madison.	Marion.	Marshall.	Miami.	Montgomery.	Morgan.	Newton.	Noble.	Owan.	Parke.	
<b>LAND AREA.</b>											
1	Approximate land area of the county..... acres.....	288,000	254,080	282,240	243,840	320,640	259,840	259,200	266,880	251,520	286,080
2	All land in operating drainage enterprises..... acres.....	226,660	40,309	256,037	201,728	77,573	29,147	172,687	198,866	6,540	12,269
3	Improved land..... acres.....	210,573	39,439	200,796	182,089	59,491	24,773	146,033	151,554	5,532	10,539
4	Per cent of all improved land in farms.....	89.0	23.6	95.7	97.4	15.2	70.6	76.2	3.8	6.5	
5	Timber and cut-over land..... acres.....	16,087	870	36,770	19,532	8,230	2,921	13,118	22,759	882	1,860
6	Other unimproved land..... acres.....	18,471	18,471	107	107	9,852	1,453	18,536	23,553	126	126
7	Swampy or subject to overflow, in enterprises..... acres.....	9,572	1,925	4,330	26	2,252	1	4,141	20,581	1,018	259
8	Suffering a loss of crops from defective drainage..... acres.....	2,675	1,028	3,100	8	2,251	.....	4,141	13,255	506	96
9	Assessed acreage.....	338,502	41,589	682,289	248,482	79,897	49,947	476,572	345,759	6,540	12,399
10	Excess over all land in operating enterprises..... acres.....	109,342	1,260	420,222	46,754	2,824	20,800	303,885	146,893	.....	.....
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed..... miles.....	427.6	77.0	571.3	248.6	67.0	49.2	244.1	459.5	11.0	13.0
12	Additional under construction..... miles.....	.....	.....	3.6	.....	6.0	.....	0.1	.....	.....	.....
13	Maximum completed in any enterprise..... miles.....	14.0	7.6	24.0	13.5	7.9	6.5	23.1	53.0	5.1	3.6
14	Maximum width at bottom of ditch <sup>1</sup> ..... feet.....	30	15	40	25	10	24	100	16	50	4
15	Maximum of average depths of outlet ditches <sup>2</sup> ..... feet.....	7.0	8.0	16.0	2.0	11.9	12.0	16.4	12.7	13.0	7.0
16	Mean depth of branch ditches <sup>3</sup> ..... feet.....	3.9	.....	4.4	6.6	3.7	4.9	6.1	5.2	4.0	.....
Tile drains:											
17	Completed..... miles.....	290.6	7.8	217.2	167.8	98.0	1.3	78.0	317.4	1.9	1.0
18	Additional under construction..... miles.....	1.9	0.7	1.5	.....	2.2	.....	0.3	.....	.....	.....
19	Maximum completed in any enterprise..... miles.....	8.4	1.6	8.2	5.6	6.7	1.3	8.0	19.6	1.0	1.0
20	Maximum size of tile <sup>1</sup> ..... inches.....	40	18	30	24	27	16	30	30	16	15
Accessory levees and dikes:											
21	Completed..... miles.....	.....	2.8	.....	.....	.....	.....	1.9	.....	.....	21.0
22	Additional under construction..... miles.....	.....	.....	.....	.....	.....	.....	0.2	.....	.....	.....
Pumping plants:											
23	Engine capacity..... horsepower.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	Pump capacity..... gallons per minute.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only <sup>1</sup> ..... acres.....	137,947	30,144	155,398	115,269	22,680	28,517	130,271	84,692	5,150	1,255
27	Length of these ditches..... miles.....	359.9	58.0	414.3	157.6	38.3	47.7	182.0	228.2	8.0	7.0
28	Average length per acre..... feet.....	13.8	10.2	14.1	6.3	8.9	8.8	7.4	14.2	8.2	29.5
29	Area having open ditches and levees <sup>2</sup> ..... acres.....	.....	2,232	.....	.....	.....	.....	8,533	.....	.....	10,724
30	Length of these ditches..... miles.....	.....	1.0	.....	.....	.....	.....	2.3	.....	.....	4.5
31	Average length per acre..... feet.....	.....	2.4	.....	.....	.....	.....	1.4	.....	.....	2.2
32	Length of the accessory levees..... miles.....	.....	2.8	.....	.....	.....	.....	2.1	.....	.....	21.0
33	Area drained by tile only <sup>1</sup> ..... acres.....	48,150	1,599	28,911	17,952	18,545	.....	15,007	27,362	.....	.....
34	Length of these tile..... miles.....	201.0	3.5	115.5	70.9	55.3	.....	35.1	149.1	.....	.....
35	Average length per acre..... feet.....	23.0	11.8	25.5	20.9	18.7	.....	12.8	28.8	.....	.....
36	Area drained by open ditches and tile <sup>1</sup> ..... acres.....	42,563	6,364	76,728	68,507	36,348	630	18,871	86,812	1,390	420
37	Length of these drains..... miles.....	159.2	28.0	263.8	207.9	79.6	2.8	103.0	359.7	4.0	2.5
38	Average length per acre..... feet.....	19.7	19.1	18.2	16.0	11.6	23.5	28.8	24.8	18.6	31.4
39	Area having open ditches, tile drains, and levees <sup>2</sup> ..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	Length of these drains..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
41	Average length per acre..... feet.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	Length of the accessory levees..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920..... acres.....	210,573	39,439	200,796	182,089	59,491	24,773	146,033	151,554	5,532	10,539
44	Improved land prior to drainage..... acres.....	202,795	39,626	146,912	160,583	45,355	11,674	112,766	112,991	4,992	7,364
45	Increase since drainage..... acres.....	7,778	813	53,884	21,506	14,136	13,099	33,267	38,563	540	3,175
46	Per cent of increase.....	3.8	2.1	36.7	13.4	31.2	112.2	29.5	34.1	10.8	43.1
47	Per cent increase is of all improved land in farms, 1920.....	.....	.....	11.5	.....	5.7	.....	18.1	19.4	0.4	1.9
48	Timber and cut-over land, 1920..... acres.....	16,087	870	36,770	19,532	8,230	2,921	13,118	22,759	882	1,860
49	Timber and cut-over land prior to drainage..... acres.....	23,865	1,683	68,506	40,930	14,469	14,558	25,993	60,376	1,338	5,035
50	Decrease since drainage..... acres.....	7,778	813	31,736	21,398	6,239	11,637	12,875	38,617	456	3,198
51	Per cent of decrease.....	32.6	48.3	46.3	52.3	43.1	79.9	49.5	60.6	34.1	63.1
52	Other unimproved land, 1920..... acres.....	18,471	18,471	107	107	9,852	1,453	18,536	23,553	126	126
53	Other unimproved land prior to drainage..... acres.....	40,619	40,619	215	215	17,749	2,915	33,928	25,499	210	210
54	Decrease since drainage..... acres.....	22,148	22,148	108	108	7,897	1,462	20,392	1,946	84	84
55	Per cent of decrease.....	54.5	54.5	50.2	44.5	50.2	60.1	60.1	7.6	40.0	.....
56	Swampy or subject to overflow, 1920..... acres.....	9,572	1,925	4,330	26	2,252	1	4,141	20,581	1,018	259
57	Swampy or subject to overflow prior to drainage..... acres.....	67,442	8,170	20,360	69,849	13,676	8,735	36,445	59,903	2,898	1,990
58	Decrease since drainage..... acres.....	57,870	6,245	16,030	69,823	11,424	8,734	32,304	39,322	1,880	1,731
59	Per cent of decrease.....	85.8	76.4	78.7	100.0	83.5	100.0	88.6	65.6	64.9	87.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises..... dollars.....	730,276	97,719	803,208	497,034	210,245	70,813	631,742	788,434	60,514	53,425
61	Capital invested in these enterprises to Dec. 31, 1919..... dollars.....	722,012	95,615	793,383	497,034	183,509	70,813	630,390	788,295	60,514	53,425
62	Additional capital required to complete these enterprises..... dollars.....	8,264	2,104	9,825	.....	26,736	.....	1,352	139	.....	.....
63	Average cost per acre when completed..... dollars.....	3.22	2.42	3.14	2.46	2.71	2.43	3.66	3.96	9.25	4.31
64	Enterprises constructing open ditches only..... dollars.....	253,877	66,070	358,118	148,802	43,456	66,813	399,401	164,990	47,499	3,232
65	Average cost per acre when completed..... dollars.....	1.84	2.19	2.30	1.29	1.92	2.34	3.07	1.95	0.23	2.58
66	Enterprises constructing open ditches and levees..... dollars.....	.....	11,500	.....	.....	.....	.....	27,032	.....	.....	47,714
67	Average cost per acre when completed..... dollars.....	.....	.....	.....	.....	.....	.....	3.17	.....	.....	4.45
68	Enterprises constructing tile drains only..... dollars.....	285,270	7,060	128,468	87,675	61,481	.....	52,333	174,399	.....	.....
69	Average cost per acre when completed..... dollars.....	5.76	4.50	5.37	4.88	3.32	.....	3.49	6.37	.....	.....
70	Enterprises constructing open ditches and tile drains..... dollars.....	211,129	13,089	316,622	260,557	105,308	4,000	152,976	449,065	13,015	2,479
71	Average cost per acre when completed..... dollars.....	4.96	2.06	4.13	3.80	2.90	6.35	8.11	5.17	9.36	5.90
72	Enterprises constructing open ditches, tile drains, and levees..... dollars.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed..... dollars.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>CROPS.</b>											
74	Improved land in enterprises reporting—										
75	Corn as principal crop on drained land..... acres.....	210,115	39,439	200,796	182,089	59,491	24,773	146,033	151,554	5,532	10,539
76	Wheat as principal crop on drained land..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
77	Hay as principal crop on drained land..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78	Oats as principal crop on drained land..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79	Vegetables as principal crop on drained land..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79	Not reporting principal crop on drained land..... acres.....	458	.....	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The reported figures have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—INDIANA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pike.	Porter.	Posey.	Pulaski.	Putnam.	Randolph.	Rush.	St. Joseph.	Scott.	Shelby.
<b>LAND AREA.</b>											
1	Approximate land area of the county.....acres..	216,320	265,600	287,280	276,480	309,120	286,080	261,760	294,400	121,600	260,480
2	All land in operating drainage enterprises.....acres..	82,152	149,323	146,970	135,754	5,225	59,618	101,373	198,571	11,895	80,506
3	Improved land.....acres..	81,298	121,331	145,117	121,510	4,198	53,659	87,969	170,763	10,707	75,636
4	Per cent of all improved land in farms.....	20.3	64.9	68.5	59.8	2.2	22.2	39.5	79.3	13.9	34.1
5	Timber and cut-over land.....acres..	854	25,584	1,711	11,313	1,027	3,626	13,404	11,912	594	4,872
6	Other unimproved land.....acres..	2,408	2,408	142	2,931	.....	2,333	.....	15,896	594	.....
7	Swampy or subject to overflow, in enterprises.....acres..	669	10,918	627	3,323	76	.....	3,233	7,380	.....	9,556
8	Suffering a loss of crops from defective drainage.....acres..	193	7,518	176	809	.....	.....	3,231	5,689	.....	.....
9	Assessed acreage.....acres..	82,152	185,424	149,284	166,731	6,025	59,798	102,254	245,877	11,895	80,890
10	Excess over all land in operating enterprises.....acres..	.....	36,101	2,294	80,977	800	178	881	147,306	.....	382
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....miles..	56.4	228.9	133.5	154.7	47.1	17.8	135.8	442.0	19.0	182.8
12	Additional under construction.....miles..	.....	2.8	.....	3.8	.....	.....	.....	.....	.....	.....
13	Maximum completed in any enterprise.....miles..	18.0	19.2	41.6	41.8	45.0	2.8	6.9	21.2	10.0	6.2
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	20	100	40	40	14	10	5	35	28	10
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	10.0	10.0	9.0	15.0	10.0	6.2	4.5	12.0	12.0	4.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	4.7	4.0	6.0	5.5	6.5	3.6	2.0	4.8	4.0	.....
Tile drains:											
17	Completed.....miles..	0.2	81.7	0.3	65.2	7.7	75.9	145.0	68.7	.....	60.6
18	Additional under construction.....miles..	.....	.....	.....	.....	.....	1.8	4.9	.....	.....	.....
19	Maximum completed in any enterprise.....miles..	0.2	12.4	0.3	8.0	2.2	6.0	5.0	7.0	.....	3.4
20	Maximum size of tile <sup>1</sup> .....inches..	10	20	10	24	20	30	24	24	.....	24
Accessory levees and dikes:											
21	Completed.....miles..	.....	16.4	12.0	.....	.....	.....	.....	.....	.....	0.1
22	Additional under construction.....miles..	.....	1.2	.....	.....	.....	.....	.....	.....	.....	.....
Pumping plants:											
23	Engine capacity.....horsepower..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	Pump capacity.....gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only <sup>1</sup> .....acres..	20,891	54,436	28,185	91,765	2,540	8,678	43,742	151,056	11,895	50,123
27	Length of these ditches.....miles..	53.2	120.1	71.6	140.3	45.4	5.7	121.3	330.0	19.0	165.6
28	Average length per acre.....feet..	9.1	11.6	13.4	8.1	94.4	8.2	14.6	11.5	8.4	17.4
29	Area having open ditches and levees <sup>1</sup> .....acres..	.....	32,358	95,085	.....	.....	.....	.....	.....	.....	.....
30	Length of these ditches.....miles..	.....	27.0	41.6	.....	.....	.....	.....	.....	.....	.....
31	Average length per acre.....feet..	.....	4.4	2.8	.....	.....	.....	.....	.....	.....	.....
32	Length of the accessory levees.....miles..	.....	17.6	12.0	.....	.....	.....	.....	.....	.....	.....
33	Area drained by tile only <sup>1</sup> .....acres..	10,814	.....	26,264	1,680	13,969	44,276	4,324	.....	.....	19,744
34	Length of these tile.....miles..	36.9	.....	58.7	5.4	45.2	128.3	32.3	.....	.....	47.4
35	Average length per acre.....feet..	18.0	.....	8.5	17.0	17.1	15.3	39.4	.....	.....	12.7
36	Area drained by open ditches and tile <sup>1</sup> .....acres..	1,261	51,715	23,700	7,725	1,005	41,971	13,355	43,191	.....	9,842
37	Length of these drains.....miles..	3.4	129.4	20.6	24.7	4.0	44.6	36.1	146.4	.....	28.2
38	Average length per acre.....feet..	14.2	13.2	4.6	16.9	21.0	8.6	14.3	17.9	.....	15.1
39	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	709
40	Length of these drains.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.2
41	Average length per acre.....feet..	.....	.....	.....	.....	.....	.....	.....	.....	.....	14.5
42	Length of the accessory levees.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920.....acres..	81,298	121,331	145,117	121,510	4,198	53,659	87,969	170,763	10,707	75,636
44	Improved land prior to drainage.....acres..	15,118	78,734	124,245	56,704	3,569	42,027	75,953	109,680	7,135	74,345
45	Increase since drainage.....acres..	15,180	42,597	20,872	64,806	630	11,632	12,016	61,083	3,572	1,291
46	Per cent of increase.....	94.2	54.1	16.8	114.3	17.6	27.7	15.8	55.7	50.1	1.7
47	Per cent increase is of all improved land in farms, 1920.....	9.9	22.8	9.9	31.9	0.3	4.8	5.4	28.4	4.7	0.6
48	Timber and cut-over land, 1920.....acres..	854	25,584	1,711	11,313	1,027	3,626	13,404	11,912	594	4,872
49	Timber and cut-over land prior to drainage.....acres..	16,034	40,954	22,339	64,824	1,271	9,879	25,420	48,183	2,380	6,163
50	Decrease since drainage.....acres..	15,180	15,370	20,628	53,511	244	6,253	12,016	36,271	1,786	1,291
51	Per cent of decrease.....	94.7	37.5	32.8	32.5	19.2	33.3	47.8	75.8	75.0	20.9
52	Other unimproved land, 1920.....acres..	2,408	142	2,931	.....	.....	2,333	.....	15,896	594	.....
53	Other unimproved land prior to drainage.....acres..	29,635	386	14,226	385	.....	7,712	.....	40,708	2,380	.....
54	Decrease since drainage.....acres..	27,227	244	11,295	385	.....	5,379	.....	24,812	1,786	.....
55	Per cent of decrease.....	91.9	63.2	79.4	100.0	.....	69.7	.....	61.0	75.0	.....
56	Swampy or subject to overflow, 1920.....acres..	669	10,918	627	3,323	76	.....	3,233	7,380	.....	9,556
57	Swampy or subject to overflow prior to drainage.....acres..	27,633	54,471	82,188	103,341	556	13,469	4,193	39,249	4,758	29,326
58	Decrease since drainage.....acres..	26,964	43,553	81,561	100,018	490	13,469	960	31,859	4,758	29,370
59	Per cent of decrease.....	97.6	80.0	99.2	94.8	86.6	100.0	22.9	81.2	100.0	68.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises.....dollars..	133,763	582,404	210,000	489,660	24,965	142,965	462,811	498,766	78,689	142,927
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	133,763	572,204	210,000	482,276	24,965	139,112	462,811	498,766	78,689	142,927
62	Additional capital required to complete these enterprises.....dollars..	.....	10,200	.....	7,374	.....	3,853	.....	.....	.....	.....
63	Average cost per acre when completed.....dollars..	4.16	3.90	1.43	3.61	4.78	3.40	4.57	2.51	6.62	1.78
64	Enterprises constructing open ditches only.....dollars..	131,119	228,066	48,337	389,619	10,255	5,809	165,142	203,387	78,689	68,997
65	Average cost per acre when completed.....dollars..	4.24	4.19	1.71	4.25	4.04	1.68	3.78	1.94	6.62	1.28
66	Enterprises constructing open ditches and levees.....dollars..	.....	128,524	112,500	.....	.....	.....	.....	.....	.....	.....
67	Average cost per acre when completed.....dollars..	.....	3.87	1.18	.....	.....	.....	.....	.....	.....	.....
68	Enterprises constructing tile drains only.....dollars..	.....	48,835	.....	77,748	.....	71,850	248,368	87,815	.....	55,299
69	Average cost per acre when completed.....dollars..	.....	4.52	.....	2.14	.....	5.11	5.61	8.75	.....	2.80
70	Enterprises constructing open ditches and tile drains.....dollars..	2,644	177,039	49,163	22,285	6,417	65,806	49,301	187,564	.....	14,093
71	Average cost per acre when completed.....dollars..	2.10	3.42	2.97	2.88	3.39	1.57	3.69	3.88	.....	1.43
72	Enterprises constructing open ditches, tile drains, and levees.....dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,538
73	Average cost per acre when completed.....dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.68
<b>CROPS.</b>											
74	Improved land in enterprises reporting—										
75	Corn as principal crop on drained land.....acres..	29,634	7,732	145,117	120,497	4,198	58,669	87,969	165,604	10,707	75,636
76	Wheat as principal crop on drained land.....acres..	.....	91,747	.....	1,013	.....	.....	.....	5,159	.....	.....
77	Hay as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78	Ons as principal crop on drained land.....acres..	.....	856	.....	.....	.....	.....	.....	.....	.....	.....
79	Vegetables as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79	Not reporting principal crop on drained land.....acres..	1,664	20,996	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> When works under construction have been completed.

# DRAINAGE—INDIANA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Spencer.	Starks.	Steuben.	Sullivan.	Tippacanoe.	Tipton.	Union.	Vanderburg.	Vermillion.	Vigo.
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	257,920	195,200	195,200	294,400	321,920	166,400	103,680	149,120	162,560	261,760
2	All land in operating drainage enterprises.....	88,143	181,208	133,743	22,958	91,785	155,109	4,640	53,014	6,548	50,835
3	Improved land.....	85,109	119,310	86,495	21,091	78,522	140,851	3,748	48,680	5,292	48,019
4	Per cent of all improved land in farms.....	45.1	67.5	61.5	10.0	29.9	69.0	4.8	42.8	5.2	26.7
5	Timber and cut-over land.....	3,034	58,252	15,106	1,867	8,068	14,227	562	8,779	1,256	2,816
6	Other unimproved land.....		8,646	32,142		5,175	81	330	555		
7	Swampy or subject to overflow, in enterprises.....	926	3,255	2,669	5,925	649	28,142	20	10,597	132	578
8	Suffering a loss of crops from defective drainage.....	374	1,941		879	248	9,757	20	1,556		
9	Assessed acreage.....	94,222	487,275	160,704	24,589	91,890	388,247	4,640	53,398	6,548	50,894
10	Excess over all land in operating enterprises.....	6,079	306,067	26,961	1,831	95	233,138		394		59
<b>DRAINAGE WORKS.</b>											
11	Open ditches:										
12	Completed.....	198.8	637.5	352.5	41.8	21.7	558.4		119.0	11.9	91.9
13	Additional under construction.....		31.9	1.6	1.5						
14	Maximum completed in any enterprise.....	18.8	28.8	37.7	12.7	5.2	11.0		10.4	5.8	13.2
15	Maximum width at bottom of ditch <sup>1</sup> .....	30	100	12	30	30	12		16	4	30
16	Maximum of average depths of outlet ditches <sup>2</sup> .....	14.0	15.0	10.0	10.0	7.9	9.0		9.0	5.5	15.0
17	Mean depth of branch ditches <sup>3</sup> .....	4.3	5.1	7.5	4.9	4.3	3.6			4.0	4.3
18	Tile drains:										
19	Completed.....	7.4	35.3	248.2	11.7	213.5	253.5	18.1	3.4	2.4	1.6
20	Additional under construction.....		1.3	6.7	0.3	2.8					
21	Maximum completed in any enterprise.....	2.0	10.0	6.9	8.2	21.2	6.4	5.0	1.5	1.3	1.6
22	Maximum size of tile <sup>4</sup> .....	12	20	30	18	30	36	24	18	12	20
23	Accessory levees and dikes:										
24	Completed.....		4.0		18.2						35.8
25	Additional under construction.....										3.0
26	Pumping plants:										
27	Engine capacity.....				25						(*)
28	Pump capacity.....				348						(*)
29	Area served by pumps.....				311						800
30	Area drained by open ditches only <sup>5</sup> .....	81,281	162,247	82,298	5,193	1,400	127,187		50,896	2,337	15,965
31	Length of these ditches.....	180.7	580.5	218.5	13.8	1.0	494.6		115.4	3.2	39.4
32	Average length per acre.....	11.7	18.9	14.0	14.0	3.8	20.5		12.0	7.2	13.0
33	Area having open ditches and levees <sup>5</sup> .....		(*)		2,290						84,280
34	Length of these ditches.....		1.6		7.8						52.5
35	Average length per acre.....				18.0						8.1
36	Length of the accessory levees.....		1.5		7.8						38.8
37	Area drained by tile only <sup>5</sup> .....	737	1,886	14,247		38,438	14,051	4,640	713		600
38	Length of these tile.....	2.7	11.8	116.8		124.2	218.6	18.1	2.3		1.6
39	Average length per acre.....	19.3	45.0	43.3		17.1	82.1	20.6	17.0		14.1
40	Area drained by open ditches and tile <sup>5</sup> .....	6,125	17,575	37,203	1,664	51,957	18,921		1,415	4,211	
41	Length of these drains.....	22.8	99.6	273.7	10.5	122.8	98.7		4.7	11.1	
42	Average length per acre.....	19.7	29.9	38.8	33.3	12.5	37.4		17.5	13.9	
43	Area having open ditches, tile drains, and levees <sup>5</sup> .....		(*)		13,811						
44	Length of these drains.....		12.5		23.2						
45	Average length per acre.....				8.9						
46	Length of the accessory levees.....		2.5		10.4						
<b>DEVELOPMENT OF LAND.</b>											
47	Improved land in operating enterprises, 1920.....	85,109	119,310	86,495	21,091	78,522	140,851	3,748	48,680	5,292	48,019
48	Improved land prior to drainage.....	46,922	112,637	75,764	4,937	60,848	130,376	3,478	37,930	4,617	29,567
49	Increase since drainage.....	38,187	106,673	10,731	16,154	17,674	4,475	270	10,750	675	18,452
50	Per cent of increase.....	81.4	94.1	14.2	227.2	28.0	3.3	7.8	28.3	14.6	62.4
51	Per cent increase is of all improved land in farms, 1920.....	20.2	87.1	7.6	7.7	6.7	8.1	0.3	9.5	0.7	10.2
52	Timber and cut-over land, 1920.....	3,034	58,252	15,106	1,867	8,068	14,227	562	3,779	1,256	2,816
53	Timber and cut-over land prior to drainage.....	41,221	75,037	25,822	3,574	15,999	18,118	832	13,553	1,931	14,822
54	Decrease since drainage.....	38,187	21,785	10,716	1,707	7,901	3,891	270	9,774	675	12,006
55	Per cent of decrease.....	92.6	29.0	41.5	47.8	49.4	21.5	32.5	72.1	35.0	81.0
56	Other unimproved land, 1920.....		8,646	32,142		5,175	81	330	555		
57	Other unimproved land prior to drainage.....		93,534	32,157	14,447	14,948	615	380	1,531		6,446
58	Decrease since drainage.....		84,888	15	14,447	9,773	584		976		6,446
59	Per cent of decrease.....		90.8		100.0	65.4	95.0		63.7		100.0
60	Swampy or subject to overflow, 1920.....	926	3,255	2,669	5,925	649	28,142	20	10,597	132	578
61	Swampy or subject to overflow prior to drainage.....	66,004	101,734	20,286	20,421	14,455	35,241	210	35,606	561	17,405
62	Decrease since drainage.....	65,078	98,479	17,597	14,496	13,812	7,099	190	25,009	429	16,827
63	Per cent of decrease.....	98.6	96.8	86.8	71.0	86.6	20.1	90.5	70.2	76.6	96.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
64	Total capital invested in and required for completion of operating enterprises.....	290,239	755,124	516,751	206,499	433,931	740,053	19,634	167,874	11,957	289,453
65	Capital invested in these enterprises to Dec. 31, 1919.....	290,239	718,185	504,041	204,499	424,771	746,053	19,634	167,874	11,957	279,453
66	Additional capital required to complete these enterprises.....		36,939	12,710	2,000	9,160					10,000
67	Average cost per acre when completed.....	3.29	4.17	3.86	8.99	4.78	4.81	4.28	3.17	1.83	5.69
68	Enterprises constructing open ditches only.....	263,934	601,050	176,605	61,937	4,000	346,677		161,814	3,642	60,489
69	Average cost per acre when completed.....	3.25	5.70	2.16	11.93	3.86	2.73		5.18	1.56	3.79
70	Enterprises constructing open ditches and levees.....		5,359								223,924
71	Average cost per acre when completed.....										6.53
72	Enterprises constructing tile drains only.....	2,806	10,091	111,793		223,845	325,393	19,634	2,308		5,060
73	Average cost per acre when completed.....	3.81	7.23	7.85		5.82	23.16	4.23	3.24		8.43
74	Enterprises constructing open ditches and tile drains.....	23,497	126,614	228,348	8,393	206,086	73,953		3,752	8,815	
75	Average cost per acre when completed.....	3.84	7.20	6.14	5.04	3.97	5.31		2.65	1.97	
76	Enterprises constructing open ditches, tile drains, and levees.....		12,000		186,169						
77	Average cost per acre when completed.....				9.86						
<b>CROPS.</b>											
78	Improved land in enterprises reporting—										
79	Corn as principal crop on drained land.....	7,537	70,996	86,495	21,091	78,522	140,851	3,748	48,680	5,292	48,019
80	Wheat as principal crop on drained land.....		41,345								
81	Hay as principal crop on drained land.....	77,572									
82	Oats as principal crop on drained land.....		6,969								
83	Vegetables as principal crop on drained land.....										
84	Not reporting principal crop on drained land.....										

1 Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 Pumping plant located in Clay County.  
 4 Area included under "open ditches only."  
 5 The reported figures have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—INDIANA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Wabash.	Warren.	Warrick.	Wash- ington.	Wayne.	Wells.	White.	Whitley.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres..	272,000	235,520	250,880	332,180	253,040	233,600	324,480	216,320	1,025,280
2	All land in operating drainage enterprises.....acres..	150,886	48,174	85,501	11,121	9,065	166,377	238,020	172,685	3,945
3	Improved land.....acres..	115,590	35,927	81,860	10,009	7,705	139,130	222,496	145,687	3,422
4	Per cent of all improved land in farms.....	58.1	20.1	43.4	4.8	8.9	72.3	80.5	91.3	2.1
5	Timber and cut-over land.....acres..	14,009	4,932	2,246	556	453	26,786	14,938	9,175	420
6	Other unimproved land.....acres..	20,687	7,315	1,395	556	907	461	586	17,823	103
7	Swampy or subject to overflow, in enterprises.....acres..	7,276		1,507			10,698	3,387	588	873
8	Suffering a loss of crops from defective drainage.....acres..	173		560			6,286	657	419	29
9	Assessed acreage.....acres..	154,779	52,905	85,501	11,121	9,065	350,570	305,912	339,491	3,945
10	Excess over all land in operating enterprises.....acres..	3,893	4,731				184,193	67,892	166,806	
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....miles..	266.6	46.0	166.0	11.0	17.4	643.3	149.1	372.4	13.6
12	Additional under construction.....miles..	1.1					18.9		14.6	
13	Maximum completed in any enterprise.....miles..	10.0	11.9	20.5	11.0	4.0	21.0	18.3	45.6	3.0
14	Maximum width at bottom of ditch.....feet..	12	6	30	28	10	125	40	14	15
15	Maximum of average depths of outlet ditches.....feet..	7.4	7.2	11.0	12.0	5.0	12.0	15.0	13.0	8.0
16	Mean depth of branch ditches.....feet..	4.5	3.9	4.5		-3.7	5.2	4.4	5.2	4.0
<b>Tile drains:</b>										
17	Completed.....miles..	121.9	70.8			5.1	262.5	74.3	336.0	1.0
18	Additional under construction.....miles..	3.9				0.6	17.0		22.8	
19	Maximum completed in any enterprise.....miles..	4.2	28.0			1.9	18.3	4.1	29.0	1.0
20	Maximum size of tile.....inches..	30	30			20	33	30	30	16
<b>Accessory levees and dikes:</b>										
21	Completed.....miles..									
22	Additional under construction.....miles..									
<b>Pumping plants:</b>										
23	Engine capacity.....horsepower.....									
24	Pump capacity.....gallons per minute.....									
25	Area served by pumps.....acres.....									
26	Area drained by open ditches only.....acres..	105,534	17,485	85,501	11,121	5,615	74,675	121,447	29,967	3,645
27	Length of these ditches.....miles..	231.9	24.0	166.0	11.0	15.6	493.5	109.4	102.4	13.6
28	Average length per acre.....feet..	11.6	7.2	10.3	5.2	14.7	34.9	4.8	18.0	19.7
29	Area having open ditches and levees.....acres..									
30	Length of these ditches.....miles..									
31	Average length per acre.....feet..									
32	Length of the accessory levees.....miles..									
33	Area drained by tile only.....acres..	29,946	14,148			1,864	50,674	30,875	29,559	300
34	Length of these tile.....miles..	96.6	56.9			4.3	191.5	56.6	120.0	1.0
35	Average length per acre.....feet..	17.0	21.2			12.2	20.0	9.7	21.4	17.6
36	Area drained by open ditches and tile.....acres..	15,406	16,531			1,586	41,028	85,698	113,159	
37	Length of these drains.....miles..	65.0	35.9			8.2	281.7	57.4	523.4	
38	Average length per acre.....feet..	22.3	11.5			10.7	36.3	8.5	24.4	
39	Area having open ditches, tile drains, and levees.....acres..									
40	Length of these drains.....miles..									
41	Average length per acre.....feet..									
42	Length of the accessory levees.....miles..									
<b>DEVELOPMENT OF LAND.</b>										
43	Improved land in operating enterprises, 1920.....acres..	115,590	35,927	81,860	10,009	7,705	139,130	222,496	145,687	3,422
44	Improved land prior to drainage.....acres..	80,269	24,435	42,285	4,449	6,345	75,266	118,338	123,212	2,108
45	Increase since drainage.....acres..	35,321	11,492	39,575	5,560	1,360	63,864	104,158	22,475	1,314
46	Per cent of increase.....	44.0	47.0	93.6	125.0	21.4	84.9	88.0	18.2	62.3
47	Per cent increase is of all improved land in farms, 1920.....	17.1	6.4	21.0	2.7	0.7	33.2	37.7	14.1	0.2
48	Timber and cut-over land, 1920.....acres..	14,009	4,932	2,246	556	453	26,786	14,938	9,175	420
49	Timber and cut-over land prior to drainage.....acres..	28,335	6,783	32,049	3,336	1,359	90,487	109,060	23,383	1,286
50	Decrease since drainage.....acres..	14,226	1,851	29,803	2,780	906	63,701	94,122	14,208	866
51	Per cent of decrease.....	49.3	27.1	93.0	83.3	66.7	70.4	86.3	60.8	67.3
52	Other unimproved land, 1920.....acres..	20,687	7,315	1,395	556	907	461	586	17,823	103
53	Other unimproved land prior to drainage.....acres..	41,782	16,971	11,167	3,336	1,361	624	10,622	26,090	551
54	Decrease since drainage.....acres..	21,095	9,656	9,772	2,780	454	163	10,036	8,267	448
55	Per cent of decrease.....	50.5	56.9	87.5	83.3	33.4	26.1	94.5	31.7	81.3
56	Swampy or subject to overflow, 1920.....acres..	7,276		1,507			10,698	3,387	588	873
57	Swampy or subject to overflow prior to drainage.....acres..	70,438	9,263	63,950	6,673	1,362	88,393	162,752	17,707	2,143
58	Decrease since drainage.....acres..	63,162	9,263	62,443	6,673	1,362	77,695	159,365	17,119	1,273
59	Per cent of decrease.....	89.7	100.0	97.6	100.0	100.0	87.9	97.9	96.7	59.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
60	Total capital invested in and required for completion of operating enterprises.....dollars..	640,543	102,247	305,980	79,000	17,765	1,018,035	561,777	979,936	19,954
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	627,043	102,247	305,980	79,000	16,640	866,817	561,777	883,249	19,954
62	Additional capital required to complete these enterprises.....dollars..	13,500				1,125	151,218		96,687	
63	Average cost per acre when completed.....dollars..	4.25	2.12	3.58	7.10	1.96	6.12	2.36	5.67	5.06
64	Enterprises constructing open ditches only.....dollars..	366,450	25,774	305,980	79,000	5,745	334,091	225,858	131,105	16,754
65	Average cost per acre when completed.....dollars..	3.47	1.47	3.58	7.10	1.02	4.47	1.86	4.37	4.60
66	Enterprises constructing open ditches and levees.....dollars..									
67	Average cost per acre when completed.....dollars..									
68	Enterprises constructing tile drains only.....dollars..	176,229	38,373			9,745	284,460	95,407	153,270	3,200
69	Average cost per acre when completed.....dollars..	5.88	2.71			5.23	5.61	3.09	5.35	10.67
70	Enterprises constructing open ditches and tile drains.....dollars..	97,804	38,100			2,275	399,434	240,512	690,561	
71	Average cost per acre when completed.....dollars..	6.35	2.30			1.43	9.74	2.81	6.10	
72	Enterprises constructing open ditches, tile drains, and levees.....dollars..									
73	Average cost per acre when completed.....dollars..									
<b>CROPS.</b>										
Improved land in enterprises reporting—										
74	Corn as principal crop on drained land.....acres..	115,590	35,927	79,934	10,009	7,705	139,130	143,687	145,687	3,422
75	Wheat as principal crop on drained land.....acres..			1,667				26,690		
76	Hay as principal crop on drained land.....acres..			259						
77	Oats as principal crop on drained land.....acres..							52,119		
78	Vegetables as principal crop on drained land.....acres..									
79	Not reporting principal crop on drained land.....acres..									

<sup>1</sup> Includes only Decatur, Martin, Monroe, Ohio, and Perry Counties.

<sup>2</sup> When works under construction have been completed.

## IOWA.

The following pages present the statistics of drainage for Iowa collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	213, 439	100. 0
Farms reporting land having drainage.....	88, 865	41. 6
Farms reporting land needing drainage.....	56, 083	26. 3
All land in farms..... acres..	33, 474, 896	100. 0
Improved land in farms..... acres..	28, 606, 951	85. 5
Farm land reported as provided with drainage..... acres..	7, 334, 404	21. 9
Farm land reported as needing drainage..... acres..	2, 052, 942	6. 1
Needing drainage only..... acres..	1, 661, 744	5. 0
Needing drainage and clearing..... acres..	391, 198	1. 2
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	35, 575, 040	100. 0
All land in operating drainage enterprises..... acres..	5, 224, 478	14. 7
Improved land..... acres..	4, 493, 407	12. 6
Per cent of all improved land in farms.....	15. 7	
Timber and cut-over land..... acres..	74, 652	0. 2
Other unimproved land..... acres..	656, 419	1. 8
Swampy, subject to overflow, seeped, or alkali..... acres..	320, 893	0. 9
Suffering a loss of crops from defective drainage..... acres..	157, 542	0. 4
Improved land prior to drainage..... acres..	3, 210, 498	9. 0
Increase since drainage began..... acres..	1, 282, 911	3. 6
Land in nonoperating enterprises..... acres..	158, 534	0. 4
Open ditches in operating enterprises..... miles..	4, 079. 1	100. 0
Completed..... miles..	3, 998. 0	98. 0
Additional under construction..... miles..	81. 1	2. 0
Tile drains in operating enterprises..... miles..	11, 153. 5	100. 0
Completed..... miles..	10, 384. 9	93. 1
Additional under construction..... miles..	768. 6	6. 9
Total capital invested in and required for completion of operating enterprises...	\$54, 169, 878	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	49, 627, 304	91. 6
Additional capital required to complete these enterprises.....	4, 542, 574	8. 4
Average cost per acre when completed.....	10. 37	







Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds, and let contracts for construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	5,388,012	100.0	\$49,649,775	100.0	\$6,858,477
Operating enterprises.....	5,224,478	97.1	49,627,304	100.0	4,542,574
With works completed.....	4,685,080	87.0	44,630,537	89.9	.....
With works under construction.....	539,398	10.0	4,996,767	10.1	4,542,574
Nonoperating enterprises.....	158,534	2.9	22,471	( <sup>2</sup> )	2,315,903

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."  
<sup>2</sup> Less than one-tenth of 1 per cent.

Location of enterprises.—The drainage enterprises in Iowa are located mostly in the central and north-central part of the state. There are some enterprises in the southeastern part and some along Missouri River, but comparatively few in the southern, eastern, and extreme northwestern counties.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	5,388,012	100.0	\$49,649,775	100.0	\$6,858,477
Operating enterprises.....	5,224,478	97.1	49,627,304	100.0	4,542,574
Big Sioux River.....	8,290	0.2	30,770	0.1	1,310
Missouri River.....	856,531	15.9	8,078,668	16.3	499,930
Des Moines River.....	2,687,073	49.9	25,490,561	51.3	1,529,770
Iowa River.....	936,841	17.4	9,201,181	18.5	1,935,207
Minnesota River.....	178,424	3.3	2,046,333	4.1	54,625
Mississippi River.....	557,319	10.4	4,779,761	9.6	521,732
Nonoperating enterprises.....	158,534	2.9	22,471	( <sup>1</sup> )	2,315,903
Big Sioux River.....	320	( <sup>1</sup> )	.....	( <sup>1</sup> )	4,500
Missouri River.....	19,623	0.4	1,085	( <sup>1</sup> )	311,713
Des Moines River.....	96,987	1.8	15,099	( <sup>1</sup> )	1,350,743
Minnesota River.....	20,758	0.4	5,336	( <sup>1</sup> )	333,243
Mississippi River.....	20,847	0.4	901	( <sup>1</sup> )	315,704

<sup>1</sup> Less than one-tenth of 1 per cent.

The pumping districts for drainage are almost entirely in the southeastern part of the state, along or near the Mississippi; but there are two near the Missouri in Fremont and Monona Counties.

Condition of land in enterprises.—The drainage enterprises in this state are generally for the improvement or protection of land already in farms, much of which was under some degree of cultivation before drainage was undertaken. In the low, level land along the Missouri, many of the natural watercourses are inadequate to carry the rapid run-off from the more hilly land to the eastward, and protection against overflow is necessary. In the northern part of the state, artificial works are needed to remove the drainage water from saucer-like depressions and to supplement the farm drainage installed by individual landowners.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	5,224,478	100.0	4,685,080	539,398	158,534
Improved land.....	4,493,407	86.0	4,075,026	418,381	84,722
Timber and cut-over land.....	74,652	1.4	71,028	3,624	4,350
Other unimproved land.....	656,419	12.6	539,026	117,393	69,462
Swampy or subject to overflow.....	320,803	6.1	258,243	62,650	68,197
Suffering a loss of crops.....	157,542	3.0	145,474	12,068	5,068

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 2,883 operating drainage enterprises are counted in Iowa, with an average area of 2,048 acres assessed. Of this number, 110 comprise 10,000 acres or more each, 1010 comprise 1,000 to 5,000 acres, and 263 are smaller than 200 acres each. The assessed acreage exceeds the land in enterprises by 681,265 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprise.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	5,224,478	5,905,743	100.0
Less than 200 acres.....	19,676	31,256	0.5
200 to 499 acres.....	167,264	222,779	3.8
500 to 999 acres.....	409,317	500,458	8.5
1,000 to 4,999 acres.....	1,794,264	2,065,782	35.0
5,000 to 9,999 acres.....	928,723	1,005,124	17.0
10,000 to 49,999 acres.....	1,732,664	1,895,497	32.1
50,000 acres and over.....	172,570	184,867	3.1

**Character of enterprises.**—The drainage public enterprises in Iowa are legally known as drainage districts, and are organized in accordance with chapters 2 and 2-A of Title X of the Code of Iowa Laws (1897) and of the Supplements to the Code (1907 and 1913). These districts are established and controlled by the boards of supervisors of the counties in which the districts are located or, under some circumstances, by trustees elected by the landowners of the districts. The statistics include also figures for five enterprises under private ownership. The information secured regarding districts embracing about one-third of the total acreage reported was not sufficiently definite to determine under just what laws those enterprises were organized.

Drainage districts organized under sections 1939 to 1989 of the code (ch. 2, T. X), as amended, are each established upon petition from a majority of the residents of the county who own land abutting upon the proposed improvement, if the county board of supervisors finds that the undertaking will be conducive to the public welfare. Before public hearing is held and establishment is granted or denied, the county surveyor or an engineer appointed by the county auditor makes a survey, plan of drainage, and estimate of the cost, and submits a report regarding the practicability and utility of the project. Damages are assessed by three appraisers appointed by the county auditor. The same official appoints three persons whose duty it is to classify the land as dry, low, wet, and swamp, and to make an equitable apportionment of the total cost of the enterprise. Hearings are held by the supervisors before they confirm the assessments of damages and the apportionment of cost, which before confirmation may be amended by the supervisors and afterwards are subject to appeal to the district court. Contracts for construction are let by the county auditor. Drainage bonds may be issued by the supervisors, to run not exceeding 15 years, payable only from taxes levied against the land in the district for which the issue was made. For an improvement in more than one county, each board of supervisors affected appoints a commissioner who acts with the commissioners from the other counties in appointing the engineer and in formulating

the drainage plan and report, and thereafter each county acts independently.

This chapter of the code embraces, in amended form, sections 1207 to 1216 of the code of 1873, requiring petition from a majority of the residents of the county owning land abutting on the proposed improvement, and chapter 186 of the laws of 1884, authorizing the drainage of wet or overflowed land upon petition from any 100 voters of the county. It embraces also chapter 46 of the laws of 1896, providing for establishing districts to aid in building and maintaining protection and drainage works in cases where the United States has undertaken the construction of levees. Proceedings under the statute of 1896 are initiated by petition from one or more owners of land within the proposed district. The chapter provides for establishing private drains across the land of objecting owners. Upon petition for such a drain, the township trustees hold hearing, decide the necessity for the improvement, award damages, and determine the location and depth of the drain.

Drainage districts may be organized under sections 1989a 1 to 1989a 79 (ch. 2-A, T. X) upon petition from one or more landowners to be affected. This chapter is the act of April 29, 1904 (ch. 68), with amendments and additions. An engineer appointed by the county board of supervisors prepares a plan of drainage, estimates the cost, and recommends the boundaries of the district. After public hearing upon the petition and the engineer's report, the supervisors may establish the district. Damages are awarded by three appraisers appointed by the county auditor. The cost is apportioned according to benefits as determined by three commissioners appointed by the supervisors, the parcel of land to receive most benefit being graded 100 per cent and the other parcels proportionately. Damages and benefits are subject to review by the county supervisors at public hearing, and then to appeal to the district court. Contracts for construction are let by the supervisors, who may issue drainage bonds to run not more than 20 years, to be paid in each instance by taxes against the district for which they are issued. For the drainage of their own land persons may sign an agreement covering the location and character of the work to be done, the classification of the land, and the amount of taxes to be paid. When this agreement has been filed with the county auditor, the county supervisors establish the district in accordance therewith and take control as over other districts. Sub-districts may be established within drainage districts in the same manner as drainage districts. For a district in more than one county, petition is filed in each county and the boards of supervisors act jointly. In case one or more of the boards of supervisors fail to act, proceedings may be transferred to the district court of any county in which a part of the district is situated.

Drainage pumping stations may be established in any district established under the chapter 2-A, upon petition from one-third of the landowners to be benefited, and in districts established under the chapter 2 upon petition from 50 per cent of the landowners (sections 1989a 49 and 1989a 52). Any drainage district operating a pumping station may be placed under control of three trustees to be elected by the landowners in the district, upon petition, from a majority of those owners, after the drainage works have been constructed. Any district not operating a pumping plant, but which has cost \$100,000 or more and of which less than 25 per cent has been spent for tile construction, may similarly be placed under control of elected trustees upon petition from a majority of the landowners holding a major part of the acreage in the district.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All drainage enterprises.....	5,383,012	100.0	\$49,649,775	100.0	\$6,858,477	
Operating enterprises.....	5,224,478	97.1	49,627,304	100.0	4,542,574	
Drainage districts.....	5,211,683	96.8	49,480,193	99.6	4,542,574	
1873 Code, sec. 1207 to 1216.....	64,574	1.2	163,708	0.3	.....	
Laws of 1884, ch. 184.....	31,611	0.6	69,686	0.1	.....	
1897 Code, sec. 1939 to 1939.....	558,553	10.4	2,968,237	6.0	71,295	
Laws of 1904, ch. 68.....	2,073,155	38.5	10,649,964	21.4	1,568,245	
1907 Supp. sec. 1939 to 1939 <sup>1</sup> .....	1,050,031	19.5	9,568,804	19.3	47,755	
1907 Supp. sec. 1939a 1 to 1939a 53 <sup>1</sup> .....	141,355	2.6	777,866	1.6	.....	
1913 Supp. sec. 1939 to 1939 <sup>1</sup> .....	776,811	14.4	10,130,544	20.4	1,560,026	
1913 Supp. sec. 1939a 1 to 1939a 60 <sup>1</sup> .....	515,593	9.6	6,133,484	12.4	1,277,253	
Individual ownership.....	12,795	0.2	167,111	0.3	.....	
Nonoperating enterprises.....	158,534	2.9	22,471	(*)	2,315,903	
Drainage districts.....	158,534	2.9	22,471	(*)	2,315,903	
1897 Code, sec. 1939 to 1939.....	822	(*)	1,121	(*)	14,576	
Laws of 1904, ch. 68.....	16,045	0.3	9,101	(*)	258,865	
1907 Supp. sec. 1939 to 1939 <sup>1</sup> .....	158	(*)	.....	.....	645	
1913 Supp. sec. 1939 to 1939 <sup>1</sup> .....	116,037	2.2	10,980	(*)	1,457,909	
1913 Supp. sec. 1939a 1 to 1939a 60 <sup>1</sup> .....	25,472	0.5	1,319	(*)	588,908	

<sup>1</sup> Most of the districts tabulated as formed under sections 1939 to 1939 of the Code Supplements of 1907 and 1913 were reported merely as organized under chapter 2 of Title X of the Supplements. At least some of those districts are organized under chapter 2-A (secs. 1939a 1 to 1939a 60).  
<sup>2</sup> Less than one-tenth of 1 per cent.

The first drainage law of Iowa was approved February 5, 1851, providing for the election of a swamp land commissioner to acquire the swamp land granted to the state by Congress in 1850. This statute was repealed in 1853, and the swamp land was given to the counties in which it was situated. An act of April 15, 1870, provided for condemning right of way by one owner across the land of another, upon petition to the township trustees. The first drainage district law was enacted April 24, 1872, which became sections

1207 to 1216, code of 1873. Originally applicable only to counties of 10,000 or more population, it was made applicable in counties of 5,000 population in 1876.

Nearly every general assembly has amended the drainage laws, usually in several respects. Most of the changes affect details of the method of procedure in completing the organization and the construction work, but there have been some changes in the number of signatures required on petitions. The provisions described herein are those effective January 1, 1920.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 3,998.0 miles of open ditches, 10,384.9 miles of tile drains, and 45.2 miles of levees; the additional lengths under construction were 81.1 miles of open ditches and 768.6 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are eight pumping districts among the operating drainage enterprises in the state, all equipped with centrifugal pumps.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All kinds.....	5,224,478	100.0	\$49,627,304	100.0	\$4,542,574	
Open ditches only.....	1,294,243	24.8	8,315,489	16.8	540,681	
Open ditches and levees.....	26,228	0.5	673,770	1.4	.....	
Tile drains only <sup>1</sup> .....	1,421,176	27.2	19,297,008	38.9	1,679,468	
Open ditches and tile drains.....	2,444,906	46.8	21,111,775	42.5	2,312,425	
Open ditches, tile drains and levees.....	37,925	0.7	229,262	0.5	10,000	

<sup>1</sup> Includes 6,000 acres having tile drains and levees.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All operating enterprises.....	5,224,478	100.0	\$49,627,304	100.0	\$4,542,574	
Gravity drainage only.....	5,065,312	97.3	48,482,112	97.7	4,542,574	
All drainage by pumping.....	79,686	1.5	778,770	1.6	.....	
Part gravity and part pumping.....	59,480	1.1	366,422	0.7	.....	
Total area served by pumps.....	134,616	.....	.....	.....	.....	

TABLE 9.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horse-power.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises....	3,153	100.0	530,800	100.0	134,616	100.0
Steam.....	1,400	44.4	209,300	39.4	60,717	45.1
Electric.....	1,700	53.9	302,500	57.0	39,821	29.6
Internal-combustion.....	53	1.7	19,000	3.6	1,450	1.1
Not reported <sup>1</sup> .....					32,628	24.2

<sup>1</sup> Enterprises under construction, pumping plants not installed.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include this group, computed as 10 feet, would make the mean depth for the state 6.6 instead of 6.5 feet.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	5,224,478	100.0
3.0 to 3.9 feet.....	47,215	0.9
4.0 to 4.9 feet.....	57,522	1.1
5.0 to 5.9 feet.....	240,845	4.6
6.0 to 6.9 feet.....	607,076	13.3
7.0 to 7.9 feet.....	295,630	5.7
8.0 to 8.9 feet.....	301,129	5.8
9.0 to 9.9 feet.....	146,912	2.8
10 feet and more.....	93,164	1.8
Not reporting branches.....	3,344,984	64.0

Maintenance of works.—The drainage district act of 1904 (ch. 68) makes it the duty of the county

boards of supervisors to keep in repair the works of all districts organized under that act, except that districts under the control of elected trustees are to be maintained by those trustees. The cost of repairs and maintenance is to be assessed against the land in the same proportion as the original cost, except when additional land is to be benefited. That statute requires that the supervisors shall have an engineer inspect the drains at least once each year, and report regarding the condition of them.

For districts established under sections 1939 to 1954 of the code, repairs are made and the cost is apportioned in the same manner as for establishing and assessing new enterprises. For districts formed under sections 1975 to 1989 of the code, the county supervisors may maintain the works and levy assessments against the real estate of the respective districts, but such assessment may not exceed 50 mills on the dollar unless the work is authorized by petition and proceedings similar to the requirements for inaugurating new work.

TABLE 11.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises....	5,224,478	100.0	\$49,627,304	100.0	\$4,542,574
By district forces.....	2,680,030	51.3	26,898,463	54.2	2,559,242
By contract.....	1,337,323	25.4	11,087,882	22.3	379,083
Method not specified <sup>1</sup> .....	9,603	0.2	132,053	0.3	
No maintenance provided.....	775,540	14.8	6,718,904	13.5	1,175,464
Not reported.....	431,982	8.3	4,790,002	9.7	428,785

<sup>1</sup> Includes 6,000 acres maintained by landowners.

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of enterprises, which are the dates when the districts were established by the county courts, since there may be a period of one or more years between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

DRAINAGE—IOWA.

TABLE 12.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	5,224,478	100.0	5,905,743	100.0
1870 to 1879.....	3,400	0.1	3,400	0.1
1880 to 1889.....	14,782	0.3	14,782	0.3
1890 to 1899.....	71,216	1.4	72,614	1.2
1900 to 1904.....	385,638	7.4	392,548	6.8
1905 to 1909.....	1,659,438	31.8	1,805,083	30.6
1910 to 1914.....	1,629,897	31.2	1,861,228	31.5
1915 to 1919.....	1,447,246	27.7	1,736,119	29.4
Not reported.....	12,811	0.2	12,969	0.2

TABLE 13.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$49,627,304	100.0	\$4,542,574
1870 to 1879.....	34,388	0.1	.....
1880 to 1889.....	26,660	0.1	.....
1890 to 1899.....	217,848	0.4	.....
1900 to 1904.....	2,019,819	4.1	.....
1905 to 1909.....	11,288,616	22.7	46,631
1910 to 1914.....	17,290,526	34.8	60,431
1915 to 1919.....	18,619,833	37.5	4,400,918
Not reported.....	129,614	0.3	34,594

TABLE 14.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	4,079.1	100.0	11,153.5	100.0	45.2	100.0
1870 to 1879.....	3.7	0.1	.....	.....	.....	.....
1880 to 1889.....	24.7	0.6	5.5	( <sup>1</sup> )	.....	.....
1890 to 1899.....	136.5	3.3	21.8	0.2	.....	.....
1900 to 1904.....	364.0	8.9	133.3	1.2	.....	.....
1905 to 1909.....	1,569.7	38.5	1,987.0	17.8	1.1	2.4
1910 to 1914.....	1,041.9	25.5	4,422.5	39.7	14.4	31.9
1915 to 1919.....	930.5	22.8	4,547.0	40.8	21.7	48.0
Not reported.....	8.1	0.2	36.4	0.3	8.0	17.7

<sup>1</sup> Less than one-tenth of 1 per cent.

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and hay. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Adair.	Adams.	Appanoose.	Audubon.	Benton.	Black-hawk.	Boone.	
1 Number of all farms in the state or county.....	213,439	2,113	1,629	2,283	1,818	2,562	2,358	2,541	
2 Farms reporting land having drainage.....	85,865	1,124	617	85	718	1,812	1,031	1,936	
3 Farms reporting land needing drainage.....	56,088	1,001	408	101	445	1,277	1,009	1,111	
4 Farms in drainage and levee districts.....	20,658	1	11	46	2	3	20	773	
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the state or county..... acres.....	35,575,040	366,720	373,280	328,320	283,520	455,680	361,600	364,160	
6 All land in farms..... acres.....	33,474,896	346,943	265,499	309,041	277,570	431,453	339,771	340,844	
7 Improved land in farms..... acres.....	28,606,951	320,926	242,020	241,524	260,992	376,818	262,625	286,873	
8 Woodland in farms..... acres.....	2,285,274	10,789	14,868	42,287	7,055	20,532	19,332	30,205	
9 Other unimproved land in farms..... acres.....	2,572,671	15,228	8,611	25,230	9,523	34,133	37,814	23,766	
10 Farm land reported as provided with drainage..... acres.....	7,334,404	47,236	26,790	3,791	13,791	155,257	60,901	181,302	
11 Farm land reported as needing drainage..... acres.....	2,052,942	27,457	12,145	5,354	9,207	38,701	35,065	37,131	
12 Drainage only..... acres.....	1,661,744	22,942	7,431	2,146	5,948	32,580	32,004	31,622	
13 Drainage and clearing..... acres.....	391,198	4,525	4,714	3,208	3,259	6,121	3,061	5,509	
	Bremar.	Buchanan.	Buena Vista.	Butler.	Calhoun.	Carroll.	Cass.	Cedar.	Cerro Gordo.
1 Number of all farms in the county.....	2,018	2,232	2,055	2,244	2,060	2,087	2,182	2,212	1,944
2 Farms reporting land having drainage.....	367	961	1,725	577	1,064	1,105	793	1,650	1,224
3 Farms reporting land needing drainage.....	823	1,276	663	647	522	828	746	698	1,040
4 Farms in drainage and levee districts.....	7	4	864	7	917	367	6	31	593
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county..... acres.....	277,760	362,880	365,440	366,280	363,520	365,440	360,960	364,800	362,580
6 All land in farms..... acres.....	263,396	341,855	351,479	348,892	349,731	355,380	355,479	346,658	336,776
7 Improved land in farms..... acres.....	206,816	280,501	326,109	307,515	330,173	327,420	326,641	307,577	274,819
8 Woodland in farms..... acres.....	15,060	15,190	6,930	14,995	4,428	7,022	12,113	20,630	15,146
9 Other unimproved land in farms..... acres.....	41,520	46,164	13,440	26,362	15,130	20,938	16,725	18,451	46,811
10 Farm land reported as provided with drainage..... acres.....	7,683	41,290	190,611	22,265	240,105	73,020	20,878	117,917	94,446
11 Farm land reported as needing drainage..... acres.....	23,049	46,797	21,105	22,440	20,397	21,296	19,823	17,994	59,735
12 Drainage only..... acres.....	18,709	34,771	18,913	18,584	18,881	20,281	14,312	9,202	53,244
13 Drainage and clearing..... acres.....	4,340	12,026	2,192	3,856	1,516	1,015	5,511	8,792	6,491

DRAINAGE—IOWA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Cherokee.	Chickasaw.	Clay.	Clayton.	Clinton.	Crawford.	Dallas.	Davis.
1	Number of all farms in the county.....	1,844	2,003	1,769	3,101	2,729	2,444	2,320	2,089
2	Farms reporting land having drainage.....	729	358	1,230	71	1,222	97	1,607	79
3	Farms reporting land needing drainage.....	467	882	661	191	706	146	813	135
4	Farms in drainage and levee districts.....	2	5	482	1	231	10	414	46
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	366,720	318,080	360,320	487,680	442,240	457,600	376,960	320,640
6	All land in farms.....acres..	352,003	299,881	341,029	463,749	420,592	438,369	356,359	303,700
7	Improved land in farms.....acres..	308,883	231,975	287,642	327,399	385,842	406,962	300,649	248,718
8	Woodland in farms.....acres..	7,998	14,448	8,518	94,533	24,060	18,123	28,576	43,617
9	Other unimproved land in farms.....acres..	37,122	53,458	44,869	41,817	30,690	13,294	26,634	11,366
10	Farm land reported as provided with drainage.....acres..	34,582	8,668	126,885	1,385	59,844	2,501	160,194	8,294
11	Farm land reported as needing drainage.....acres..	11,641	26,732	34,701	5,286	25,311	2,298	25,353	4,650
12	Drainage only.....acres..	11,198	19,236	32,933	1,757	20,871	2,025	19,807	11,101
13	Drainage and clearing.....acres..	443	7,496	1,768	3,529	4,440	273	5,546	3,549

		Decatur.	Delaware.	Des Moines.	Dickinson.	Dubuqua.	Emmet.	Fayette.	Floyd.
1	Number of all farms in the county.....	2,029	2,294	1,926	1,043	2,372	1,198	3,157	1,916
2	Farms reporting land having drainage.....	61	645	1,062	804	156	1,051	607	631
3	Farms reporting land needing drainage.....	160	918	266	710	254	598	1,545	544
4	Farms in drainage and levee districts.....	14	3	154	310	9	541	4	85
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	341,190	365,440	261,760	240,640	334,640	251,520	463,360	316,800
6	All land in farms.....acres..	322,246	347,767	243,516	208,396	366,017	232,063	437,626	295,458
7	Improved land in farms.....acres..	264,184	278,610	181,069	186,890	269,830	200,675	336,346	254,433
8	Woodland in farms.....acres..	40,484	28,246	35,682	3,550	52,453	5,558	28,467	14,788
9	Other unimproved land in farms.....acres..	17,608	40,931	26,765	17,956	43,734	25,820	72,813	26,227
10	Farm land reported as provided with drainage.....acres..	2,776	22,894	100,814	84,439	3,830	145,888	20,688	81,602
11	Farm land reported as needing drainage.....acres..	4,662	31,727	12,390	45,825	6,627	24,260	51,129	18,144
12	Drainage only.....acres..	1,324	24,739	8,533	42,573	4,500	31,318	89,812	13,961
13	Drainage and clearing.....acres..	3,338	6,938	3,857	3,252	2,127	2,942	11,317	4,183

		Franklin.	Fremont.	Greene.	Grundy.	Guthrie.	Hamilton.	Hancock.	Hardin.
1	Number of all farms in the county.....	2,040	1,858	2,059	1,725	2,315	2,181	1,875	2,129
2	Farms reporting land having drainage.....	1,481	304	1,759	1,173	1,027	1,990	1,354	1,476
3	Farms reporting land needing drainage.....	1,110	175	681	928	638	645	934	827
4	Farms in drainage and levee districts.....	707	169	884	8	58	1,239	723	446
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	369,920	324,480	367,360	320,640	380,800	364,800	364,800	364,160
6	All land in farms.....acres..	356,479	283,658	339,050	313,516	357,966	353,069	345,713	350,027
7	Improved land in farms.....acres..	306,062	254,475	305,840	281,303	291,806	316,755	300,755	300,986
8	Woodland in farms.....acres..	11,559	14,800	14,394	3,110	32,955	13,205	6,584	24,535
9	Other unimproved land in farms.....acres..	38,858	14,383	18,816	29,103	33,225	23,109	38,374	24,506
10	Farm land reported as provided with drainage.....acres..	156,488	25,653	201,675	73,998	57,065	254,872	154,493	145,748
11	Farm land reported as needing drainage.....acres..	48,952	9,896	23,065	29,981	26,637	23,953	55,719	26,675
12	Drainage only.....acres..	43,861	6,886	21,225	29,205	16,409	21,912	49,526	23,105
13	Drainage and clearing.....acres..	5,091	3,010	1,860	776	10,228	2,041	6,193	3,570

		Harrison.	Henry.	Howard.	Humboldt.	Ida.	Iowa.	Jackson.	Jasper.
1	Number of all farms in the county.....	2,881	1,989	1,708	1,380	1,898	2,256	2,327	2,046
2	Farms reporting land having drainage.....	311	819	320	1,256	246	1,569	97	1,541
3	Farms reporting land needing drainage.....	277	133	832	536	153	865	187	725
4	Farms in drainage and levee districts.....	262	2	49	768	.....	6	2	53
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	442,240	273,280	299,520	275,840	275,200	373,120	404,480	487,200
6	All land in farms.....acres..	414,961	252,368	280,807	254,844	270,906	360,634	392,339	439,155
7	Improved land in farms.....acres..	330,633	201,173	232,451	235,655	258,787	312,071	266,453	385,825
8	Woodland in farms.....acres..	35,451	27,399	11,544	8,333	4,403	31,962	78,577	29,576
9	Other unimproved land in farms.....acres..	48,877	23,796	36,812	10,856	7,716	16,601	47,309	23,754
10	Farm land reported as provided with drainage.....acres..	27,579	70,039	10,178	156,801	6,473	102,511	3,272	92,797
11	Farm land reported as needing drainage.....acres..	9,733	3,914	42,005	29,321	2,791	19,229	3,577	22,435
12	Drainage only.....acres..	4,628	2,513	39,722	27,873	2,674	16,391	1,311	16,957
13	Drainage and clearing.....acres..	5,107	1,401	2,283	1,448	117	2,938	2,266	5,478

		Jefferson.	Johnson.	Jones.	Keokuk.	Kossuth.	Lee.	Linn.	Louisa.
1	Number of all farms in the county.....	1,960	2,625	2,090	2,764	2,928	2,297	3,666	1,470
2	Farms reporting land having drainage.....	653	1,409	1,043	1,670	2,605	306	1,781	818
3	Farms reporting land needing drainage.....	165	919	733	847	1,353	160	1,370	310
4	Farms in drainage and levee districts.....	3	6	3	.....	1,185	62	19	196
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	275,840	390,400	364,160	369,920	622,720	327,040	453,760	253,440
6	All land in farms.....acres..	262,038	374,243	339,502	357,112	574,605	303,415	418,676	228,438
7	Improved land in farms.....acres..	192,358	320,596	276,873	303,497	505,689	265,508	335,164	186,344
8	Woodland in farms.....acres..	27,294	34,187	35,715	35,315	10,520	63,216	35,943	29,477
9	Other unimproved land in farms.....acres..	42,388	19,460	37,914	15,300	58,416	34,691	47,569	12,617
10	Farm land reported as provided with drainage.....acres..	44,337	105,139	61,879	124,907	343,681	12,876	79,505	83,013
11	Farm land reported as needing drainage.....acres..	5,461	27,842	20,391	37,575	77,339	8,005	35,932	11,678
12	Drainage only.....acres..	2,714	15,689	12,778	26,913	73,470	5,673	24,331	5,362
13	Drainage and clearing.....acres..	2,747	12,263	7,613	10,662	3,869	2,332	11,601	6,313

DRAINAGE—IOWA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Lucas.	Lyon.	Madison.	Mahaska.	Marion.	Marshall.	Mills.	Mitchell.
1	1,617	1,774	2,125	2,784	2,402	2,315	1,571	1,770
2	36	790	1,020	1,411	633	1,385	85	472
3	118	201	742	613	294	798	86	494
4		59	71	7	11	30	51	59
<b>LAND AND FARM AREA.</b>								
5	276,480	372,480	360,320	363,520	360,320	366,080	280,320	296,320
6	246,292	356,071	335,445	342,155	336,015	354,069	245,301	277,152
7	193,806	323,593	262,441	293,850	275,545	320,266	220,223	244,711
8	36,302	7,560	30,060	27,098	39,999	15,375	16,869	13,896
9	16,184	24,918	42,944	21,207	20,471	18,428	8,209	18,545
10	801	34,613	70,023	106,093	38,916	67,391	4,727	20,885
11	4,483	3,967	28,117	27,041	9,130	16,698	4,320	20,923
12	1,305	3,760	22,115	21,622	6,276	12,216	2,930	17,927
13	3,177	207	6,062	5,419	2,854	4,482	1,390	2,996
	Monona.	Monroe.	Montgomery.	Muscatine.	O'Brien.	Osceola.	Page.	Palo Alto.
1	2,166	1,793	1,650	1,923	1,908	1,265	2,252	1,815
2	277	107	322	953	1,307	917	879	1,464
3	104	72	205	456	670	626	495	902
4	275	2	7	132	26	219	73	731
<b>LAND AND FARM AREA.</b>								
5	439,040	276,480	271,360	276,480	364,160	252,800	339,840	359,040
6	383,956	247,685	258,887	263,051	348,783	247,864	323,323	334,409
7	319,953	179,209	240,186	217,466	322,132	230,971	304,508	280,679
8	29,523	47,254	10,196	32,213	5,181	2,460	14,696	4,774
9	34,480	21,222	8,505	13,372	21,470	14,433	9,119	30,956
10	33,457	3,874	8,497	69,204	97,253	69,170	30,643	172,760
11	7,926	1,782	4,777	16,813	25,223	26,686	12,229	53,463
12	6,977	880	3,909	10,686	24,584	26,195	8,386	51,067
13	949	902	868	6,127	639	491	3,843	2,396
	Pocahontas.	Polk.	Pottawattamia.	Poweshiek.	Ringgold.	Sac.	Scott.	Shelby.
1	1,992	2,948	3,781	2,179	1,923	1,945	2,316	2,049
2	1,873	1,440	297	1,668	38	1,044	1,213	274
3	644	670	225	840	190	527	707	237
4	922	71	146	3	1	224	23	26
<b>LAND AND FARM AREA.</b>								
5	368,640	372,480	602,880	371,200	345,600	367,360	287,360	376,960
6	348,189	326,840	568,473	357,265	315,350	356,528	273,351	355,336
7	326,339	283,211	627,476	317,999	284,742	329,046	242,446	333,663
8	4,435	25,722	25,606	14,199	20,660	6,603	14,466	8,781
9	17,917	17,907	15,391	25,067	9,948	20,879	16,439	12,892
10	268,758	98,808	17,683	169,942	1,649	87,369	61,023	6,718
11	29,477	14,678	7,668	45,661	8,940	16,465	17,021	6,626
12	26,053	11,744	3,958	33,051	5,725	13,613	14,549	4,095
13	3,424	2,934	3,710	12,010	3,215	2,852	2,472	2,731
	Sloux.	Story.	Tama.	Taylor.	Union.	Van Buren.	Wapello.	Warren.
1	2,801	2,215	2,494	2,159	1,631	2,013	2,112	2,402
2	841	1,871	1,085	368	323	142	630	860
3	193	550	590	294	273	147	208	436
4	5	902	3	33	7	53	7	29
<b>LAND AND FARM AREA.</b>								
5	486,400	362,880	460,800	341,760	273,280	805,280	373,920	364,800
6	467,473	328,058	424,132	324,279	259,064	291,384	254,866	337,533
7	443,980	292,748	370,662	290,188	222,420	209,197	203,280	284,107
8	7,893	19,021	24,785	16,075	16,932	55,529	30,328	30,724
9	16,600	16,289	28,685	18,018	19,712	26,658	21,258	22,702
10	41,150	197,633	48,193	17,107	14,842	8,165	47,432	54,266
11	4,922	13,954	13,273	8,877	6,873	5,504	6,023	13,958
12	4,540	11,189	9,889	5,984	5,074	1,789	1,889	8,967
13	382	2,765	3,384	2,893	1,799	3,715	4,139	4,991
	Washing- ton.	Webster.	Winne- bago.	Winne- shiek.	Wood- bury.	Worth.	Wright.	All other counties. <sup>1</sup>
1	2,307	2,566	1,543	2,915	2,969	1,461	1,927	8,252
2	1,722	2,210	1,016	135	150	894	1,721	44
3	520	977	753	491	42	894	885	336
4	20	1,406	487	4	97	551	1,071	1
<b>LAND AND FARM AREA.</b>								
5	357,760	456,960	255,360	439,040	552,960	255,360	368,000	1,566,080
6	336,801	424,727	243,076	428,386	492,820	242,561	344,516	1,455,311
7	276,960	376,031	212,564	329,113	460,451	201,195	309,649	1,187,172
8	33,171	25,512	6,559	55,721	16,973	8,139	7,377	157,872
9	26,670	23,184	23,933	43,552	15,396	33,227	27,490	110,267
10	157,957	295,854	67,350	2,429	24,042	50,190	224,760	1,231
11	36,803	41,433	27,755	9,658	1,450	44,080	37,830	9,665
12	24,654	36,567	24,702	6,885	842	39,456	30,195	1,264
13	12,149	4,866	3,053	2,773	608	4,624	1,635	8,401

<sup>1</sup> Drainage on farms was reported in all counties in Iowa.



DRAINAGE—IOWA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Adams.	Appanoose.	Boone.	Buena Vista.	Calhoun.	Carroll.	Cedar.	Cerro Gordo.	
<b>LAND AREA.</b>										
1	Approximate land area of the state or county .....	35,575,040	273,280	328,320	364,180	365,440	363,520	366,440	364,800	362,880
2	All land in operating drainage enterprises .....	5,224,478	4,797	6,805	50,039	116,826	246,559	78,040	6,333	108,300
3	Improved land .....	4,493,407	2,650	6,464	86,089	114,264	123,377	72,531	6,206	95,385
4	Per cent of all improved land in farms .....	15.7	1.1	2.7	30.0	35.0	37.4	22.2	2.0	34.7
5	Timber and cut-over land .....	74,652	240	341	3,950	2,562	1,015	1,015	127	13
6	Other unimproved land .....	656,419	1,907	308	3,895	204	122,167	5,509	127	12,902
7	Swampy or subject to overflow, in enterprises .....	320,893	594	308	3,895	204	24,149	4,321	127	12,018
8	Suffering a loss of crops from defective drainage .....	157,542	46	204	2,531	4,094	3,406	127	127	2,300
9	Assessed acreage .....	5,905,743	4,797	6,805	91,709	190,286	335,032	91,183	6,333	108,300
10	Excess over all land in enterprises .....	681,265			1,670	73,460	88,473	13,123		
<b>DRAINAGE WORKS.</b>										
11	Open ditches: Completed .....	3,998.0	16.6	10.0	7.5	96.7	191.7	51.9	3.1	37.7
12	Additional under construction .....	81.1				6.8				3.0
13	Maximum completed in any enterprise .....	82.3	14.4	5.0	2.3	64.4	20.0	36.3	3.1	10.6
14	Maximum width at bottom of ditch <sup>1</sup> .....	90	12		14	45	68	35	10	30
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	25.0	10.0		8.4	11.5	12.0	14.0	6.0	8.3
16	Mean depth of branch ditches <sup>1</sup> .....	6.5	8.0			9.0	5.4	6.8		5.8
17	Tile drains: Completed .....	10,394.9			455.7	295.1	422.5	230.8	3.0	323.1
18	Additional under construction .....	768.6			6.0	6.6		12.3		121.7
19	Maximum completed in any enterprise .....	127.0			20.6	20.0	14.0	12.9	3.0	50.4
20	Maximum size of tile <sup>1</sup> .....	52			44	42	38	44	24	48
21	Accessory levees and dikes: Completed .....	45.2								
22	Additional under construction .....									
23	Pumping plants: Engine capacity .....	3,153								
24	Pump capacity .....	530,800								
25	Area served by pumps .....	134,616								
26	Area drained by open ditches only <sup>1</sup> .....	1,294,243	4,797	6,805		41,809	79,902	3,466		
27	Length of these ditches .....	1,934.7	16.6	10.0		78.4	89.7	9.8		
28	Average length per acre .....	7.9	18.3	7.8		9.6	6.2	14.8		
29	Area having open ditches and levees <sup>1</sup> .....	26,228								
30	Length of these ditches .....	45.4								
31	Average length per acre .....	9.1								
32	Length of the accessory levees .....	29.1								
33	Area drained by tile only <sup>1</sup> .....	1,415,176			75,551	89,067	73,559	40,702		48,536
34	Length of these tile .....	6,785.7			397.2	343.2	349.6	215.5		259.7
35	Average length per acre .....	26.3			27.8	46.4	23.5	28.0		26.2
36	Area having tile drains and levees <sup>1</sup> .....	6,000								
37	Length of these tile .....	6.0								
38	Average length per acre .....	5.3								
39	Length of the accessory levees .....	8.0								
40	Area drained by open ditches and tile <sup>1</sup> .....	2,444,906			14,488	25,950	91,098	83,842	6,333	59,714
41	Length of these drains .....	6,392.2			72.0	78.8	185.1	69.7	6.1	225.8
42	Average length per acre .....	13.8			26.2	11.6	10.7	10.9	5.1	20.0
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....	37,925								
44	Length of these drains .....	68.6								
45	Average length per acre .....	9.6								
46	Length of the accessory levees .....	8.1								
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920 .....	4,493,407	2,650	6,464	86,089	114,264	123,377	72,531	6,206	95,385
48	Improved land prior to drainage .....	3,210,496	1,439	5,791	63,958	87,048	62,761	26,411	1,583	89,976
49	Increase since drainage .....	1,282,911	1,211	673	22,131	27,216	60,616	44,120	4,623	5,409
50	Per cent of increase .....	40.0	84.2	11.5	34.6	31.3	98.6	155.3	292.0	6.0
51	Per cent increase is of all improved land in farms, 1920 .....	4.5	0.5	0.3	7.7	8.3	18.4	13.5	1.5	2.0
52	Timber and cut-over land, 1920 .....	74,652	240				1,015			18
53	Timber and cut-over land prior to drainage .....	93,994	240				1,015			13
54	Decrease since drainage .....	19,342								
55	Per cent of decrease .....	20.6								
56	Other unimproved land, 1920 .....	656,419	1,907	341	3,950	2,562	122,167	5,509	127	12,902
57	Other unimproved land prior to drainage .....	1,919,988	3,118	1,014	26,081	29,778	182,783	49,629	4,750	18,311
58	Decrease since drainage .....	1,263,569	1,211	673	22,131	27,216	60,616	44,120	4,623	5,409
59	Per cent of decrease .....	65.8	38.8	66.4	84.9	91.4	88.9	97.3	29.5	29.5
60	Swampy or subject to overflow, 1920 .....	320,893	594	308	3,895	204	24,149	4,321	127	12,018
61	Swampy or subject to overflow prior to drainage .....	1,567,960	2,878	774	25,813	34,248	148,334	29,258	4,750	15,421
62	Decrease since drainage .....	1,247,067	2,284	466	21,918	34,042	124,185	24,937	4,623	3,403
63	Per cent of decrease .....	79.5	79.4	60.2	84.9	99.4	83.7	85.2	97.8	22.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises .....	54,169,878	102,760	61,989	1,551,773	1,508,798	2,182,582	728,624	31,773	1,809,193
65	Capital invested in these enterprises to Dec. 31, 1919 .....	49,627,304	102,760	61,989	1,516,735	1,485,798	2,042,119	677,815	31,773	1,064,892
66	Additional capital required to complete these enterprises .....	4,542,574			35,038	23,000	140,463	50,809		744,301
67	Average cost per acre when completed .....	10.37	21.42	9.11	17.23	21.91	8.85	9.34	5.02	16.71
68	Enterprises constructing open ditches only .....	8,836,170	102,760	61,989		243,678	285,747	37,226		
69	Average cost per acre when completed .....	6.84	21.42	9.11		6.83	8.72	10.65		
70	Enterprises constructing open ditches and levees .....	673,770								
71	Average cost per acre when completed .....	25.69								
72	Enterprises constructing tile drains only .....	20,836,476			1,301,993	936,684	1,141,733	379,860		543,077
73	Average cost per acre when completed .....	14.76			17.23	23.98	14.53	9.33		11.18
74	Enterprises constructing tile drains and levees .....	90,000								
75	Average cost per acre when completed .....	15.00								
76	Enterprises constructing open ditches and tile drains .....	23,424,200			249,780	328,436	755,102	311,538	31,773	1,266,116
77	Average cost per acre when completed .....	9.58			17.24	9.14	8.29	9.21	5.02	21.20
78	Enterprises constructing open ditches, tile drains, and levees .....	239,262								
79	Average cost per acre when completed .....	8.31								
<b>CROPS.</b>										
80	Improved land in enterprises reporting—									
81	Corn as principal crop on drained land .....	4,365,787	2,650	6,464	86,089	114,264	123,377	72,531	6,206	95,385
82	Hay as principal crop on drained land .....	90,381								
	Not reporting principal crop on drained land .....	37,239								

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Includes 380 acres reporting vegetables as principal crop.



DRAINAGE—IOWA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Clay.	Clinton.	Crawford.	Dallas.	Davis.	Des Moines.	Dickinson.	Emmet.	Floyd.	Franklin.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....acres.	360,320	442,240	457,600	376,960	320,640	261,760	240,640	251,520	316,800	369,920
2	All land in operating drainage enterprises.....acres.	105,912	63,279	5,500	72,637	7,978	53,188	100,317	184,355	15,543	139,852
3	Improved land.....acres.	103,553	51,910	2,750	69,469	7,658	49,965	98,233	162,624	14,878	132,504
4	Per cent of all improved land in farms.....	36.0	14.2	0.7	23.1	3.1	27.6	52.6	81.0	5.8	43.3
5	Timber and cut-over land.....acres.	13,175	550						68		
6	Other unimproved land.....acres.	2,359	3,194	2,200	3,168	320	3,223	2,084	1,663	665	7,348
7	Swampy or subject to overflow, in enterprises.....acres.	2,453	2,669	550	873	320	2,628	1,833	718	665	6,674
8	Suffering a loss of crops from defective drainage.....acres.	676	5,387	550	16		659	1,673	208	117	2,812
9	Assessed acreage.....acres.	107,892	72,119	6,000	77,763	7,078	103,188	133,024	169,871	15,543	152,747
10	Excess over all land in enterprises.....acres.	1,780	3,840	500	5,126		50,000	82,707	8,516		12,895
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....miles.	45.7	89.8	12.0	35.9	14.4	18.6	76.1	120.5	14.3	51.6
12	Additional under construction.....miles.						0.8		6.6		0.7
13	Maximum completed in any enterprise.....miles.	12.1	26.0	11.2	7.0	13.5	15.2	13.0	15.0	10.0	11.3
14	Maximum width at bottom of ditch <sup>1</sup> .....feet.	25	25	20	24	12	60	25	24	12	16
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet.	11.5	10.0	13.0	8.0	12.0	7.2	10.0	12.0	5.0	8.3
16	Mean depth of branch ditches <sup>1</sup> .....feet.	6.4	7.2		5.0		6.0	5.9	7.0	5.0	5.0
Tile drains:											
17	Completed.....miles.	293.8	29.9		166.2		11.8	410.3	492.9	42.3	423.6
18	Additional under construction.....miles.	45.7	1.1		8.5		0.3	27.5	14.2		35.2
19	Maximum completed in any enterprise.....miles.	76.0	6.0		10.0		6.6	53.3	64.5	20.0	37.4
20	Maximum size of tile <sup>1</sup> .....inches.	38	35		42		33	44	36	36	48
Accessory levees and dikes:											
21	Completed.....miles.		2.0								
22	Additional under construction.....miles.										
Pumping plants:											
23	Engine capacity.....horsepower.						600				
24	Pump capacity.....gallons per minute.						74,300				
25	Area served by pumps.....acres.						53,188				
26	Area drained by open ditches only <sup>1</sup> .....acres.	12,440	8,000	5,500	8,821	7,978		2,852	46,350	802	8,660
27	Length of these ditches.....miles.	15.8	11.0	12.0	15.5	14.4		11.3	63.2	10.0	18.9
28	Average length per acre.....feet.	6.7	7.3	11.5	9.3	9.5		20.9	7.2	65.8	10.3
29	Area having open ditches and levees <sup>1</sup> .....acres.		1,000								
30	Length of these ditches.....miles.		3.0								
31	Average length per acre.....feet.		15.8								
32	Length of the accessory levees.....miles.		1.0								
33	Area drained by tile only <sup>1</sup> .....acres.	37,883	1,800		43,000		3,188	18,967	51,831	6,550	55,550
34	Length of these tile.....miles.	152.5	6.0		138.4		5.2	125.7	262.0	22.3	316.6
35	Average length per acre.....feet.	21.3	17.6		17.0		8.6	35.0	26.7	18.0	25.5
36	Area having tile drains and levees <sup>1</sup> .....acres.										
37	Length of these tile.....miles.										
38	Average length per acre.....feet.										
39	Length of the accessory levees.....miles.										
40	Area drained by open ditches and tile <sup>1</sup> .....acres.	55,589	56,250		20,816		50,000	78,498	66,174	8,191	65,642
41	Length of these drains.....miles.	218.9	97.8		56.7		26.3	376.9	309.0	24.3	177.6
42	Average length per acre.....feet.	20.6	9.1		14.4		2.8	25.4	24.7	16.7	14.3
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres.		1,229								
44	Length of these drains.....miles.		3.5								
45	Average length per acre.....feet.		15.0								
46	Length of the accessory levees.....miles.		1.0								
<b>DEVELOPMENT OF LAND.</b>											
47	Improved land in operating enterprises, 1920.....acres.	103,553	51,910	2,750	69,469	7,658	49,965	98,233	162,624	14,878	132,504
48	Improved land prior to drainage.....acres.	81,025	10,352	1,650	33,703	6,124	44,072	75,106	121,617	13,081	112,871
49	Increase since drainage.....acres.	22,528	41,558	1,100	35,766	1,534	5,893	23,127	41,007	1,797	19,633
50	Per cent of increase.....	27.8	401.4	66.7	106.1	25.0	13.4	30.8	33.7	13.7	17.4
51	Per cent increase is of all improved land in farms, 1920.....	7.8	11.4	0.3	11.9	0.6	3.3	12.4	20.4	0.7	6.4
52	Timber and cut-over land, 1920.....acres.	13,175	550						68		
53	Timber and cut-over land prior to drainage.....acres.	17,675	550						68		
54	Decrease since drainage.....acres.	4,500									
55	Per cent of decrease.....	25.5								100.0	
56	Other unimproved land, 1920.....acres.	2,359	3,194	2,200	3,168	320	3,223	2,084	1,663	665	7,348
57	Other unimproved land prior to drainage.....acres.	24,887	40,252	3,300	38,934	1,854	9,116	25,211	42,670	2,430	26,981
58	Decrease since drainage.....acres.	22,528	37,558	1,100	35,766	1,534	5,893	23,127	41,007	1,765	19,633
59	Per cent of decrease.....	90.6	92.1	33.3	91.9	82.7	64.6	91.7	96.1	72.6	72.8
60	Swampy or subject to overflow, 1920.....acres.	2,453	2,669	550	873	320	2,628	1,833	718	665	6,674
61	Swampy or subject to overflow prior to drainage.....acres.	32,756	52,977	3,850	24,444	2,122	7,138	20,221	29,120	1,947	21,620
62	Decrease since drainage.....acres.	30,303	49,308	3,300	23,571	1,802	4,510	18,388	28,402	1,282	14,946
63	Per cent of decrease.....	92.5	93.1	85.7	96.4	84.9	63.2	90.9	97.6	65.8	69.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
64	Total capital invested in and required for completion of operating enterprises.....dollars.	1,024,852	406,500	80,447	807,668	46,887	255,057	1,376,275	1,713,804	230,204	2,020,349
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	879,678	396,500	86,447	746,448	46,887	248,260	1,199,111	1,627,901	230,204	1,794,811
66	Additional capital required to complete these enterprises.....dollars.	145,174	10,000		61,220		6,797	177,164	85,903		235,538
67	Average cost per acre when completed.....dollars.	9.68	5.95	15.72	11.13	5.88	4.80	13.72	10.43	14.81	14.45
68	Enterprises constructing open ditches only.....dollars.	54,664	35,000	86,447	62,670	46,887		13,155	226,902	16,842	66,464
69	Average cost per acre when completed.....dollars.	4.39	4.38	15.72	7.10	5.68		4.61	4.90	21.00	7.67
70	Enterprises constructing open ditches and levees.....dollars.		12,000								
71	Average cost per acre when completed.....dollars.		12.00								
72	Enterprises constructing tile drains only.....dollars.	376,857	20,000		535,485		128,956	303,611	688,031	102,575	1,264,535
73	Average cost per acre when completed.....dollars.	9.95	11.11		12.45		40.46	16.01	13.27	15.66	19.29
74	Enterprises constructing tile drains and levees.....dollars.										
75	Average cost per acre when completed.....dollars.										
76	Enterprises constructing open ditches and tile drains.....dollars.	563,301	299,500		209,513		126,071	1,059,500	798,871	110,787	689,350
77	Average cost per acre when completed.....dollars.	10.67	5.32		10.06		2.52	13.50	12.07	13.53	10.50
78	Enterprises constructing open ditches, tile drains, and levees.....dollars.		40,000								
79	Average cost per acre when completed.....dollars.		32.55								
<b>CROPS.</b>											
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres.	102,168	51,910	2,750	69,109	7,658	49,965	91,393	153,772	14,878	132,504
81	Hay as principal crop on drained land.....acres.										
82	Not reporting principal crop on drained land.....acres.	1,385			360			6,840	8,852		

<sup>1</sup> When works under construction have been completed.

DRAINAGE—IOWA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Fre- mont.	Greene.	Guthrie.	Hamil- ton.	Han- cock.	Hardin.	Harris- son.	Humb- oldt.	Jasper.	Kos- uth.
<b>LAND AREA.</b>											
1	Approximate land area of the county.....acres.	324,480	367,360	380,800	364,800	364,800	364,160	442,240	275,840	467,200	622,720
2	All land in operating drainage enterprises.....acres.	67,493	139,487	14,176	238,515	261,498	121,228	68,951	187,425	25,170	488,297
3	Improved land.....acres.	33,829	126,870	10,523	231,858	229,256	117,860	31,492	176,691	23,690	459,084
4	Per cent of all improved land in farms.....	13.3	41.5	3.6	73.2	76.2	39.2	9.5	75.0	6.1	91.0
5	Timber and cut-over land.....acres.	3,514				731		7,724		232	38
6	Other unimproved land.....acres.	30,150	12,617	3,653	6,657	31,511	3,368	27,735	10,734	1,248	28,275
7	Swampy or subject to overflow, in enterprises.....acres.	13,374	8,377	2,919	6,145	18,464	3,265	7,851	10,729	1,024	23,005
8	Suffering a loss of crops from defective drainage.....acres.	4,980	4,512	739	1,991	11,728	2,780	3,799	10,610	251	9,708
9	Assessed acreage.....acres.	67,493	150,823	14,176	287,068	333,555	129,335	73,827	204,429	25,170	488,755
10	Excess over all land in enterprises.....acres.		11,336		48,551	72,057	8,107	6,876	17,004		458
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....miles.	88.4	24.2	0.7	171.5	226.9	52.5	113.7	158.5	27.7	316.2
12	Additional under construction.....miles.				1.1		0.5				1.7
13	Maximum completed in any enterprise.....miles.	16.1	6.3	0.4	17.0	24.6	24.0	16.6	18.4	20.3	33.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet.	40	12	8	28	40	16	20	24	30	30
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet.	16.0	9.2	5.4	11.6	12.0	8.1	15.0	7.0	10.0	10.5
16	Mean depth of branch ditches <sup>1</sup> .....feet.	5.4			6.4	5.8	6.6	6.2	5.9		6.9
Tile drains:											
17	Completed.....miles.	6.0	482.5	34.3	504.4	431.2	284.9	16.4	311.6		1,343.1
18	Additional under construction.....miles.		48.6	7.4	23.5	48.4	4.0		0.4		108.1
19	Maximum completed in any enterprise.....miles.	6.0	32.5	7.9	19.1	72.3	23.3	10.6	14.8		127.0
20	Maximum size of tile <sup>1</sup> .....inches.		44	44	52	40	48	34	36		45
Accessory levees and dikes:											
21	Completed.....miles.	8.0						0.3			
22	Additional under construction.....miles.										
Pumping plants:											
23	Engine capacity.....horsepower.	25									
24	Pump capacity.....gallons per minute.	4,000									
25	Area served by pumps.....acres.	650									
26	Area drained by open ditches only <sup>1</sup> .....acres.	61,493	233		40,478	40,446	30,106	55,956	35,798	25,170	22,098
27	Length of these ditches.....miles.	88.4	1.7		59.0	107.8	35.1	107.9	51.5	27.7	26.6
28	Average length per acre.....feet.	7.6	38.5		7.7	14.1	6.2	10.2	7.6	5.8	6.1
29	Area having open ditches and levees <sup>1</sup> .....acres.							527			
30	Length of these ditches.....miles.							1.8			
31	Average length per acre.....feet.							18.0			
32	Length of the accessory levees.....miles.							0.3			
33	Area drained by tile only <sup>1</sup> .....acres.		93,501	0,014	91,222	38,420	62,318	(*)	38,069		85,510
34	Length of these tile.....miles.		398.9	26.4	425.1	272.6	251.8	2.0	193.0		547.9
35	Average length per acre.....feet.		22.5	15.5	24.6	37.5	21.3		26.8		33.8
36	Area having tile drains and levees <sup>1</sup> .....acres.	6,000									
37	Length of these tile.....miles.	6.0									
38	Average length per acre.....feet.	5.3									
39	Length of the accessory levees.....miles.	8.0									
40	Area drained by open ditches and tile <sup>1</sup> .....acres.		45,753	5,162	106,815	182,632	28,804	10,468	113,553		379,789
41	Length of these drains.....miles.		154.7	16.0	216.4	326.1	55.0	18.4	221.0		1,194.6
42	Average length per acre.....feet.		17.9	16.4	10.7	9.4	10.1	9.3	10.3		16.6
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres.										
44	Length of these drains.....miles.										
45	Average length per acre.....feet.										
46	Length of the accessory levees.....miles.										
<b>DEVELOPMENT OF LAND.</b>											
47	Improved land in operating enterprises, 1920.....acres.	33,829	126,870	10,523	231,858	229,256	117,860	31,492	176,691	23,690	459,084
48	Improved land prior to drainage.....acres.	21,269	70,972	6,891	213,497	109,761	108,623	21,136	110,982	20,834	402,055
49	Increase since drainage.....acres.	12,560	55,898	3,632	18,361	119,495	9,237	10,356	65,709	2,856	57,029
50	Per cent of increase.....	59.1	78.8	52.7	8.6	108.9	8.5	49.0	59.2	13.7	14.4
51	Per cent increase is of all improved land in farms, 1920.....	4.9	18.3	1.2	5.8	39.7	3.1	3.1	27.9	0.7	11.5
52	Timber and cut-over land, 1920.....acres.	3,514				731		7,724		232	38
53	Timber and cut-over land prior to drainage.....acres.	4,714				731		8,480		441	38
54	Decrease since drainage.....acres.	1,200						756		209	
55	Per cent of decrease.....	28.5						8.9		47.4	
56	Other unimproved land, 1920.....acres.	30,150	12,617	3,653	6,657	31,511	3,368	27,735	10,734	1,248	28,275
57	Other unimproved land prior to drainage.....acres.	41,510	68,515	7,285	25,018	151,006	12,605	37,335	76,443	3,895	86,204
58	Decrease since drainage.....acres.	11,360	55,898	3,632	18,361	119,495	9,237	9,600	65,709	2,647	57,929
59	Per cent of decrease.....	27.4	81.6	49.9	73.4	79.1	73.3	25.7	86.0	68.0	67.2
60	Swampy or subject to overflow, 1920.....acres.	13,374	8,377	2,919	6,145	18,464	3,265	7,851	10,729	1,024	23,005
61	Swampy or subject to overflow prior to drainage.....acres.	32,337	41,462	3,310	14,638	113,202	11,484	28,099	72,836	3,367	54,809
62	Decrease since drainage.....acres.	18,963	33,085	391	8,493	94,738	8,219	20,248	62,107	2,343	31,804
63	Per cent of decrease.....	58.6	79.8	11.8	58.0	83.7	71.6	72.1	85.3	69.6	58.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
64	Total capital invested in and required for completion of operating enterprises.....dollars.	418,940	2,018,172	183,245	2,460,514	2,734,297	950,141	693,221	1,437,527	142,635	6,220,759
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	418,940	1,749,554	146,744	2,341,671	2,355,636	931,232	693,221	1,437,361	142,635	5,738,533
66	Additional capital required to complete these enterprises.....dollars.		268,618	36,501	118,843	378,661	18,909		146		482,226
67	Average cost per acre when completed.....dollars.	6.21	14.47	12.93	10.33	10.46	7.84	10.35	7.67	6.67	12.74
68	Enterprises constructing open ditches only.....dollars.	328,940	1,207		103,649	91,315	108,452	611,597	111,103	142,635	121,426
69	Average cost per acre when completed.....dollars.	5.35	6.18		2.56	2.26	3.60	10.93	3.10	5.67	5.28
70	Enterprises constructing open ditches and levees.....dollars.							6,497			
71	Average cost per acre when completed.....dollars.							12.33			
72	Enterprises constructing tile drains only.....dollars.		1,263,454	86,639	1,564,805	1,230,642	660,415	5,198	574,565		1,118,012
73	Average cost per acre when completed.....dollars.		13.51	9.61	17.15	32.03	10.60		15.09		13.07
74	Enterprises constructing tile drains and levees.....dollars.	90,000									
75	Average cost per acre when completed.....dollars.	16.00									
76	Enterprises constructing open ditches and tile drains.....dollars.		753,511	96,606	792,060	1,412,340	181,274	69,929	751,859		4,981,321
77	Average cost per acre when completed.....dollars.		16.47	18.71	7.42	7.73	6.29	6.68	6.62		13.12
78	Enterprises constructing open ditches, tile drains, and levees.....dollars.										
79	Average cost per acre when completed.....dollars.										
<b>CROPS.</b>											
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres.	33,829	126,684	10,523	231,048	207,576	117,152	22,314	176,691	23,690	459,084
81	Hay as principal crop on drained land.....acres.					21,680		9,178			
82	Not reporting principal crop on drained land.....acres.		186		810		708				

<sup>1</sup> When works under construction have been completed.

\* Acreage included under open ditches.

DRAINAGE—IOWA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Lee.	Louisa.	Maha- ka.	Marlon.	Mar- shall.	Mills.	Mitchell.	Monona.	Mont- gomery.	Musca- tine.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	327,040	263,440	363,520	360,320	366,080	280,320	296,320	439,040	271,360	276,480
2	All land in operating drainage enterprises.....	16,781	52,113	16,415	8,707	9,000	55,420	7,875	129,004	6,777	43,922
3	Improved land.....	14,676	48,572	14,203	8,272	8,730	27,045	6,640	69,751	2,711	40,770
4	Per cent of all improved land in farms.....	7.1	26.1	4.8	3.0	2.7	12.3	2.7	21.8	1.1	18.7
5	Timber and cut-over land.....			750		270	5,543		13,433	338	88
6	Other unimproved land.....	1,105	3,541	1,462	435		22,832	1,235	45,820	3,728	3,064
7	Swampy or subject to overflow, in enterprises.....	947	2,565	1,462	435	270	7,923	918	11,846	3,203	2,475
8	Suffering a loss of crops from defective drainage.....	316	1,200	608	348		2,797	625	10,604	271	784
9	Assessed acreage.....	15,781	52,113	16,415	8,707	9,000	58,850	7,875	202,631	6,777	43,922
10	Excess over all land in enterprises.....						3,430		73,627		
<b>DRAINAGE WORKS.</b>											
11	Open ditches:										
12	Completed.....	24.0	28.0	6.9	8.3	9.3	58.6	1.9	106.5	9.6	42.8
13	Additional under construction.....			15.8		4.7					
14	Maximum completed in any enterprise.....	24.0	17.9	5.1	5.6	9.3	8.3	1.9	24.3	8.5	10.5
15	Maximum width at bottom of ditch <sup>1</sup> .....	30	30	32	30	30	36	8	80	20	24
16	Maximum of average depths of outlet ditches <sup>1</sup> .....	8.6	8.0	11.0	11.0	12.0	14.0	5.0	25.0	17.0	7.8
17	Mean depth of branch ditches <sup>1</sup> .....	7.0	7.4			5.0	5.0		8.2		0.7
18	Tile drains:										
19	Completed.....		4.1	3.8				23.7	33.8		
20	Additional under construction.....							2.3			
21	Maximum completed in any enterprise.....		2.6	3.8				5.7	17.6		
22	Maximum size of tile <sup>1</sup> .....		18	16				36	24		
23	Accessory levees and dikes:										
24	Completed.....	19.0	3.8						8.3		
25	Additional under construction.....										
26	Pumping plants:										
27	Engine capacity.....	800	1,900						28		
28	Pump capacity.....	100,000	337,500						15,000		
29	Area served by pumps.....	15,781	34,757						800		29,440
30	Area drained by open ditches only <sup>1</sup> .....	24,040	15,665	8,707	9,000	55,420	123,622	6,777	43,922		
31	Length of these ditches.....	8.8	22.7	8.3	14.0	58.6	191.5	9.6	42.8		
32	Average length per acre.....	1.9	7.7	5.0	8.2	5.6	7.9	7.5	5.1		
33	Area having open ditches and levees <sup>1</sup> .....	15,781	900				272		4.0		
34	Length of these ditches.....	24.0	0.3				77.6		2.3		
35	Average length per acre.....	8.0	4.7				110		18.8		
36	Length of the accessory levees.....	19.0	3.1				10.0		806.4		
37	Area drained by tile only <sup>1</sup> .....			750			3,122		110		
38	Length of these tile.....			3.8			16.9		18.0		
39	Average length per acre.....			26.8					6.0		
40	Area having tile drains and levees <sup>1</sup> .....										
41	Length of these tile.....										
42	Average length per acre.....										
43	Length of the accessory levees.....										
44	Area drained by open ditches and tile <sup>1</sup> .....	10,717					4,753				
45	Length of these drains.....	2.0					17.9				
46	Average length per acre.....	1.0									
47	Area having open ditches, tile drains, and levees <sup>1</sup> .....	16,456									
48	Length of these drains.....	20.5									
49	Average length per acre.....	6.0									
50	Length of the accessory levees.....	0.7									
<b>DEVELOPMENT OF LAND.</b>											
51	Improved land in operating enterprises, 1920.....	14,676	48,572	14,203	8,272	8,730	27,045	6,640	69,751	2,711	40,770
52	Improved land prior to drainage.....	11,362	37,969	14,068	6,908	8,730	19,892	6,568	39,675	2,626	33,943
53	Increase since drainage.....	3,314	10,603	135	1,464		7,153	72	30,076	85	6,827
54	Per cent of increase.....	29.2	27.9	1.0	21.5		36.0	1.1	75.8	3.2	20.1
55	Per cent increase is of all improved land in farms, 1920.....	1.6	5.7	(*)	0.5		8.2	(*)	9.4	(*)	3.1
56	Timber and cut-over land, 1920.....			750		270	5,543		13,433	338	88
57	Timber and cut-over land prior to drainage.....			795	348	270	5,543		21,629	338	88
58	Decrease since drainage.....			45	348				8,196		
59	Per cent of decrease.....			5.7	100.0				37.9		
60	Other unimproved land, 1920.....	1,105	3,541	1,462	435		22,832	1,235	45,820	3,728	3,064
61	Other unimproved land prior to drainage.....	4,419	14,144	1,552	1,551		29,985	1,307	67,700	3,813	8,891
62	Decrease since drainage.....	3,314	10,603	90	1,116		7,153	72	21,880	85	6,827
63	Per cent of decrease.....	75.0	75.0	5.8	72.0		23.9	5.5	32.8	2.2	69.0
64	Swampy or subject to overflow, 1920.....	947	2,565	1,462	435	270	7,923	918	11,846	3,203	2,475
65	Swampy or subject to overflow prior to drainage.....	3,787	12,370	1,552	1,551	1,000	25,489	961	48,317	3,542	8,354
66	Decrease since drainage.....	2,840	9,805	90	1,116	730	17,566	43	36,471	339	5,879
67	Per cent of decrease.....	75.0	79.3	5.8	72.0	73.0	68.9	4.5	75.5	9.6	70.4
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
68	Total capital invested in and required for completion of operating enterprises.....	551,888	366,461	190,542	44,151	260,000	392,201	96,620	1,551,571	88,613	201,939
69	Capital invested in these enterprises to Dec. 31, 1919.....	551,888	366,461	88,175	44,151	200,000	392,201	85,499	1,551,571	88,613	201,939
70	Additional capital required to complete these enterprises.....			102,367		60,000		11,121			
71	Average cost per acre when completed.....	34.97	7.03	11.61	5.07	28.89	7.08	12.27	12.03	13.06	4.60
72	Enterprises constructing open ditches only.....		112,010	177,813	44,151	260,000	392,201		1,457,252	88,613	201,939
73	Average cost per acre when completed.....		4.86	11.35	5.07	28.89	7.08		11.33	13.06	4.60
74	Enterprises constructing open ditches and levees.....	551,888	32,629						17,434		
75	Average cost per acre when completed.....	34.97	38.26						64.10		
76	Enterprises constructing tile drains only.....			12,729				50,499	46,885		
77	Average cost per acre when completed.....			16.97				16.18	426.23		
78	Enterprises constructing tile drains and levees.....										
79	Average cost per acre when completed.....										
80	Enterprises constructing open ditches and tile drains.....		96,000					46,121			
81	Average cost per acre when completed.....		8.96					9.70			
82	Enterprises constructing open ditches, tile drains, and levees.....		125,822					30,000			
83	Average cost per acre when completed.....		7.65								
<b>CROPS.</b>											
84	Improved land in enterprises reporting—										
85	Corn as principal crop on drained land.....	14,676	48,572	14,203	8,272	8,730	25,857	6,640	23,289	2,711	40,770
86	Hay as principal crop on drained land.....						1,188		46,462		
87	Not reporting principal crop on drained land.....										

<sup>1</sup> When works under construction have been completed.  
<sup>2</sup> Pump located in Louisa County.

<sup>3</sup> Acreage included under open ditches.  
<sup>4</sup> Less than one-tenth of 1 per cent.

DRAINAGE—IOWA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		O'Brien.	Osceola.	Page.	Palo Alto.	Pocahontas.	Polk.	Pottawattamie.	Ringgold.	Sac.	Shelby.	
<b>LAND AREA.</b>												
1	Approximate land area of the county.....	acres	364,160	252,800	339,840	359,040	268,640	372,480	602,880	345,600	367,360	376,960
2	All land in operating drainage enterprises.....	acres	5,453	63,342	81,412	221,389	265,904	26,019	41,036	9,530	98,600	22,700
3	Improved land.....	acres	5,453	60,151	13,990	195,471	263,091	24,275	20,890	3,812	53,050	12,074
4	Per cent of all improved land in farms.....		1.7	26.0	4.6	67.5	80.6	8.6	4.0	1.3	16.1	3.6
5	Timber and cut-over land.....	acres		3,140	1,350	24,568	2,790	1,744	4,105	953	707	1,199
6	Other unimproved land.....	acres		8,191	14,282	24,568	2,790	1,744	16,041	4,765	44,843	9,427
7	Swampy or subject to overflow, in enterprises.....	acres		2,932	5,191	3,953	1,075	1,438	5,797	5,718	8,615	2,686
8	Suffering a loss of crops from defective drainage.....	acres		1,028	3,426	3,426	243	1,217	330	330	1,207	2,700
9	Assessed acreage.....	acres	5,453	63,342	32,932	223,209	298,941	26,019	45,250	9,530	100,234	22,700
10	Excess over all land in enterprises.....	acres		1,520	1,820	33,037		4,214		1,634		
<b>DRAINAGE WORKS.</b>												
Open ditches:												
11	Completed.....	miles	2.5	45.4	53.0	130.4	209.1	16.0	81.0	18.4	47.3	50.9
12	Additional under construction.....	miles		0.5		6.5		12.9			0.9	
13	Maximum completed in any enterprise.....	miles	2.5	9.3	12.4	21.5	23.4	14.0	12.3	18.4	11.2	11.6
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet	15	20	24	40	35	16	26	20	68	20
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet	6.6	8.4	16.0	10.5	10.0	8.0	15.0	10.0	10.6	12.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet		5.7	4.0	6.5	6.4		6.4		6.6	6.7
Tile drains:												
17	Completed.....	miles	11.8	179.4		442.0	400.0	30.5	4.1		190.1	0.4
18	Additional under construction.....	miles		66.0		24.0					0.2	
19	Maximum completed in any enterprise.....	miles	6.3	22.0		41.5	32.3	5.9	2.5		11.6	0.4
20	Maximum size of tile <sup>1</sup> .....	inches	30	42		38	40	34	15		44	12
Accessory levees and dikes:												
21	Completed.....	miles						0.4	3.0			
22	Additional under construction.....	miles										
Pumping plants:												
23	Engine capacity.....	horsepower										
24	Pump capacity.....	gallons per minute										
25	Area served by pumps.....	acres										
26	Area drained by open ditches only <sup>1</sup> .....	acres	1,850	9,397	31,412	24,474	68,900	11,258	32,661	9,530	680	19,980
27	Length of these ditches.....	miles	2.5	28.7	53.0	26.5	41.3	25.1	65.9	18.4	1.5	43.4
28	Average length per acre.....	feet	7.1	16.1	8.9	5.7	3.2	11.8	10.7	10.2	11.6	11.5
29	Area having open ditches and levees <sup>1</sup> .....	acres						1,373	6,375			
30	Length of these ditches.....	miles						0.8	11.0			
31	Average length per acre.....	feet						3.1	9.1			
32	Length of the accessory levees.....	miles						0.4	3.0			
33	Area drained by tile only <sup>1</sup> .....	acres	3,603	21,199		42,468	46,152	12,823			38,012	
34	Length of these tile.....	miles	11.8	130.5		161.4	156.1	30.1			121.3	
35	Average length per acre.....	feet	17.3	32.5		20.1	17.9	12.4			16.8	
36	Area having tile drains and levees <sup>1</sup> .....	acres										
37	Length of these tile.....	miles										
38	Average length per acre.....	feet										
39	Length of the accessory levees.....	miles										
40	Area drained by open ditches and tile <sup>1</sup> .....	acres		32,746		154,447	150,852	565	2,000		59,908	2,720
41	Length of these drains.....	miles		132.1		415.0	411.7	3.4	8.2		115.7	7.9
42	Average length per acre.....	feet		21.3		14.2	14.4	31.8	21.6		10.2	15.3
43	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres										
44	Length of these drains.....	miles										
45	Average length per acre.....	feet										
46	Length of the accessory levees.....	miles										
<b>DEVELOPMENT OF LAND.</b>												
47	Improved land, in operating enterprises, 1920.....	acres	5,453	60,151	13,990	195,471	263,091	24,275	20,890	3,812	53,050	12,074
48	Improved land prior to drainage.....	acres	4,561	43,830	10,440	109,035	151,742	22,279	17,264	3,812	36,440	7,676
49	Increase since drainage.....	acres	892	16,321	3,550	86,436	111,349	1,996	3,626		16,610	4,398
50	Per cent of increase.....		19.6	37.2	34.0	79.3	73.4	9.0	21.0		45.6	57.3
51	Per cent increase is of all improved land in farms, 1920.....		0.3	7.1	1.2	29.8	34.1	0.7	0.7		5.0	1.3
52	Timber and cut-over land, 1920.....	acres		3,140	1,350	24,568	2,790	1,744	4,105	953	707	1,199
53	Timber and cut-over land prior to drainage.....	acres		755	3,140	1,350	46	4,105	953	707	707	1,199
54	Decrease since drainage.....	acres		755			23					
55	Per cent of decrease.....			100.0			50.0					
56	Other unimproved land, 1920.....	acres		8,191	14,282	24,568	2,790	1,744	16,041	4,765	44,843	9,427
57	Other unimproved land prior to drainage.....	acres		892	18,757	17,832	111,004	114,116	19,667	4,765	61,453	13,825
58	Decrease since drainage.....	acres		892	15,566	3,550	86,436	111,326	1,996	3,626	16,610	4,398
59	Per cent of decrease.....			100.0	83.0	19.9	77.9	53.4	18.4		27.0	31.8
60	Swampy or subject to overflow, 1920.....	acres		2,932	5,191	3,953	1,075	1,438	5,797	5,718	8,615	2,686
61	Swampy or subject to overflow prior to drainage.....	acres		892	17,679	18,698	43,949	95,207	2,720	19,768	50,787	13,670
62	Decrease since drainage.....	acres		892	14,947	13,507	39,996	94,132	1,282	13,971	42,172	10,984
63	Per cent of decrease.....			100.0	83.6	72.2	91.0	98.9	47.1	70.7	83.0	80.4
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
64	Total capital invested in and required for completion of operating enterprises.....	dollars	51,558	722,847	292,364	1,649,640	2,041,778	473,596	592,302	125,000	1,008,267	240,971
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	51,558	643,945	292,364	1,547,570	2,041,778	203,507	582,302	125,000	989,898	240,971
66	Additional capital required to complete these enterprises.....	dollars		178,902		102,070		270,089			18,369	
67	Average cost per acre when completed.....	dollars	9.45	11.41	9.31	7.45	7.68	18.20	14.43	13.12	10.23	10.62
68	Enterprises constructing open ditches only.....	dollars	9,505	64,100	292,364	109,789	169,316	326,293	484,732	125,000	7,183	208,001
69	Average cost per acre when completed.....	dollars	5.14	6.82	9.31	4.49	2.46	28.98	14.84	13.12	10.56	10.41
70	Enterprises constructing open ditches and levees.....	dollars						2,980	50,342			
71	Average cost per acre when completed.....	dollars						2.17	7.90			
72	Enterprises constructing tile drains only.....	dollars	42,053	310,155		383,054	558,503	140,277			357,172	
73	Average cost per acre when completed.....	dollars	11.67	14.63		8.55	12.10	10.94			8.40	
74	Enterprises constructing tile drains and levees.....	dollars										
75	Average cost per acre when completed.....	dollars										
76	Enterprises constructing open ditches and tile drains.....	dollars	348,532			1,176,797	1,318,959	4,046	57,228		643,912	32,970
77	Average cost per acre when completed.....	dollars	10.65			7.62	8.71	7.16	28.61		10.75	12.12
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars										
79	Average cost per acre when completed.....	dollars										
<b>CROPS.</b>												
80	Improved land in enterprises reporting—											
81	Corn as principal crop on drained land.....	acres	5,453	54,391	13,699	195,471	257,791	24,275	13,317	3,812	53,050	12,074
82	Hay as principal crop on drained land.....	acres							958			
	Not reporting principal crop on drained land.....	acres		5,760	291		5,300		6,615			

<sup>1</sup> When works under construction have been completed.

# DRAINAGE—IOWA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Story.	Taylor.	Van Buren.	Warren.	Webster.	Winnebago.	Woodbury.	Worth.	Wright.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	acres.. 362,880	341,780	305,280	364,800	456,960	255,360	552,960	255,360	368,000	4,758,400
2	All land in operating drainage enterprises.....	acres.. 143,336	10,585	5,200	16,497	267,768	181,023	94,795	92,680	261,167	19,328
3	Improved land.....	acres.. 135,125	6,351	5,044	8,958	243,386	162,076	51,115	78,210	250,456	16,496
4	Per cent of all improved land in farms.....	46.2	2.2	2.4	3.2	64.7	76.2	11.1	38.9	80.9	0.4
5	Timber and out-over land.....	acres.. 1,276	529	156	2,184	24,402	18,400	10,773	41	10,711	103
6	Other unimproved land.....	acres.. 6,935	3,705	156	6,355	24,402	18,400	32,907	14,609	10,711	2,729
7	Swampy or subject to overflow, in enterprises.....	acres.. 13,943	1,429	156	1,649	24,920	11,054	14,875	6,625	13,794	1,847
8	Suffering a loss of crops from defective drainage.....	acres.. 6,043	462	260	426	23,918	1,907	10,453	420	11,003	1,774
9	Assessed acreage.....	145,668	10,585	5,200	16,829	325,773	182,695	96,872	92,860	305,273	19,328
10	Excess over all land in enterprises.....	acres.. 2,332			332	57,985	1,672	2,077		44,106	
<b>DRAINAGE WORKS.</b>											
11	Open ditches:										
12	Completed.....	miles.. 53.2	17.1	16.2	40.8	223.5	120.9	144.6	74.3	183.0	15.1
13	Additional under construction.....	miles.. 8.8	7.0	16.2	11.4				4.4	1.3	1.5
14	Maximum completed in any enterprise.....	miles.. 8.8	7.0	16.2	15.6	37.4	39.3	32.3	16.9	32.0	3.8
15	Maximum width at bottom of ditch.....	feet.. 20	12	12	24	30	30	30	30	30	16
16	Maximum of average depths of outlet ditches.....	feet.. 9.8	15.5	10.8	15.0	12.0	9.5	12.0	9.1	8.0	10.0
17	Mean depth of branch ditches.....	feet.. 5.0			7.7		6.4	5.9	6.0	6.1	7.3
18	Tile drains:										
19	Completed.....	miles.. 324.0			1.2	506.3	442.4	8.1	172.9	448.8	42.1
20	Additional under construction.....	miles.. 4.4			19.8	55.3			52.3	13.1	8.3
21	Maximum completed in any enterprise.....	miles.. 18.0			1.2	20.4	29.3	6.1	34.0	22.2	7.1
22	Maximum size of tile.....	inches.. 45			24	36	48	24	36	48	30
23	Accessory levees and dikes:										
24	Completed.....	miles..					0.2		0.2		
25	Additional under construction.....	miles..									
26	Pumping plants:										
27	Engine capacity.....	horsepower..									
28	Pump capacity.....	gallons per minute..									
29	Area served by pumps.....	acres..									
30	Area drained by open ditches only.....	acres.. 13,575	10,585	5,200	16,191	28,459	6,610	39,801	3,719	115,761	4,157
31	Length of these ditches.....	miles.. 22.6	17.1	16.2	52.2	32.7	28.8	60.6	14.1	140.8	8.7
32	Average length per acre.....	feet.. 8.8	8.5	16.4	17.0	6.1	23.0	8.0	20.0	6.4	11.1
33	Area having open ditches and levees.....	acres..									
34	Length of these ditches.....	miles..									
35	Average length per acre.....	feet..									
36	Length of the accessory levees.....	miles..									
37	Area drained by tile only.....	acres.. 90,338			306	66,225	44,908	2,275	25,850	78,882	8,870
38	Length of these tiles.....	miles.. 276.1			1.2	390.1	223.0	1.0	166.9	343.2	30.8
39	Average length per acre.....	feet.. 16.1			20.7	31.1	26.2	2.3	34.1	23.0	18.3
40	Area having tile drains and levees.....	acres..									
41	Length of these tiles.....	miles..									
42	Average length per acre.....	feet..									
43	Length of the accessory levees.....	miles..									
44	Area drained by open ditches and tile.....	acres.. 39,428				173,104	113,330	52,719	59,226	66,524	6,301
45	Length of these drains.....	miles.. 32.9				326.8	351.2	91.1	111.9	162.2	27.5
46	Average length per acre.....	feet.. 11.1				10.0	16.4	9.1	10.0	12.9	23.0
47	Area having open ditches, tile drains, and levees.....	acres..					16,175		4,065		
48	Length of these drains.....	miles..					15.6		11.0		
49	Average length per acre.....	feet..					5.1		14.3		
50	Length of the accessory levees.....	miles..					0.2		0.2		
<b>DEVELOPMENT OF LAND.</b>											
51	Improved land in operating enterprises, 1920.....	acres.. 135,125	6,351	5,044	8,958	243,386	162,076	51,115	78,210	250,456	16,496
52	Improved land prior to drainage.....	acres.. 92,531	3,176	4,004	5,658	166,389	142,442	37,719	73,247	155,454	14,538
53	Increase since drainage.....	acres.. 42,594	3,175	1,040	3,300	76,997	19,634	13,396	4,963	94,972	1,958
54	Per cent of increase.....	46.0	100.0	26.0	58.3	46.3	13.8	35.5	6.8	61.1	13.5
55	Per cent increase is of all improved land in farms, 1920.....	14.5	1.1	0.5	1.2	20.5	9.2	2.9	2.5	30.7	0.1
56	Timber and out-over land, 1920.....	acres.. 1,276	529	156	2,184	24,402	18,400	10,773	41	10,711	103
57	Timber and out-over land prior to drainage.....	acres.. 3,608	529	156	2,184	24,402	18,400	10,773	203	10,711	103
58	Decrease since drainage.....	acres.. 2,332					680	104	162		
59	Per cent of decrease.....	64.6					55.4	1.0	79.8		
60	Other unimproved land, 1920.....	acres.. 6,935	3,705	156	6,355	24,402	18,400	32,907	14,609	10,711	2,729
61	Other unimproved land prior to drainage.....	acres.. 47,197	6,850	1,196	8,855	101,399	37,354	46,199	19,410	105,683	4,687
62	Decrease since drainage.....	acres.. 40,262	3,175	1,040	8,855	76,997	18,954	13,292	4,801	94,972	1,958
63	Per cent of decrease.....	85.3	46.1	87.0	38.1	75.9	50.7	28.8	24.7	89.9	41.8
64	Swampy or subject to overflow, 1920.....	acres.. 13,943	1,429	156	1,649	24,920	11,054	14,875	6,625	13,794	1,847
65	Swampy or subject to overflow prior to drainage.....	acres.. 52,035	6,536	1,144	11,077	97,073	18,894	53,887	8,377	105,683	3,850
66	Decrease since drainage.....	acres.. 38,092	5,107	988	9,428	72,153	7,840	38,092	1,752	91,889	2,003
67	Per cent of decrease.....	73.2	78.1	86.4	85.1	74.3	41.5	72.4	20.9	86.9	52.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
68	Total capital invested in and required for completion of operating enterprises.....	dollars.. 1,358,036	82,196	47,169	333,379	2,532,904	1,613,542	476,816	867,350	2,514,519	196,672
69	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 1,239,365	82,196	47,169	252,302	2,412,781	1,368,324	476,816	684,411	2,417,034	161,840
70	Additional capital required to complete these enterprises.....	dollars.. 118,671			81,077	120,123	245,218		182,939	97,485	34,832
71	Average cost per acre when completed.....	dollars.. 6.47	7.77	9.07	20.21	6.46	8.91	5.08	6.34	6.63	10.16
72	Enterprises constructing open ditches only.....	dollars.. 33,974	82,196	47,169	327,741	97,050	16,761	259,412	32,802	430,437	35,611
73	Average cost per acre when completed.....	dollars.. 2.50	7.77	9.07	20.24	3.41	2.84	6.52	8.32	3.72	8.57
74	Enterprises constructing open ditches and levees.....	dollars..									
75	Average cost per acre when completed.....	dollars..									
76	Enterprises constructing tile drains only.....	dollars.. 976,136			5,638	1,269,070	624,210	16,110	459,144	1,336,370	91,294
77	Average cost per acre when completed.....	dollars.. 10.81			18.42	19.16	13.90	7.08	17.76	16.94	10.29
78	Enterprises constructing tile drains and levees.....	dollars..									
79	Average cost per acre when completed.....	dollars..									
80	Enterprises constructing open ditches and tile drains.....	dollars.. 347,926				1,166,784	945,157	201,294	357,378	747,712	69,777
81	Average cost per acre when completed.....	dollars.. 8.52				6.74	8.34	3.52	6.03	11.24	11.07
82	Enterprises constructing open ditches, tile drains, and levees.....	dollars..					25,414		18,026		
83	Average cost per acre when completed.....	dollars..					1.57		4.43		
<b>CROPS.</b>											
84	Improved land in enterprises reporting--										
85	Corn as principal crop on drained land.....	acres.. 135,125	6,351	5,044	8,958	243,386	162,076	40,200	78,210	250,324	16,496
86	Hay as principal crop on drained land.....	acres..						10,915			
87	Not reporting principal crop on drained land.....	acres..								132	

<sup>1</sup> Includes only Blackhawk, Buchanan, Butler, Cass, Grundy, Howard, Iowa, Johnson, Linn, Madison, Scott, Tama, and Washington Counties.  
<sup>2</sup> When works under construction have been completed.

# KANSAS.

The following pages present the statistics of drainage for Kansas collected at the census of 1920. The figures relate to conditions as of January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The

statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount	Percent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state .....	165, 286	100. 0
Farms reporting land having drainage .....	2, 806	1. 7
Farms reporting land needing drainage .....	2, 573	1. 6
All land in farms..... acres..	45, 425, 179	100. 0
Improved land in farms..... acres..	30, 600, 760	67. 4
Farm land reported as provided with drainage..... acres..	106, 985	0. 2
Farm land reported as needing drainage..... acres..	68, 292	0. 2
Needing drainage only..... acres..	36, 371	0. 1
Needing drainage and clearing..... acres..	31, 921	0. 1
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	52, 335, 360	100. 0
All land in operating drainage enterprises..... acres..	93, 856	0. 2
Improved land..... acres..	87, 449	0. 2
Per cent of all improved land in farms.....	0. 3	.....
Timber and cut-over land..... acres..	4, 135	(1)
Other unimproved land..... acres..	2, 272	(1)
Swampy, subject to overflow, seeped, or alkali..... acres..	6, 704	(1)
Suffering a loss of crops from defective drainage..... acres..	6, 088	(1)
Improved land prior to drainage..... acres..	74, 072	0. 1
Increase since drainage began..... acres..	13, 377	(1)
Land in nonoperating enterprises..... acres..	12, 078	(1)
Open ditches in operating enterprises..... miles..	145. 6	100. 0
Completed..... miles..	138. 4	95. 1
Additional under construction..... miles..	7. 2	4. 9
Tile drains in operating enterprises..... miles..	213. 0	100. 0
Completed..... miles..	213. 0	100. 0
Additional under construction..... miles..	.....	.....
Total capital invested in and required for completion of operating enterprises.....	\$1, 210, 353	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	936, 508	77. 4
Additional capital required to complete these enterprises.....	273, 845	22. 6
Average cost per acre when completed.....	12. 90	.....

<sup>1</sup> Less than one-tenth of 1 per cent.





Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	105,934	100.0	\$938,103	100.0	\$440,634
Operating enterprises.....	93,856	88.6	938,508	99.8	273,845
With works completed.....	72,780	68.7	747,853	79.7	.....
With works under construction	21,076	19.9	188,655	20.1	273,845
Nonoperating enterprises.....	12,078	11.4	1,595	0.2	166,789

Location of enterprises.—All the drainage enterprises in Kansas are in the eastern half of the state. There is a considerable area in such enterprises in Neosho County, but most of the other land in drainage organizations is located in the northeast corner of the state, in only a few counties.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	105,934	100.0	\$938,103	100.0	\$440,634
Operating enterprises.....	93,856	88.6	938,508	99.8	273,845
Arkansas River.....	37,534	35.4	316,246	33.8	261,845
Kansas River.....	52,928	50.0	574,848	61.2	12,000
Missouri River.....	3,394	3.2	45,414	4.8	.....
Nonoperating enterprises.....	12,078	11.4	1,595	0.2	166,789
Arkansas River.....	7,040	6.6	1,164	0.1	85,000
Kansas River.....	3,038	2.9	372	( <sup>1</sup> )	59,628
Missouri River.....	2,000	1.9	59	( <sup>1</sup> )	22,161

<sup>1</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—The drainage enterprises in this state are mostly for the protection and improvement of land subject to overflow by stream floods. This is done most economically, in very many instances, by a drainage plan that combines levees and ditches. The usual purpose of an

organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	93,856	100.0	72,780	21,076	12,078
Improved land.....	87,449	93.2	67,473	19,976	11,278
Timber and cut-over land.....	4,135	4.4	3,085	1,100	400
Other unimproved land.....	2,272	2.4	2,272	.....	400
Swampy or subject to overflow.....	6,704	7.1	910	5,794	12,078
Suffering a loss of crops.....	6,038	6.5	294	5,794	( <sup>1</sup> )

<sup>1</sup> Not reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 54 operating drainage enterprises are counted in Kansas, with an average area of 1,738 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	93,856	93,856	100.0
Less than 200 acres.....	575	575	0.6
200 to 499 acres.....	4,419	4,419	4.7
500 to 999 acres.....	11,944	11,944	12.7
1,000 to 4,999 acres.....	33,036	33,036	35.3
5,000 to 9,999 acres.....	22,792	22,792	24.3
10,000 to 49,999 acres.....	21,040	21,040	22.4

Character of enterprises.—Most of the drainage enterprises in Jefferson and Neosho Counties, Kans., are organized as county drains under a law applicable to only those counties, while nearly all of the enterprises elsewhere in the state are drainage districts. The distinction made here between county drains and drainage districts is merely that the county commissioners serve as the executive officers for the county drains, while special officers are chosen for each drainage district.

The state water commission was created in 1917, to have control of the problems of flood prevention, drainage, domestic water supply, water power, navigation, and irrigation, but the law provided that this commission should not interfere with any drainage systems then established in drainage districts created under



existing laws. The water commission is composed of the governor of the state and two civil engineers appointed by him.

County drains may be organized under a law of February 19, 1886 (ch. 161). Though this statute applies to the whole state, only a small amount of drainage has been done under it. The enterprises are established by the boards of county commissioners upon petition from one or more owners of land adjacent to the line of the proposed drain, if the enterprise will be of public benefit. Claims for damages are determined by the commissioners at public hearing before the drain is established. The commissioners apportion the work of construction to the landowners that will be benefited, and let contract for the parts not completed within the specified time. Appeals may be taken to the probate court of the county for jury trial.

County drains in Jefferson and Neosho Counties are organized under a law of March 6, 1891 (ch. 204). It is applicable only in those counties, yet the enterprises organized under it comprise in number more than half the drainage enterprises in the state. A petition for the drain is submitted to the board of county commissioners from one or more owners of land that would be benefited. The commissioners, or three viewers appointed by them, and the county surveyor lay out the drain and assess damages and benefits, notice of the proposed assessments having been given previously. Appeals from the decisions of the commissioners may be taken to the district court of the county. The commissioners establish the drain if they find it will be of public benefit and that the cost will not be excessive. They have the plan of drainage improvement works prepared, and let contract for construction.

A very few small township drains have been established in accordance with the act of March 12, 1879 (ch. 100). The procedure is the same as provided for county drains by the law of 1886, except that they are under control of the township trustees instead of the county commissioners.

Drainage districts incorporated under the act of February 22, 1905 (ch. 215), for the benefit of land and property subject to damage from overflow of national watercourses, include several of the larger enterprises of the state. A petition defining the proposed district, signed by two-fifths or more of the tax-paying residents of the district is submitted to the board of county commissioners, who establish the district if they find, after public hearing, that the petition conforms to the law and that the allegations therein are true, including the fact that the enterprise will be conducive to the public health, convenience, and welfare. The executive officers are three elected directors (before 1914 the number was

five), who determine the plan of improvement works and decide which parts shall be paid for by general taxation and which parts by special assessment. Construction of works to be paid for by general taxation must be approved by a majority vote of the taxpayers; construction to be paid for by special assessments against the lands benefited need not be submitted to vote of the taxpayers if no tract will be assessed more than 10 per cent of its value. Assessments of special benefits and of damages are made by a board of three freeholders appointed by the directors. The determinations of the directors upon these assessments, made after public hearing, are final. Bonds for drainage works may be issued if authorized by vote of the taxpayers. Special provision is made for districts where three-fifths of the owners are nonresident.

Drainage districts incorporated under the act of March 14, 1911 (ch. 168), for reclaiming or protecting a contiguous body of swamp or overflowed land, also include some of the larger enterprises. Articles of association are signed by a majority in interest of the owners of the land to be affected and filed with the district court of the county containing the greater portion of the proposed district. Five elected supervisors have exclusive charge of the construction and maintenance of the drainage works. Damages are awarded by appraisers appointed by the court; the cost of the enterprise is apportioned by the supervisors against the lands according to the benefits that will be conferred. Public hearings are held upon the engineer's report describing the plan of improvement and his determination of benefits, and also upon the supervisor's apportionment of the costs. The supervisors may issue bonds of the district running 5 to 20 years.

Drainage districts in counties having not more than 100,000 population may be established by the district court according to a law of March 5, 1907 (ch. 197). However, no enterprises were reported as organized under this statute. The officers provided for are three special commissioners appointed by the court. They assess benefits and damages subject to review by the court; the cost is apportioned against the lands according to benefits. Contracts for work must not be let until sufficient money to pay for the work has been paid to the county clerk.

Drainage districts may be established by the governor of the state, in accordance with the act of March 27, 1911 (ch. 170), but no enterprises have been reported as established in this manner. Petition for the district must be signed by two-fifths of the landowners of the district, and must be approved by the board of county commissioners after public hearing. Three elected directors adopt the plan of drainage improvements, which must be approved by the college of engineering of the state university or by the

state college of agriculture. Benefits and damages are assessed by a commission appointed by the directors. The benefits are divided into two classes, general and special.

The first general drainage law of Kansas was enacted March 3, 1868, providing for the establishment of private ditches when necessary to secure outlet for one landowner across the land of another. Petition was made to a justice of the peace, who summoned a jury to hold a hearing upon the petition and to assess benefits and damages. An act of March 3, 1870, provided for the construction of levees and drains by three or more persons signing articles of association to be recorded in the county recorder's office. Appraisers to assess benefits and damages were appointed by the county commissioners upon petition of the directors of the association after the plan of improvement had been adopted. The appropriation of land for right of way was authorized. Both of these laws were repealed by the township drain law of March 12, 1879. The many amendments to the various drainage laws have not changed the general character of the enterprises as described in the preceding paragraphs.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	105,934	100.0	\$938,103	100.0	\$440,634
Operating enterprises.....	93,856	88.6	916,508	99.8	273,845
County drains.....	25,865	24.4	164,420	17.5	.....
Laws of 1888, ch. 161.....	1,051	1.0	8,878	0.9	.....
Laws of 1891, ch. 204.....	24,314	23.4	155,742	16.6	.....
Drainage districts.....	64,291	60.7	704,583	75.1	269,345
Laws of 1905, ch. 215.....	29,750	28.1	373,136	39.8	7,500
Laws of 1911, ch. 168.....	34,541	32.6	331,452	35.3	261,845
Individual ownership <sup>1</sup> .....	3,700	3.5	67,500	7.2	4,500
Nonoperating enterprises.....	12,078	11.4	1,595	0.2	166,789
Drainage districts—Laws of 1911, ch. 168 <sup>2</sup> .....	12,078	11.4	1,595	0.2	166,789

<sup>1</sup> Includes 1,500 acres established under township drain law of 1879.  
<sup>2</sup> Includes 3,038 acres not reporting law under which district was organized.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 138.4 miles of open ditches, 213 miles of tile drains, and 165.1 miles of accessory levees; the additional lengths under construction were 7.2 miles of open ditches and 7.8 miles of levees. Most of the tile drains are in one enterprise that is under individual ownership, but otherwise these figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. Only one pumping district was reported, in which 2,200 acres are served by pumps part of the time.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	93,856	100.0	\$936,508	100.0	\$273,845
Open ditches only.....	37,038	39.5	426,616	45.5	251,345
Open ditches and levees.....	47,998	51.1	498,962	48.7	22,500
Open ditches, tile drains, and levees <sup>1</sup> .....	8,825	9.4	100,930	10.8	.....

<sup>1</sup> Includes 4,215 acres reporting open ditches and tile drains only.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	93,856	100.0
Less than 3 feet.....	8,082	8.6
3.0 to 3.9 feet.....	7,574	8.1
4.0 to 4.9 feet.....	13,922	14.8
5.0 to 5.9 feet.....	18,996	20.2
6.0 to 6.9 feet.....	346	0.4
7.0 to 7.9 feet.....	.....	.....
8.0 to 8.9 feet.....	266	0.3
9.0 to 9.9 feet.....	.....	.....
10 feet and more.....	18,525	19.7
Not reporting branches.....	31,145	33.2

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted, also those of 10 feet and more; the latter seemed not to represent so well the average depths of outlet provided for all the farms in those districts. To include both of these groups, computed as 3 feet and 10 feet, respectively, would make the mean depth for the state 5.4 instead of 4.3 feet.

Maintenance of works.—Township drains are to be repaired by the township trustee upon notice from interested persons that repairs are needed. The cost is assessed against the parties to be benefited by the work. The county drains established under the law effective only in Jefferson and Neosho Counties may use for repair work any surplus of funds left after payment is made for construction of the drainage works;

additional assessments for maintenance purposes may be made by the county commissioners apportioned like the cost of original construction. The directors of drainage districts incorporated under the law of 1905 are empowered to establish a general fund by an annual general tax not exceeding 5 mills on the dollar on all taxable property in the district, from which payment may be made for repairing the drainage works. The supervisors of drainage districts incorporated under the law of 1911 are authorized to levy assessments for repairing the drainage works of the district, based upon the original assessment of benefits, and they may appoint overseers to see that the works are maintained in good condition.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises . . . . .	93,856	100.0	\$936,508	100.0	\$273,845
By district forces . . . . .	69,154	73.7	676,377	72.2	12,000
No maintenance provided . . . . .	13,126	14.0	117,976	12.6	.....
Not reporting <sup>1</sup> . . . . .	11,576	12.3	142,155	15.2	261,845

<sup>1</sup> Includes 2,500 acres reporting maintenance by contract.  
<sup>2</sup> Includes 2,200 acres maintained by private owners.

**Date of organization.**—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises . . . . .	93,856	100.0	93,856	100.0
1880 to 1889 <sup>1</sup> . . . . .	1,446	1.5	1,446	1.5
1890 to 1899 . . . . .	18,482	19.7	18,482	19.7
1900 to 1904 . . . . .	9,368	10.0	9,368	10.0
1905 to 1909 . . . . .	16,981	18.1	16,981	18.1
1910 to 1914 . . . . .	20,932	22.3	20,932	22.3
1915 to 1919 . . . . .	26,647	28.4	26,647	28.4

<sup>1</sup> Includes 800 acres organized 1879.

since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Kansas earlier than 1879.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises . . . . .	\$936,508	100.0	\$273,845
1880 to 1889 <sup>1</sup> . . . . .	8,900	1.0	.....
1890 to 1899 . . . . .	98,602	10.5	.....
1900 to 1904 . . . . .	83,272	10.0	.....
1905 to 1909 . . . . .	213,000	22.7	7,500
1910 to 1914 . . . . .	290,459	31.0	.....
1915 to 1919 . . . . .	232,215	24.8	206,845

<sup>1</sup> Includes estimated cost of 800 acres organized 1879.

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees . . . . .	145.6	100.0	213.0	100.0	172.9	100.0
1880 to 1889 <sup>1</sup> . . . . .	4.2	2.9	.....	.....	1.2	0.7
1890 to 1899 . . . . .	59.8	41.1	1.7	0.8	82.0	47.4
1900 to 1904 . . . . .	17.5	12.0	1.0	0.5	35.3	20.4
1905 to 1909 . . . . .	11.4	7.8	210.0	98.6	18.6	11.3
1910 to 1914 . . . . .	13.8	9.5	0.3	0.1	0.2	0.1
1915 to 1919 . . . . .	38.9	26.7	.....	.....	34.6	20.1

<sup>1</sup> Includes 1.2 miles of ditch and 1.2 miles of levee in district organized 1879.

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are wheat, corn, and vegetables. Statistics were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Allen.	Anderson.	Atchison.	Bourbon.	Brown.	Butler.	Chase.
1	Number of all farms in the state or county . . . . .	165,286	1,932	1,914	1,717	2,517	2,107	2,680	873
2	Farms reporting land having drainage . . . . .	2,806	69	98	156	59	167	24	26
3	Farms reporting land needing drainage . . . . .	2,573	84	92	125	74	100	20	13
4	Farms in drainage and levee districts . . . . .	628	18	.....	32	.....	4	3	10
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county . . . . . acres . . . . .	52,335,360	325,120	369,280	263,680	419,840	365,440	917,760	492,160
6	All land in farms . . . . . acres . . . . .	45,425,179	293,849	340,641	245,840	401,550	334,407	770,878	350,315
7	Improved land in farms . . . . . acres . . . . .	30,600,760	238,042	261,164	209,939	285,849	299,810	419,017	105,641
8	Woodland in farms . . . . . acres . . . . .	1,313,093	7,180	18,241	18,856	18,214	16,332	19,408	9,874
9	Other unimproved land in farms . . . . . acres . . . . .	18,511,326	48,627	61,236	17,045	97,487	18,265	332,453	234,800
10	Farm land reported as provided with drainage . . . . . acres . . . . .	106,985	1,631	2,286	4,410	3,163	5,300	1,014	1,447
11	Farm land reported as needing drainage . . . . . acres . . . . .	68,292	1,684	2,325	2,094	1,832	1,875	271	226
12	Drainage only . . . . . acres . . . . .	36,371	823	1,163	1,233	1,397	1,103	38	75
13	Drainage and clearing . . . . . acres . . . . .	31,921	861	1,162	861	435	772	233	151

DRAINAGE—KANSAS.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Chan- tauqua.	Chero- kee.	Clay.	Cowley.	Craw- ford.	Doni- phan.	Douglas.	Elk.	Frank- lin.
1	Number of all farms in the county.....	1,291	2,350	1,938	2,896	2,439	1,722	2,085	1,289	2,261
2	Farms reporting land having drainage.....	10	86	13	42	43	55	159	41	118
3	Farms reporting land needing drainage.....	26	228	5	38	64	58	90	41	104
4	Farms in drainage and levee districts.....	5	3	1	8	2	18	70	.....	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	417,280	387,200	408,320	725,120	387,200	241,920	300,160	417,280	374,400
6	All land in farms..... acres..	360,963	321,462	397,096	660,370	321,058	219,428	231,872	360,693	337,704
7	Improved land in farms..... acres..	134,509	279,864	321,724	340,640	267,927	185,119	202,104	167,205	258,622
8	Woodland in farms..... acres..	40,074	23,880	8,744	21,663	12,050	23,562	30,947	19,289	22,480
9	Other unimproved land in farms..... acres..	212,380	17,738	66,628	298,067	41,081	10,747	48,821	174,199	56,802
10	Farm land reported as provided with drainage..... acres..	563	3,076	753	1,682	1,702	1,364	7,887	1,242	2,684
11	Farm land reported as needing drainage..... acres..	289	6,637	83	931	1,275	1,434	1,834	508	1,982
12	Drainage only..... acres..	48	1,085	20	795	554	1,147	1,373	246	543
13	Drainage and clearing..... acres..	241	5,572	63	136	721	287	461	352	1,439

		Green- wood.	Harvey.	Jackson.	Jefferson.	Johnson.	Labette.	Leaven- worth.	Lincoln.	Linn.
1	Number of all farms in the county.....	1,883	1,719	2,416	2,261	2,223	2,505	2,115	1,466	2,111
2	Farms reporting land having drainage.....	36	58	71	81	259	84	89	7	48
3	Farms reporting land needing drainage.....	53	41	20	134	65	51	64	7	61
4	Farms in drainage and levee districts.....	.....	32	57	72	.....	15	13	2	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	741,120	345,600	432,000	347,520	311,040	411,520	281,600	481,440	392,320
6	All land in farms..... acres..	617,730	324,428	380,070	343,520	271,248	373,417	270,416	441,498	341,559
7	Improved land in farms..... acres..	250,793	296,447	330,279	282,532	232,757	303,701	207,560	276,127	248,423
8	Woodland in farms..... acres..	30,617	2,985	22,055	34,683	14,838	14,149	41,065	6,225	32,589
9	Other unimproved land in farms..... acres..	336,320	24,996	27,736	26,314	23,653	55,567	21,191	159,146	60,547
10	Farm land reported as provided with drainage..... acres..	1,108	4,801	2,024	3,588	3,353	4,118	2,300	835	812
11	Farm land reported as needing drainage..... acres..	647	671	392	2,837	1,035	1,616	3,855	120	1,071
12	Drainage only..... acres..	157	784	33	672	663	750	1,184	60	294
13	Drainage and clearing..... acres..	490	87	359	2,165	373	866	2,671	60	777

		McPher- son.	Marshall.	Miami.	Mont- gomery.	Nemaha.	Neosho.	Osage.	Potta- watomia.	Reno.
1	Number of all farms in the county.....	2,656	2,798	2,303	2,250	2,508	2,160	2,578	2,151	3,358
2	Farms reporting land having drainage.....	36	12	283	60	22	55	32	22	10
3	Farms reporting land needing drainage.....	79	10	130	89	70	49	28	37	20
4	Farms in drainage and levee districts.....	23	8	7	18	8	19	.....	18	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	576,000	579,200	385,280	412,160	458,240	371,200	459,520	530,560	794,880
6	All land in farms..... acres..	557,662	552,308	354,375	362,134	426,132	326,171	431,204	500,933	757,440
7	Improved land in farms..... acres..	458,673	434,248	287,068	265,948	373,622	259,827	312,964	278,609	642,358
8	Woodland in farms..... acres..	6,403	24,567	25,179	23,439	21,636	17,127	14,012	27,027	11,098
9	Other unimproved land in farms..... acres..	92,586	93,493	42,128	72,747	31,394	49,217	104,228	195,297	103,984
10	Farm land reported as provided with drainage..... acres..	4,992	1,850	6,150	2,350	763	1,388	1,058	1,447	557
11	Farm land reported as needing drainage..... acres..	3,329	179	3,807	819	1,269	2,237	537	939	774
12	Drainage only..... acres..	3,259	18	2,594	209	516	645	330	424	354
13	Drainage and clearing..... acres..	70	161	1,213	610	763	1,592	207	515	420

		Riley.	Saline.	Sedg- wick.	Shawnee.	Sumner.	Wash- ington.	Wilson.	Wood- son.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,572	1,604	3,347	2,303	3,066	2,790	1,917	1,121	73,954
2	Farms reporting land having drainage.....	15	20	26	63	18	13	125	14	81
3	Farms reporting land needing drainage.....	11	7	54	83	16	40	98	17	140
4	Farms in drainage and levee districts.....	11	14	20	64	9	8	21	4	13
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	386,560	460,800	636,160	348,160	754,560	577,280	371,840	321,920	33,374,720
6	All land in farms..... acres..	339,636	421,867	614,428	293,576	705,135	540,225	333,371	240,043	28,280,517
7	Improved land in farms..... acres..	180,672	295,218	537,529	212,829	619,102	382,871	248,062	188,771	18,215,874
8	Woodland in farms..... acres..	14,857	17,485	16,256	20,037	13,253	17,846	17,820	19,810	494,556
9	Other unimproved land in farms..... acres..	144,107	109,164	60,344	60,660	72,775	139,508	67,499	30,462	9,570,087
10	Farm land reported as provided with drainage..... acres..	990	1,916	1,132	2,049	2,086	428	5,596	432	2,816
11	Farm land reported as needing drainage..... acres..	2,617	953	956	2,674	558	735	2,773	280	5,041
12	Drainage only..... acres..	2,532	958	767	528	388	352	2,153	133	3,996
13	Drainage and clearing..... acres..	85	.....	189	2,146	170	383	620	147	1,045

<sup>1</sup>No drainage reported in Barber, Cheyenne, Clark, Comanche, Decatur, Ellis, Ellsworth, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kiowa, Lane, Logan, Mitchell, Morton, Ness, Norton, Russell, Scott, Seward, Sheridan, Sherman, Stafford, Stanton, Stevens, Thomas, Trego, Wallace, and Wichita Counties.

DRAINAGE—KANSAS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Atchison.	Jefferson.	McPherson.	Marion.	Neosho.	Pottawatomie.	Saline.	Shawnee.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>											
1	Approximate land area of the state or county .....	52,335,360	263,680	347,520	576,000	609,920	371,200	530,560	460,800	348,160	2,900,480
2	All land in operating drainage enterprises .....	93,856	8,009	14,147	4,760	5,216	21,758	9,567	4,636	12,518	13,247
3	Improved land .....	87,449	7,208	14,046	4,760	5,216	17,558	9,567	4,636	11,281	13,179
4	Per cent of all improved land in farms .....	0.3	3.4	5.0	1.0	1.2	6.8	3.4	1.6	5.3	0.7
5	Timber and cut-over land .....	4,135	801	26	—	—	2,005	—	—	1,235	68
6	Other unimproved land .....	2,272	—	75	—	—	2,197	—	—	—	—
7	Swampy or subject to overflow .....	6,704	—	—	600	4,694	95	—	96	1,219	—
8	Suffering a loss of crops from defective drainage .....	6,033	—	79	—	4,694	—	—	96	1,219	—
9	Assessed acreage .....	93,856	8,009	14,147	4,760	5,216	21,758	9,567	4,636	12,518	13,247
10	Excess over all land in operating enterprises .....	—	—	—	—	—	—	—	—	—	—
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed .....	133.4	4.4	18.3	8.3	1.6	58.9	7.7	9.0	2.6	27.6
12	Additional under construction .....	7.2	—	—	—	3.2	—	—	—	4.0	—
13	Maximum completed in any enterprise .....	14.4	4.4	2.9	8.0	1.6	14.4	7.7	7.8	0.9	3.2
14	Maximum width at bottom of ditch <sup>2</sup> .....	54	24	45	20	54	8	25	18	40	20
15	Maximum of average depths of outlet ditches <sup>2</sup> .....	20.0	20.0	20.0	5.0	25.0	9.0	8.0	7.0	22.0	20.0
16	Mean depth of branch ditches <sup>2</sup> .....	4.3	—	5.8	5.0	—	2.3	4.0	5.0	5.0	3.6
Tile drains:											
17	Completed .....	213.0	—	0.2	—	—	2.5	—	—	—	210.3
18	Additional under construction .....	—	—	—	—	—	—	—	—	—	—
19	Maximum completed in any enterprise .....	210.0	—	0.2	—	—	1.5	—	—	—	210.0
20	Maximum size of tile .....	30	—	14	—	—	8	—	—	—	30
Accessory levees and dikes:											
21	Completed .....	155.1	—	—	9.5	—	119.8	13.5	1.2	6.0	15.1
22	Additional under construction .....	7.8	—	—	7.1	—	—	—	—	0.7	—
Pumping plants:											
23	Engine capacity .....	65	—	—	—	—	—	—	—	—	65
24	Pump capacity .....	4,000	—	—	—	—	—	—	—	—	4,000
25	Area served by pumps .....	2,200	—	—	—	—	—	—	—	—	2,200
26	Area drained by open ditches only <sup>3</sup> .....	37,038	8,009	13,737	—	5,216	1,200	—	3,836	688	4,152
27	Length of these ditches .....	53.3	4.4	16.4	—	4.8	3.0	—	7.8	5.2	11.7
28	Average length per acre .....	7.6	2.9	6.3	—	4.9	13.2	—	10.7	30.9	14.9
29	Area having open ditches and levees <sup>4</sup> .....	47,993	—	—	4,760	—	16,343	9,567	800	11,628	4,895
30	Length of these ditches .....	68.3	—	—	8.3	—	40.2	7.7	1.2	1.4	9.5
31	Average length per acre .....	7.5	—	—	9.2	—	13.0	4.2	7.9	0.6	10.3
32	Length of the accessory levees .....	135.7	—	—	16.6	—	95.5	13.5	1.2	6.7	5.2
33	Area drained by open ditches and tile <sup>4</sup> .....	8,825	—	410	—	4,215	—	—	—	—	4,200
34	Length of these drains .....	237.0	—	2.1	—	18.2	—	—	—	—	216.7
35	Average length per acre .....	141.8	—	27.0	—	22.8	—	—	—	—	272.4
36	Length of the accessory levees .....	34.2	—	—	—	24.3	—	—	—	—	9.9
<b>DEVELOPMENT OF LAND.</b>											
37	Improved land in operating enterprises, 1920 .....	87,449	7,208	14,046	4,760	5,216	17,558	9,567	4,636	11,281	13,179
38	Improved land prior to drainage .....	74,072	6,407	11,522	4,760	5,216	16,113	4,530	4,636	11,281	9,697
39	Increase since drainage .....	13,377	801	2,524	—	—	1,445	5,037	—	—	3,572
40	Per cent of increase .....	18.1	12.5	21.9	—	—	9.0	111.2	—	—	37.2
41	Per cent increase is of all improved land in farms, 1920 .....	(*)	0.4	0.9	—	—	0.6	1.8	—	—	0.2
42	Timber and cut-over land, 1920 .....	4,135	801	26	—	—	2,005	—	—	1,235	68
43	Timber and cut-over land prior to drainage .....	6,848	1,602	539	—	—	2,917	—	—	1,235	555
44	Decrease since drainage .....	2,713	801	513	—	—	912	—	—	—	487
45	Per cent of decrease .....	39.6	50.0	95.2	—	—	31.3	—	—	—	87.7
46	Other unimproved land, 1920 .....	2,272	—	75	—	—	2,197	—	—	—	—
47	Other unimproved land prior to drainage .....	12,936	—	2,066	—	—	2,728	5,037	—	—	3,085
48	Decrease since drainage .....	10,664	—	2,011	—	—	531	5,037	—	—	3,085
49	Per cent of decrease .....	82.4	—	96.4	—	—	19.5	—	—	—	100.0
50	Swampy or subject to overflow, 1920 .....	6,704	—	—	600	4,694	95	—	96	1,219	—
51	Swampy or subject to overflow prior to drainage .....	16,452	—	2,820	3,720	4,694	649	1,232	134	1,219	1,984
52	Decrease since drainage .....	9,748	—	2,820	3,120	—	554	1,232	38	—	1,984
53	Per cent of decrease .....	59.3	—	100.0	83.9	—	85.4	100.0	28.4	—	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
54	Total capital invested in and required for completion of operating enterprises .....	1,210,353	90,000	127,692	43,500	300,000	122,450	74,439	23,730	232,500	196,042
55	Capital invested in these enterprises to Dec. 31, 1919 .....	936,508	90,000	127,692	28,500	53,155	122,450	74,439	23,730	220,500	196,042
56	Additional capital required to complete these enterprises .....	273,845	—	—	15,000	246,845	—	—	—	12,000	—
57	Average cost per acre when completed .....	12.80	11.24	9.03	9.14	57.52	5.63	7.78	5.12	18.58	14.80
58	Enterprises constructing open ditches only .....	677,961	90,000	125,427	—	300,000	1,140	—	20,730	90,000	50,664
59	Average cost per acre when completed .....	18.30	11.24	9.13	—	57.52	0.95	—	5.40	101.35	12.20
60	Enterprises constructing open ditches and levees .....	431,452	—	—	43,500	—	98,645	74,439	3,000	142,500	66,378
61	Average cost per acre when completed .....	8.99	—	—	9.14	—	6.04	7.78	3.75	12.25	14.17
62	Enterprises constructing open ditches and tile drains .....	100,930	—	2,265	—	—	22,665	—	—	—	76,000
63	Average cost per acre when completed .....	11.44	—	5.52	—	—	5.38	—	—	—	18.10
<b>CROPS.</b>											
Improved land in enterprises reporting—											
64	Wheat as principal crop on drained land .....	51,819	—	14,046	4,760	5,216	16,674	—	4,636	1,202	5,285
65	Corn as principal crop on drained land .....	33,451	7,208	—	—	—	832	9,567	—	9,900	5,894
66	Vegetables as principal crop on drained land .....	2,179	—	—	—	—	—	—	—	179	2,000

<sup>1</sup> Includes only Chase, Doniphan, Douglas, Jackson, Labette, Riley, and Sedgwick Counties.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Includes 6,416 acres having open ditches, tile drains, and levees.  
<sup>4</sup> Includes 4,215 acres having open ditches, tile drains, and levees.  
<sup>5</sup> Includes 2,200 acres having open ditches, tile drains, and levees.

\* Less than one-tenth of 1 per cent.  
<sup>6</sup> Includes cost of 34.2 miles of accessory levees.  
<sup>7</sup> Includes cost of 24.3 miles of accessory levees.  
<sup>8</sup> Includes cost of 9.9 miles of accessory levees.

## KENTUCKY.

The following pages present the statistics of drainage for Kentucky collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of timbered and other unimproved land not yet

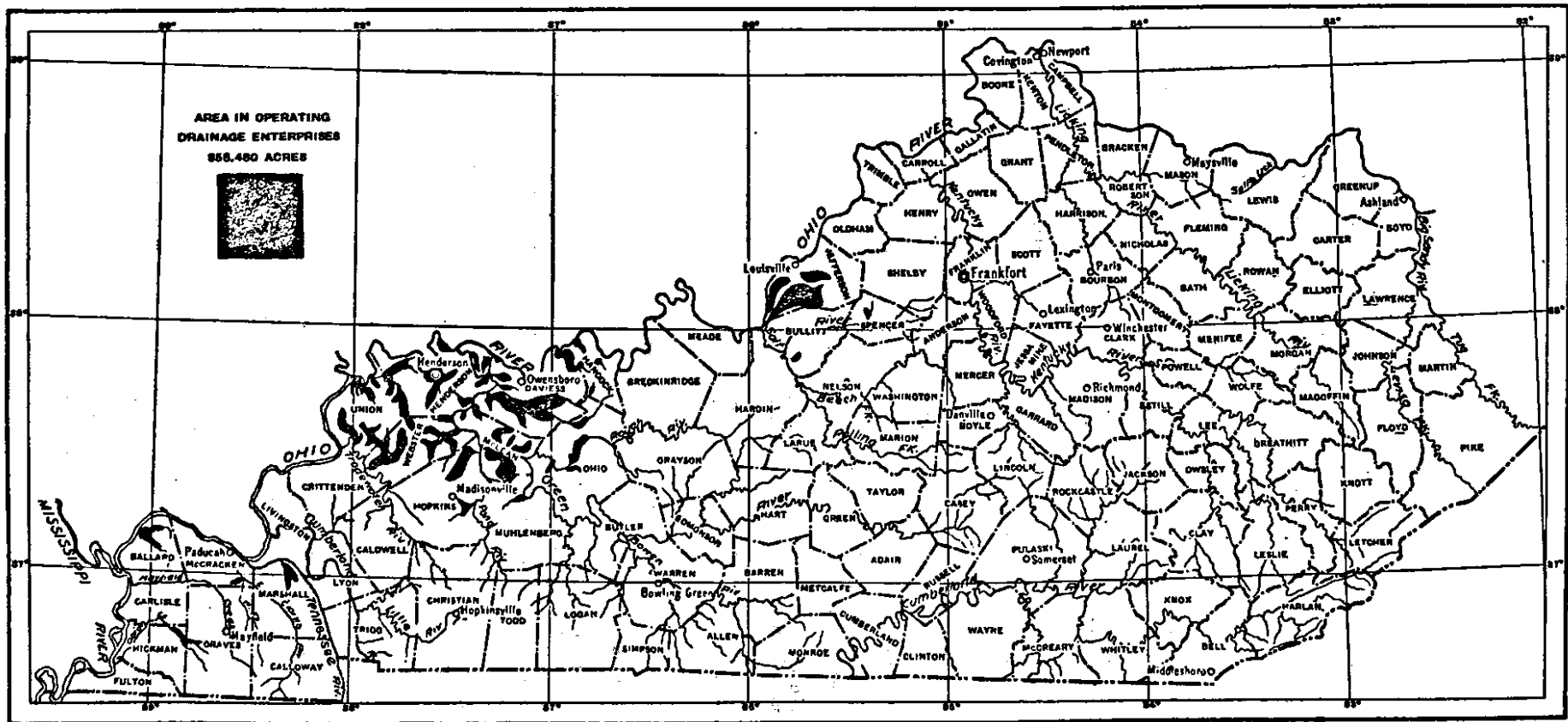
in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	270, 626	100. 0
Farms reporting land having drainage.....	5, 817	2. 1
Farms reporting land needing drainage.....	19, 592	7. 2
All land in farms..... acres..	21, 612, 772	100. 0
Improved land in farms..... acres..	13, 975, 746	64. 7
Farm land reported as provided with drainage..... acres..	225, 228	1. 0
Farm land reported as needing drainage..... acres..	573, 299	2. 7
Needing drainage only..... acres..	84, 189	0. 4
Needing drainage and clearing..... acres..	489, 110	2. 3
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	25, 715, 840	100. 0
All land in operating drainage enterprises..... acres..	358, 480	1. 4
Improved land..... acres..	245, 334	1. 0
Per cent of all improved land in farms.....	1. 8	.....
Timber and cut-over land..... acres..	92, 495	0. 4
Other unimproved land..... acres..	20, 651	0. 1
Swampy, subject to overflow, seeped, or alkali..... acres..	69, 413	0. 3
Suffering a loss of crops from defective drainage..... acres..	36, 723	0. 1
Improved land prior to drainage..... acres..	181, 915	0. 7
Increase since drainage began..... acres..	63, 419	0. 2
Land in nonoperating enterprises..... acres..	113, 394	0. 4
Open ditches in operating enterprises..... miles..	741. 5	100. 0
Completed..... miles..	664. 5	89. 6
Additional under construction..... miles..	77. 0	10. 4
Tile drains in operating enterprises..... miles..	87. 2	100. 0
Completed..... miles..	86. 2	98. 9
Additional under construction..... miles..	1. 0	1. 1
Total capital invested in and required for completion of operating enterprises... \$1, 820, 996	\$1, 820, 996	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	1, 521, 725	83. 6
Additional capital required to complete these enterprises.....	299, 271	16. 4
Average cost per acre when completed.....	5. 08	.....

# KENTUCKY

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

**TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.**

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	471,874	100.0	\$1,620,027	100.0	\$1,825,513
Operating enterprises.....	358,480	76.0	1,521,725	93.9	299,271
With works completed.....	288,143	61.1	1,278,701	78.9	.....
With works under construction.....	70,337	14.9	243,024	15.0	299,271
Nonoperating enterprises.....	113,394	24.0	98,302	6.1	1,526,242

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

**Location of enterprises.**—Almost two-thirds of the area in operating drainage enterprises in Kentucky are situated in Daviess and Henderson Counties and the counties adjoining. One-fourth of the area is in Jefferson County, and nearly all the rest is in the counties west of Tennessee River.

**TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.**

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	471,874	100.0	\$1,620,027	100.0	\$1,825,513
Operating enterprises.....	358,480	76.0	1,521,725	93.9	299,271
Green River.....	138,829	29.4	629,517	38.9	40,869
Mississippi River.....	8,079	1.7	50,000	3.1	.....
Ohio River.....	203,392	43.1	760,042	46.9	252,402
Tennessee River.....	8,180	1.7	82,166	5.1	.....
Nonoperating enterprises.....	113,394	24.0	98,302	6.1	1,526,242
Green River.....	73,045	15.5	.....	.....	957,050
Mississippi River.....	21,143	4.5	50,000	3.1	500,000
Ohio River.....	19,206	4.1	48,302	3.0	60,192

One enterprise under private ownership in Lewis County is the only operating enterprise found in the eastern half of the state. From most of the enterprises the drainage water is discharged into one or another of the smaller tributaries of Ohio River.

**Condition of land in enterprises.**—In the extreme western end of the state the drainage enterprises are for the purpose of relieving the bottom land in the narrow stream valleys, which is subject to overflow in flood seasons. In the group of counties where the greatest amount of drainage has been done, in the region of Henderson and Owensboro, the enterprises are for draining rather broad tracts of swamp land caused by overflow of the larger tributaries of Ohio River. The lower courses of such streams as Green River and its principal branches have but slight fall, and the channels are not sufficient to carry the more rapid run-off from the rolling land lying to the south and east. The nature of the drainage problem in the vicinity of Louisville is similar to that just described. In all counties along the Ohio and the Mississippi, high water in those rivers causes overflow of considerable areas.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

**TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.**

CONDITION OF LAND:	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of total.			
All land in enterprises.....	358,480	100.0	288,143	70,337	113,394
Improved land.....	245,834	68.4	209,468	35,866	67,526
Timber and cut-over land.....	92,495	25.8	71,152	21,343	28,539
Other unimproved land.....	20,651	5.8	7,523	13,128	17,329
Swampy or subject to overflow.....	69,413	19.4	37,429	31,984	55,339
Suffering loss of crops.....	36,723	10.2	26,873	10,050	375

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 179 operating drainage enterprises are counted in Kentucky, with an average area of 2,003 acres each. There are 18 such enterprises of 5,000 acres or more each, 100 of between 500 and 5,000 acres, and 61 of less than 500 acres each. There is no overlapping of the enterprises in this state.



TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	358,480	358,480	100.0
Less than 200 acres.....	1,651	1,651	0.5
200 to 499 acres.....	16,537	16,537	4.6
500 to 999 acres.....	23,143	23,143	6.5
1,000 to 4,999 acres.....	130,176	130,176	36.3
5,000 to 9,999 acres.....	79,592	79,592	22.2
10,000 to 49,999 acres.....	107,381	107,381	30.0

Character of enterprises.—Very nearly all of the drainage enterprises in Kentucky are drainage districts under the control of the county drainage commissioners, though the enterprises in Jefferson County are county drains under the fiscal court, and nine of the operating enterprises in the state are under individual ownership. The drainage law of 1912 provided that in each county where there is a public ditch, drain, levee, or similar improvement established, the county judge should appoint a board of three drainage commissioners. An amendment in 1918 provides for the appointment of one county drainage commissioner when the term of the existing board should expire.

The drainage districts, with one exception, have been established by decree of the county judges in accordance with the laws of July 10, 1893 (ch. 266), of March 23, 1900 (ch. 30), and of March 19, 1912 (ch. 132). Each of these superseded the earlier statute. The first of these acts was the first general drainage law of the state.

Under the first drainage law, one or more persons interested filed a petition for a drain, and the county judge appointed three viewers to examine the land that would be affected by the proposed work, to locate the drain, to assess benefits and damages, and to determine whether the proposed improvement would be of public utility and benefit. The judge ordered the district established or he dismissed proceedings, in accordance with the report of the viewers, except that in case of remonstrance a report was first obtained from reviewers specially appointed by the judge to review the work and findings of the first viewers. Construction of the drain was apportioned to the landowners in proportion to the benefits they would receive. For work not done by the landowners, contract was let by the county clerk and the costs were collected by the sheriff. The requirements and method of procedure under the law of 1900 were very similar to those under the law of 1893.

The law of 1912 required only that the petition for the drainage district be signed by one or more owners of land that would be assessed for the enterprise, but the amendment of March 28, 1918 (ch. 114), requires the signatures of at least 25 per cent of the landowners, or of the owners of not less than 25 per cent of the land

to be affected. A board of three viewers appointed by the county judge makes such a survey of the proposed district as is necessary to report regarding the practicability and utility of the project and the boundary of the area that will be benefited. If the report is unfavorable, proceedings are dismissed at the cost of the petitioners. If the report is favorable, public hearing upon it is held by the county court before the order of establishment is issued. Appeals may be taken to the circuit court and to the court of appeals. The county board of drainage commissioners employs an engineer to make plans and specifications for the drainage improvements. Damages then are assessed by the original viewers, who also divide the land in the district into five classes for assessment of the cost of the district. The cost assessments per acre in the five classes are made in the ratio 5 : 4 : 3 : 2 : 1. When necessary, in order to secure substantial justice, the number of classes may be increased or diminished. Benefits to railroad companies are assessed as fixed sums. The amendment of March 28, 1918, permits the viewers to estimate the value of the benefits that will accrue to each tract instead of classifying the land. If the total cost averages less than 25 cents per acre, it is collected in one installment; if more than 25 cents per acre, the drainage commissioners issue bonds running 2 to 11 years for the amount of the cost assessments not paid within 30 days.

Separate drainage districts may be formed under the law of 1912, to be under the control of special commissioners elected by the landowners instead of under the county drainage commissioners. When the improvement works have been constructed and paid for, control of the enterprise passes to the county drainage commissioners. A special petition for such separate district must be filed at the time of filing exceptions to the viewers' preliminary report, and must be signed by the owners of at least 50 per cent of the land, who must comprise one-fourth or more of all the landowners in the district.

Drainage districts may be established by either the county courts or the circuit courts, under a law of March 26, 1918 (ch. 64), which also provides for a county board of three drainage commissioners. The petition for a district must be signed by 25 per cent of the landowners or by the owners of 25 per cent of the land in the proposed district. Viewers are appointed to make a preliminary report, as for districts organized under the law of 1912, and after the court orders the district established it is under control of the county drainage commissioners. Damages and benefits are assessed by a board of appraisers appointed by the court. The circuit court has appellate jurisdiction from judgments of the county court, and appeals may be taken from the circuit court to the court of appeals. After contract for construction has been let, the board of drainage commissioners assesses the estimated cost against the land in proportion to the

assessed benefits. The board may issue bonds of the district to run not more than 30 years.

County drains may be constructed to reclaim swamp land for benefit of health and for other purposes, under a statute of March 19, 1894 (ch. 97). The fiscal court has control over this work. The cost is paid by a general tax upon all property in the county subject to taxation for state purposes. The cost is limited to 2 per cent of the value of such property. If the probable cost will exceed the county revenue for the year in which the works will be constructed, the project must be approved by two-thirds of the votes cast at a special election. Should the proposed drainage affect but a small part of the county, a special taxing district may be formed to vote upon and to pay for the improvements, but this was not done in Jefferson County.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	471, 874	100. 0	\$1, 620, 027	100. 0	\$1, 825, 513
Operating enterprises.....	358, 480	76. 0	1, 521, 725	93. 9	299, 271
Drainage districts.....	262, 080	55. 6	1, 297, 237	80. 1	277, 271
Laws of 1893, ch. 268.....	70, 530	15. 0	239, 786	14. 8	.....
Laws of 1900, ch. 30.....	48, 361	10. 2	167, 595	9. 7	.....
Laws of 1912, ch. 132.....	133, 409	28. 3	827, 290	51. 1	277, 271
Laws of 1918, ch. 64.....	4, 480	0. 9	72, 566	4. 5	.....
County drains—Laws of 1894, ch. 97.....	90, 000	19. 1	175, 000	10. 8	22, 000
Individual ownership.....	6, 400	1. 4	49, 488	3. 1	.....
Nonoperating enterprises.....	113, 394	24. 0	98, 302	6. 1	1, 526, 242
Drainage districts <sup>1</sup> .....	113, 394	24. 0	98, 302	6. 1	1, 526, 242
Laws of 1900, ch. 30 <sup>1</sup> .....	1, 726	0. 4	1, 000	0. 1	2, 489
Laws of 1912, ch. 132.....	85, 434	18. 1	47, 302	2. 9	988, 445
Laws of 1918, ch. 64.....	26, 234	5. 6	50, 000	3. 1	535, 308

<sup>1</sup> Includes one enterprise under individual ownership.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 664.5 miles of open ditches, 86.2 miles of tile drains, and 0.2 mile of accessory levees; the additional lengths under construction were 77.0 miles of open ditches and 1.0 mile of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts for land drainage in Kentucky.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would show the mean depth for the state 5.0 instead of 5.1 feet.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	358, 480	100. 0	\$1, 521, 725	100. 0	\$299, 271
Open ditches only.....	245, 605	68. 4	1, 406, 698	92. 4	295, 701
Open ditches and levees.....	1, 140	0. 3	5, 333	0. 5	.....
The drains only.....	117	(1)	1, 979	0. 1	.....
Open ditches and tile drains.....	11, 616	3. 2	104, 717	6. 9	3, 570

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	358, 480	100. 0
Less than 3 feet.....	4, 491	1. 3
3.0 to 3.9 feet.....	21, 031	5. 9
4.0 to 4.9 feet.....	41, 243	11. 5
5.0 to 5.9 feet.....	19, 379	5. 4
6.0 to 6.9 feet.....	21, 444	6. 0
7.0 to 7.9 feet.....	15, 747	4. 4
8.0 to 8.9 feet.....	13, 579	3. 8
Not reporting branches.....	221, 566	61. 8

Maintenance of works.—The drainage law of 1912 requires that all ditches, levees, and like public improvements under control of the board of drainage commissioners shall be kept in good repair by that board, which is authorized to appoint a superintendent of drainage to have charge of the work. Assessments for maintenance and repair work may be made, apportioned like the cost of original construction, but not to exceed in any year 10 per cent of that cost. The law of 1918 also provides for maintenance of drainage works by the board of drainage commissioners. Both statutes define as public ditches all watercourses into which any public drains empty, and place such streams under control of the county drainage commissioners. The later law does not limit such natural public drains to nonnavigable streams, as was done in the earlier statute.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	358,480	100.0	\$1,521,725	100.0	\$299,271
By district forces <sup>1</sup> .....	221,674	61.8	896,795	58.9	37,000
By contract.....	79,959	22.3	309,932	20.4	8,780
By landowners.....	27,513	7.7	220,265	14.5	10,790
Not reporting <sup>2</sup> .....	29,334	8.2	94,732	6.2	242,701

<sup>1</sup> Includes 8,079 acres for which method of maintenance was not specified.  
<sup>2</sup> Includes 1,514 acres reporting maintenance not provided.

**Date of organization.**—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		ASSESSED AREA.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	358,480	100.0	358,480	100.0
1890 to 1899 <sup>1</sup> .....	15,111	4.2	15,111	4.2
1900 to 1904.....	28,085	7.8	28,085	7.8
1905 to 1909.....	69,741	19.5	69,741	19.5
1910 to 1914.....	131,160	36.6	131,160	36.6
1915 to 1919.....	112,583	31.4	112,583	31.4
Not reported <sup>2</sup> .....	1,800	0.5	1,800	0.5

<sup>1</sup> Includes 800 acres under individual ownership, on which drainage was begun in 1888.  
<sup>2</sup> All under individual ownership.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,521,725	100.0	\$299,271
1890 to 1899 <sup>1</sup> .....	74,326	4.9	.....
1900 to 1904.....	69,499	4.6	.....
1905 to 1909.....	190,355	12.5	.....
1910 to 1914.....	516,628	34.0	10,790
1915 to 1919.....	650,629	42.8	288,571
Not reported <sup>2</sup> .....	20,288	1.3	.....

<sup>1</sup> Includes cost for 800 acres under individual ownership, on which drainage was begun in 1888.  
<sup>2</sup> All under individual ownership.

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	741.5	100.0	87.2	100.0	0.2	100.0
1890 to 1899 <sup>1</sup> .....	69.6	9.4	10.0	11.5	.....	.....
1900 to 1904.....	74.3	10.0	2.6	3.0	.....	.....
1905 to 1909.....	111.6	15.1	.....	.....	0.2	100.0
1910 to 1914.....	230.5	31.1	32.5	37.3	.....	.....
1915 to 1919.....	252.6	34.1	13.2	15.1	.....	.....
Not reported <sup>2</sup> .....	2.9	0.4	28.9	33.1	.....	.....

<sup>1</sup> Includes works on 800 acres under individual ownership, on which drainage was begun in 1888.  
<sup>2</sup> All under individual ownership.

**Crops.**—The principal crop grown upon the drained land in drainage enterprises is corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Anderson.	Ballard.	Bath.	Boyd.	Bullitt.	Butler.	Caldwell.
1 Number of all farms in the state or county.....	270,626	1,650	1,979	2,005	830	1,259	2,540	2,218
2 Farms reporting land having drainage.....	5,817	20	109	38	70	77	102	57
3 Farms reporting land needing drainage.....	19,592	15	65	110	80	106	401	44
4 Farms in drainage and levee districts.....	773	.....	59	.....	.....	1	.....	.....
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the state or county.....	25,715,840	128,640	161,280	172,800	101,760	197,120	266,880	206,080
6 All land in farms.....	21,612,772	128,523	142,010	130,238	72,649	160,306	246,016	202,957
7 Improved land in farms.....	13,975,746	92,373	108,971	91,459	50,738	93,640	132,770	143,970
8 Woodland in farms.....	6,018,280	8,612	29,766	26,718	15,981	46,364	83,202	39,433
9 Other unimproved land in farms.....	1,618,746	27,638	3,273	12,061	5,930	20,302	25,044	19,554
10 Farm land reported as provided with drainage.....	225,228	822	2,859	817	1,153	4,393	4,525	885
11 Farm land reported as needing drainage.....	573,299	1,051	1,267	4,069	3,020	5,154	14,268	1,818
12 Drainage only.....	84,189	141	464	186	209	528	4,227	839
13 Drainage and clearing.....	489,110	910	803	3,883	2,811	4,626	10,041	979

DRAINAGE—KENTUCKY.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Calloway.	Carlisle.	Casey.	Clay.	Crittenden.	Cumberland.	Davies.	Estill.
1	Number of all farms in the county.....	4,283	1,437	2,912	8,088	2,041	1,747	3,808	1,832
2	Farms reporting land having drainage.....	28	18	8	83	31	93	913	33
3	Farms reporting land needing drainage.....	90	159	176	285	185	206	229	188
4	Farms in drainage and levee districts.....		3		3	1	10	34	
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres.....	263,680	126,720	242,560	805,620	250,240	247,680	305,920	162,560
6	All land in farms..... acres.....	243,057	102,199	226,643	250,128	210,711	176,999	240,006	139,160
7	Improved land in farms..... acres.....	163,346	81,381	102,992	109,492	152,911	70,372	201,722	61,069
8	Woodland in farms..... acres.....	62,907	17,790	115,993	131,812	47,935	97,733	16,298	70,972
9	Other unimproved land in farms..... acres.....	16,804	3,028	7,658	8,824	9,885	8,994	21,986	7,119
10	Farm land reported as provided with drainage..... acres.....	657	713	1,300	7,756	604	1,196	42,036	955
11	Farm land reported as needing drainage..... acres.....	1,179	5,303	4,270	8,044	4,145	3,352	5,775	4,126
12	Drainage only..... acres.....	613	3,324	80	868	1,391	678	2,126	151
13	Drainage and clearing..... acres.....	566	1,979	4,240	7,176	2,764	2,674	3,649	3,975

		Fulton.	Graves.	Grayson.	Green.	Hancock.	Henderson.	Hickman.	Hopkins.
1	Number of all farms in the county.....	1,205	6,082	3,382	2,345	1,272	2,949	1,649	3,473
2	Farms reporting land having drainage.....	110	32	28	8	163	403	53	195
3	Farms reporting land needing drainage.....	243	202	303	49	140	225	189	122
4	Farms in drainage and levee districts.....	130	18	1		28	40	8	40
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres.....	123,520	352,640	318,080	178,560	123,520	278,400	144,000	349,440
6	All land in farms..... acres.....	101,746	324,454	296,476	163,688	103,691	236,741	142,609	292,794
7	Improved land in farms..... acres.....	83,826	259,416	198,787	109,277	63,243	201,360	114,244	191,901
8	Woodland in farms..... acres.....	16,100	47,084	82,909	30,882	13,492	22,270	25,118	70,204
9	Other unimproved land in farms..... acres.....	1,820	17,964	14,780	23,529	26,956	13,111	3,247	30,690
10	Farm land reported as provided with drainage..... acres.....	4,074	997	1,281	8,055	5,122	21,757	1,799	7,600
11	Farm land reported as needing drainage..... acres.....	6,733	5,733	5,532	664	2,860	7,906	4,902	4,656
12	Drainage only..... acres.....	1,630	2,803	120	333	804	2,750	1,174	914
13	Drainage and clearing..... acres.....	5,103	2,930	5,412	331	2,056	5,156	3,728	3,742

		Jefferson.	Larue.	Laurel.	Lewis.	Livingston.	Logan.	McCracken.	McLean.
1	Number of all farms in the county.....	2,826	1,569	2,937	2,777	1,644	3,819	2,128	1,922
2	Farms reporting land having drainage.....	257	110	111	45	61	42	37	140
3	Farms reporting land needing drainage.....	354	204	539	191	344	353	170	169
4	Farms in drainage and levee districts.....	51	42		16	8	8		24
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres.....	247,680	184,320	286,080	314,240	250,880	411,520	152,960	161,920
6	All land in farms..... acres.....	181,378	147,847	190,056	242,165	181,718	328,148	127,782	143,083
7	Improved land in farms..... acres.....	135,903	109,387	103,281	101,639	129,456	236,973	101,390	106,228
8	Woodland in farms..... acres.....	22,138	27,728	68,510	120,006	48,100	68,614	20,764	24,944
9	Other unimproved land in farms..... acres.....	23,337	10,732	18,264	20,470	4,162	22,561	5,628	11,911
10	Farm land reported as provided with drainage..... acres.....	8,716	1,758	1,171	1,161	3,198	863	861	3,994
11	Farm land reported as needing drainage..... acres.....	9,809	2,804	17,247	5,402	12,299	10,446	3,195	7,841
12	Drainage only..... acres.....	4,844	503	1,083	186	1,310	1,608	157	3,288
13	Drainage and clearing..... acres.....	4,965	2,241	16,164	5,217	10,989	8,638	3,038	4,553

		Madison.	Marion.	Metcalf.	Muhlenberg.	Nelson.	Ohio.	Powell.	Pulaski.	Rowan.
1	Number of all farms in the county.....	3,558	1,970	2,011	2,836	1,869	4,112	844	5,015	1,303
2	Farms reporting land having drainage.....	60	74	36	141	128	229	43	77	35
3	Farms reporting land needing drainage.....	164	310	450	316	273	580	109	744	65
4	Farms in drainage and levee districts.....	3		1	25	5	103	1		
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	285,440	220,800	193,920	302,080	263,040	373,760	115,840	401,920	174,080
6	All land in farms..... acres.....	255,451	187,860	156,771	231,620	228,932	336,794	90,267	336,143	132,282
7	Improved land in farms..... acres.....	222,060	123,665	87,892	125,647	153,652	218,793	31,659	201,604	41,682
8	Woodland in farms..... acres.....	22,470	56,490	52,455	69,004	58,336	71,544	53,125	119,435	81,609
9	Other unimproved land in farms..... acres.....	10,931	7,705	16,624	36,969	11,944	46,457	5,483	15,104	8,991
10	Farm land reported as provided with drainage..... acres.....	1,218	1,436	523	5,384	8,632	8,236	1,096	834	763
11	Farm land reported as needing drainage..... acres.....	3,645	7,907	8,753	18,500	13,445	14,608	3,936	14,264	2,483
12	Drainage only..... acres.....	849	1,352	1,663	7,807	2,638	1,584	692	1,972	719
13	Drainage and clearing..... acres.....	2,796	6,555	7,090	10,693	10,807	13,024	3,244	12,292	1,764

		Shelby.	Spencer.	Taylor.	Union.	Wayne.	Webster.	Whitley.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,709	1,518	2,152	1,809	2,448	2,407	2,614	155,853
2	Farms reporting land having drainage.....	20	26	55	292	78	414	103	533
3	Farms reporting land needing drainage.....	38	49	439	69	132	212	187	9,330
4	Farms in drainage and levee districts.....	1	1		88	1	40	1	33
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres.....	273,280	119,040	178,560	208,000	305,920	220,160	282,880	14,779,520
6	All land in farms..... acres.....	238,926	118,221	165,357	183,507	270,423	170,821	176,988	12,458,432
7	Improved land in farms..... acres.....	210,252	89,255	100,743	164,968	117,410	133,241	104,247	7,940,719
8	Woodland in farms..... acres.....	8,761	8,971	51,127	13,936	139,180	18,895	66,220	3,602,343
9	Other unimproved land in farms..... acres.....	19,913	17,995	13,487	4,603	13,833	18,685	7,521	915,370
10	Farm land reported as provided with drainage..... acres.....	598	1,425	897	26,554	1,887	21,705	1,053	7,916
11	Farm land reported as needing drainage..... acres.....	874	1,052	13,026	2,415	3,289	7,326	2,604	280,312
12	Drainage only..... acres.....	35	75	1,704	1,004	1,334	3,226	1,233	16,761
13	Drainage and clearing..... acres.....	639	977	11,322	1,411	1,935	4,110	1,371	263,661

<sup>1</sup> No drainage on farms reported in Bourbon, Breathitt, Fayette, Garrard, Grant, Harrison, Knott, Marshall, Martin, Mason, Menifee, Nicholas, Perry, Pike, and Robertson Counties.

## DRAINAGE—KENTUCKY.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Ballard.	Daviess.	Hancock.	Henderson.	Hickman.	Hopkins.
<b>LAND AREA.</b>								
1	Approximate land area of the state or county.....	acres.. 25,715,840	161,280	305,920	123,520	273,400	144,000	349,440
2	All land in operating drainage enterprises.....	acres.. 358,490	8,560	61,477	10,758	43,304	4,879	15,219
3	Improved land.....	acres.. 245,334	2,822	56,004	3,987	33,463	1,952	6,888
4	Per cent of all improved land in farms.....	1.8	2.6	27.8	6.3	16.6	1.7	8.6
5	Timber and cut-over land.....	acres.. 92,495	5,738	4,677	2,257	7,349	2,927	7,109
6	Other unimproved land.....	acres.. 20,651	796	796	4,514	7,492	.....	1,222
7	Swampy or subject to overflow in enterprises.....	acres.. 69,413	.....	7,257	8,125	16,327	.....	7,788
8	Suffering a loss of crops from defective drainage.....	acres.. 36,723	.....	3,688	3	11,080	.....	2,080
9	Assessed acreage.....	358,480	8,560	61,477	10,758	43,304	4,879	15,219
10	Excess over all land in operating enterprises.....	acres.. ..	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>								
Open ditches:								
11	Completed.....	miles.. 664.5	17.4	205.1	19.1	79.1	6.5	13.2
12	Additional under construction.....	miles.. 77.0	3.6	13.8	33.3	4.9	.....	7.9
13	Maximum completed in any enterprise.....	miles.. 21.3	7.0	21.3	3.0	15.8	6.5	5.2
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet.. 34	10	34	34	20	24	15
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet.. 20.0	8.0	12.0	10.0	14.0	8.0	6.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet.. 5.1	4.0	3.9	6.8	4.8	8.0	5.2
Tile drains:								
17	Completed.....	miles.. 86.2	.....	3.1	.....	10.0	.....	44.0
18	Additional under construction.....	miles.. 1.0	.....	0.2	.....	.....	.....	.....
19	Maximum completed in any enterprise.....	miles.. 32.0	.....	2.6	.....	10.0	.....	32.0
20	Maximum size of tile <sup>1</sup> .....	inches.. 24	.....	24	.....	6	.....	6
Accessory levees and dikes:								
21	Completed.....	miles.. 0.2	.....	.....	.....	.....	.....	.....
22	Additional under construction.....	miles.. ..	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only <sup>1</sup> .....	acres.. * 346,745	8,560	58,812	10,758	47,504	4,879	12,219
24	Length of these ditches.....	miles.. 691.4	21.0	199.2	52.4	82.0	6.5	13.1
25	Average length per acre.....	feet.. 10.5	13.0	17.9	25.7	9.1	7.0	5.7
26	Area drained by open ditches and tile <sup>1</sup> .....	acres.. * 11,735	.....	* 2,665	.....	800	.....	3,000
27	Length of these drains.....	miles.. 137.3	.....	23.0	.....	12.0	.....	52.0
28	Average length per acre.....	feet.. 61.8	.....	45.6	.....	79.2	.....	91.5
<b>DEVELOPMENT OF LAND.</b>								
29	Improved land in operating enterprises, 1920.....	acres.. 245,334	2,822	56,004	3,987	33,463	1,952	6,888
30	Improved land prior to drainage.....	acres.. 181,915	1,674	46,262	3,549	22,522	1,220	6,088
31	Increase since drainage.....	acres.. 63,419	1,148	9,742	438	10,941	732	800
32	Per cent of increase.....	34.9	68.6	21.1	12.3	48.6	60.0	13.1
33	Per cent increase is of all improved land in farms, 1920.....	0.5	1.1	4.8	0.7	5.4	0.6	0.4
34	Timber and cut-over land, 1920.....	acres.. 92,495	5,738	4,677	2,257	7,349	2,927	7,109
35	Timber and cut-over land prior to drainage.....	acres.. 148,096	5,838	14,079	2,257	18,044	3,659	7,909
36	Decrease since drainage.....	acres.. 53,601	100	9,402	.....	10,695	732	700
37	Per cent of decrease.....	36.7	1.7	66.8	.....	56.3	20.0	9.0
38	Other unimproved land, 1920.....	acres.. 20,651	796	796	4,514	7,492	.....	1,222
39	Other unimproved land prior to drainage.....	acres.. 30,469	1,048	1,135	4,952	7,738	.....	1,322
40	Decrease since drainage.....	acres.. 9,518	1,048	339	438	246	.....	100
41	Per cent of decrease.....	32.2	100.0	29.9	8.8	3.2	.....	7.6
42	Swampy or subject to overflow, 1920.....	acres.. 69,413	.....	7,257	8,125	16,327	.....	7,788
43	Swampy or subject to overflow prior to drainage.....	acres.. 199,161	5,414	35,777	8,783	24,747	4,879	7,888
44	Decrease since drainage.....	acres.. 129,748	5,414	28,520	638	8,420	4,879	100
45	Per cent of decrease.....	65.1	100.0	79.7	7.3	34.0	100.0	1.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
46	Total capital invested in and required for completion of operating enterprises.....	dollars.. 1,820,996	66,172	289,555	222,129	197,571	30,196	52,447
47	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 1,521,725	51,172	249,580	37,942	189,829	30,196	31,016
48	Additional capital required to complete these enterprises.....	dollars.. 299,271	15,000	39,995	184,187	7,742	.....	21,431
49	Average cost per acre when completed.....	dollars.. 5.08	7.73	4.71	20.65	4.09	6.19	3.45
50	Enterprises constructing open ditches only.....	dollars.. * 1,710,730	66,172	259,682	222,129	193,571	30,196	31,247
51	Average cost per acre when completed.....	dollars.. 4.93	7.73	4.42	20.65	4.07	6.19	2.56
52	Enterprises constructing open ditches and tile drains.....	dollars.. * 110,266	.....	29,873	.....	4,000	.....	21,200
53	Average cost per acre when completed.....	dollars.. 9.40	.....	11.21	.....	5.00	.....	7.07
<b>CROPS.</b>								
Improved land in enterprises reporting—								
54	Corn as principal crop on drained land.....	acres.. 239,254	2,822	56,004	3,987	33,463	1,952	6,888
55	Other crops as principal ones on drained land.....	acres.. 1,080	.....	.....	.....	.....	.....	.....
56	Not reporting crops on drained land.....	acres.. 5,000	.....	.....	.....	.....	.....	.....

<sup>1</sup> When works under construction have been completed.

\* Includes 1.140 acres reporting 0.2 mile of accessory levees, also.

\* Includes 117 acres reporting 2.6 miles of tile drain only.

\* Includes cost of 0.2 mile of accessory levees.

\* Includes enterprises constructing tile drains only.

# DRAINAGE—KENTUCKY.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Jefferson.	McLean.	Marshall.	Ohio.	Union.	Webster.	Other counties. <sup>1</sup>
<b>LAND AREA.</b>								
1	Approximate land area of the county.....acres.....	247,680	161,920	209,280	373,760	208,000	220,160	1,564,800
2	All land in operating drainage enterprises.....acres.....	90,000	18,485	5,180	10,320	32,722	42,291	10,285
3	Improved land.....acres.....	45,000	13,709	4,980	7,657	29,294	32,984	6,594
4	Per cent of all improved land in farms.....	33.1	12.9	3.8	3.5	17.8	24.8	0.8
5	Timber and cut-over land.....acres.....	40,000	4,642	200	1,838	3,428	8,809	3,521
6	Other unimproved land.....acres.....	5,000	134	.....	825	.....	498	170
7	Swampy or subject to overflow in enterprises.....acres.....	11,750	4,579	.....	1,474	3,646	4,947	3,520
8	Suffering a loss of crops from defective drainage.....acres.....	8,750	250	.....	984	2,326	4,855	2,729
9	Assessed acreage.....acres.....	90,000	18,485	5,180	10,320	32,722	42,291	10,285
10	Excess over all land in operating enterprises.....acres.....	.....	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>								
<b>Open ditches:</b>								
11	Completed.....miles.....	38.5	76.6	15.8	24.4	64.3	85.7	18.8
12	Additional under construction.....miles.....	1.5	12.0	.....	.....	.....	.....	.....
13	Maximum completed in any enterprise.....miles.....	12.0	17.6	12.8	5.6	20.2	7.3	4.2
14	Maximum width at bottom of ditch <sup>2</sup> .....feet.....	30	16	30	20	30	20	30
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet.....	15.0	8.5	7.8	6.0	14.0	10.0	20.0
16	Mean depth of branch ditches <sup>2</sup> .....feet.....	3.0	5.5	7.0	.....	6.0	4.7	8.0
<b>Tile drains:</b>								
17	Completed.....miles.....	.....	0.2	.....	.....	18.9	.....	10.0
18	Additional under construction.....miles.....	.....	0.8	.....	.....	.....	.....	.....
19	Maximum completed in any enterprise.....miles.....	.....	0.1	.....	.....	18.9	.....	10.0
20	Maximum size of tile <sup>2</sup> .....inches.....	.....	12	.....	.....	12	.....	.....
<b>Accessory levees and dikes:</b>								
21	Completed.....miles.....	.....	.....	.....	.....	0.2	.....	.....
22	Additional under construction.....miles.....	.....	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only <sup>2</sup> .....acres.....	90,000	15,015	5,180	10,320	<sup>3</sup> 31,922	42,291	9,285
24	Length of these ditches.....miles.....	40.0	71.1	15.8	24.4	63.1	85.7	17.3
25	Average length per acre.....feet.....	2.3	25.0	16.1	12.5	10.2	10.7	9.8
26	Area having both open ditches and tile <sup>2</sup> .....acres.....	.....	3,470	.....	.....	800	.....	1,000
27	Length of these drains.....miles.....	.....	15.5	.....	.....	20.3	.....	11.5
28	Average length per acre.....feet.....	.....	23.1	.....	.....	134.0	.....	60.7
<b>DEVELOPMENT OF LAND.</b>								
29	Improved land in operating enterprises, 1920.....acres.....	45,000	13,709	4,980	7,657	29,294	32,984	6,594
30	Improved land prior to drainage.....acres.....	30,500	12,903	.....	4,368	24,594	24,060	3,875
31	Increase since drainage.....acres.....	14,500	806	4,980	3,289	4,400	8,924	2,719
32	Per cent of increase.....	47.5	6.2	.....	75.3	17.7	37.1	70.2
33	Per cent increase is of all improved land in farms, 1920.....	10.7	0.8	3.8	1.5	2.7	6.7	0.3
34	Timber and cut-over land, 1920.....acres.....	40,000	4,642	200	1,838	3,428	8,809	3,521
35	Timber and cut-over land prior to drainage.....acres.....	54,500	5,448	400	4,737	6,967	16,656	5,701
36	Decrease since drainage.....acres.....	14,500	806	200	2,899	3,539	7,847	2,180
37	Per cent of decrease.....	26.6	14.8	50.0	61.2	50.8	47.1	38.2
38	Other unimproved land, 1920.....acres.....	5,000	134	.....	825	.....	498	170
39	Other unimproved land prior to drainage.....acres.....	5,000	134	.....	1,215	.....	1,575	709
40	Decrease since drainage.....acres.....	.....	.....	4,780	390	861	1,077	539
41	Per cent of decrease.....	.....	.....	100.0	32.1	100.0	68.4	76.0
42	Swampy or subject to overflow, 1920.....acres.....	11,750	4,579	.....	1,474	3,646	4,947	3,520
43	Swampy or subject to overflow prior to drainage.....acres.....	43,000	13,867	5,180	9,010	10,638	21,667	8,331
44	Decrease since drainage.....acres.....	31,250	9,288	5,180	7,536	6,992	16,720	4,811
45	Per cent of decrease.....	72.7	67.0	100.0	83.6	65.7	77.2	57.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
46	Total capital invested in and required for completion of operating enterprises.....dollars.....	197,000	202,922	77,366	45,500	267,668	129,609	42,891
47	Capital invested in these enterprises to Dec. 31, 1919.....dollars.....	175,000	194,076	77,366	45,500	267,668	129,609	42,891
48	Additional capital required to complete these enterprises.....dollars.....	22,000	8,916	.....	.....	.....	.....	.....
49	Average cost per acre when completed.....dollars.....	2.19	10.98	14.94	4.41	8.18	3.06	4.17
50	Enterprises constructing open ditches only.....dollars.....	197,000	168,087	77,366	45,500	<sup>4</sup> 253,280	129,609	36,891
51	Average cost per acre when completed.....dollars.....	2.19	11.19	14.94	4.41	7.93	3.06	3.97
52	Enterprises constructing open ditches and tile drains.....dollars.....	.....	34,905	.....	.....	14,268	.....	6,000
53	Average cost per acre when completed.....dollars.....	.....	10.06	.....	.....	17.86	.....	6.00
<b>CROPS.</b>								
Improved land in enterprises reporting—								
54	Corn as principal crop on drained land.....acres.....	40,000	13,709	4,980	7,657	29,294	32,984	5,514
55	Other crops as principal products on drained land.....acres.....	.....	.....	.....	.....	.....	.....	1,080
56	Not reporting principal crops on drained land.....acres.....	5,000	.....	.....	.....	.....	.....	.....

<sup>1</sup> Includes only Bullitt, Carlisle, Graves, Lewis, McCracken, Muhlenberg and Spencer counties.  
<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Includes 1,140 acres reporting 0.2 mile of accessory levees, also.  
<sup>4</sup> Includes cost of 0.2 mile of accessory levees.

## LOUISIANA.

The following pages present the statistics of drainage for Louisiana collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not

yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	135, 463	100. 0
Farms reporting land having drainage.....	21, 271	15. 7
Farms reporting land needing drainage.....	14, 985	11. 1
All land in farms..... acres..	10, 019, 822	100. 0
Improved land in farms..... acres..	5, 826, 226	56. 2
Farm land reported as provided with drainage..... acres..	1, 004, 935	10. 0
Farm land reported as needing drainage..... acres..	1, 095, 769	10. 9
Needing drainage only..... acres..	179, 305	1. 8
Needing drainage and clearing..... acres..	916, 464	9. 1
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	29, 061, 760	100. 0
All land in operating drainage enterprises..... acres..	2, 266, 328	7. 8
Improved land..... acres..	1, 269, 391	4. 4
Per cent of all improved land in farms.....	22. 6	-----
Timber and cut-over land..... acres..	467, 822	1. 6
Other unimproved land..... acres..	529, 115	1. 8
Swampy, subject to overflow, seeped, or alkali..... acres..	569, 189	2. 0
Suffering a loss of crops from defective drainage..... acres..	198, 935	0. 7
Improved land prior to drainage..... acres..	936, 902	3. 2
Increase since drainage began..... acres..	332, 489	1. 1
Land in nonoperating enterprises..... acres..	466, 040	1. 6
Open ditches in operating enterprises..... miles..	1, 934. 3	100. 0
Completed..... miles..	1, 771. 6	91. 6
Additional under construction..... miles..	162. 7	8. 4
Tile drains in operating enterprises..... miles..	0. 2	100. 0
Completed..... miles..	0. 2	100. 0
Additional under construction..... miles..	-----	-----
Total capital invested in and required for completion of operating enterprises..	\$9, 990, 788	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	9, 021, 991	90. 3
Additional capital required to complete these enterprises.....	968, 797	9. 7
Average cost per acre when completed.....	4. 41	-----





Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by the police juries of the parishes and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises ..	2,732,368	100.0	\$9,117,991	100.0	\$2,564,497
Operating enterprises.....	2,266,328	82.9	9,021,991	98.9	968,797
With works completed.....	1,534,634	56.3	5,956,938	65.3	.....
With works under construction.....	731,694	26.6	3,065,053	33.6	968,797
Nonoperating enterprises.....	466,040	17.1	96,000	1.1	1,595,700

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Nearly all the drainage enterprises in Louisiana are situated in the southern part of the state. While many of the enterprises are near the Mississippi, the drainage from most of these is away from the river and toward the Gulf of Mexico.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises ..	2,732,368	100.0	\$9,117,991	100.0	\$2,564,497
Operating enterprises.....	2,266,328	82.9	9,021,991	98.9	968,797
Black River.....	43,075	1.6	75,000	0.8	.....
Red River.....	125,000	4.6	305,449	3.3	70,800
Mississippi River.....	57,677	2.1	145,140	1.6	11,000
Sabine River and Lake.....	64,840	2.4	115,000	1.3	.....
Gulf of Mexico.....	1,975,736	72.3	8,388,403	91.9	837,197
Nonoperating enterprises.....	466,040	17.1	96,000	1.1	1,595,700
Black River.....	30,100	1.1	50,000	0.6	120,000
Red River.....	81,300	1.9	.....	.....	26,200
Mississippi River.....	1,250	( <sup>1</sup> )	.....	.....	32,000
Gulf of Mexico.....	383,490	14.0	46,000	0.5	1,417,500

<sup>1</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—The organized drainage enterprises in this state are mostly for the protection and reclamation of land that in its natural condition was continuously swampy. The enterprises in the parishes along the Mississippi are generally protected from overflows from the river by the system of Government levees. The area southerly from Lake Pontchartrain and westward, for a considerable width along the whole gulf coast, is but a few feet above sea level and most of it can be drained only by pumping. In districts given largely to rice cultivation, drainage need not be so thorough as that required for such crops as sugar cane, cotton, corn, and vegetables.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	2,266,328	100.0	1,534,634	731,694	466,040
Improved land.....	1,269,391	56.0	855,757	413,634	180,980
Timber and cut-over land.....	467,822	20.6	395,941	71,881	172,440
Other unimproved land.....	529,115	23.3	282,936	246,179	112,620
Swampy or subject to overflow....	569,189	25.1	303,313	265,876	212,782
Suffering a loss of crops.....	198,935	8.8	68,134	130,801	47,376

Size of enterprises.—Presentation of the statistics by parishes requires that an enterprise located in more than one parish be divided, and the part in each parish be considered a separate enterprise. In this way 111 operating drainage enterprises are counted in Louisiana, with an average area of 21,099 acres assessed. Of the total number of enterprises, 13 comprise 50,000 acres or more each, and 29 less than 5,000 acres each. The assessed acreage exceeds the land in enterprises by 75,706 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acres.	Per cent of total.
All operating enterprises.....	2,266,328	2,342,034	100.0
500 to 999 acres.....	2,269	2,269	0.1
1,000 to 4,999 acres.....	55,567	64,063	2.7
5,000 to 9,999 acres.....	153,161	159,161	6.8
10,000 to 49,999 acres.....	975,996	1,037,196	44.3
50,000 to 99,999 acres.....	628,385	628,385	26.8
100,000 to 499,999 acres.....	450,960	450,960	19.3

**Character of enterprises.**—Of the operating drainage enterprises in Louisiana, all but 10 are drainage districts established by the police juries of the parishes. Two enterprises are organized under a special act of the state legislature, and the others are commercial land developments or private farm improvements by individual landowners.

The state constitution of 1898 (art. 281) as amended specifically authorizes the formation of drainage districts and subdrainage districts as minor political subdivisions of the state, by the police jury of any parish. These districts may levy taxes for drainage purposes, not exceeding in any year 10 mills on the dollar of assessed valuation, when authorized by vote of a majority in number and amount of the property taxpayers. They have power further, when similarly authorized, to impose forced contributions not exceeding 50 cents per acre on all land susceptible of gravity drainage, for not longer than 40 years. Districts having construction work 80 per cent completed may levy additional taxes to complete the works without authorization by vote of the taxpayers, provided the total cost will not exceed 50 cents per acre. Districts involving the construction of levees and the installation of drainage pumping plants may levy annually, upon petition from the owners of a majority of the acreage to be assessed, not exceeding \$3.50 per acre for construction of the works and for maintaining the drainage.

The general drainage district law of Louisiana now in effect is that enacted July 7, 1910 (act No. 317), as amended July 9, 1914 (act No. 227). Drainage districts containing not less than five landowners may be established within the parish by the police jury upon its own initiative; a district shall be established upon petition from a majority of the resident landowners in the district or from the owners of a majority of the acreage. The governing board of each such enterprise is a board of five drainage commissioners, two of whom are appointed by the governor of the state and the others by the police jury upon the recommendation of a majority of the resident landowners, in number or in acreage. For a district situated in more than one parish, the commissioners appointed by the police

juries are apportioned according to the acreage of the district in each parish. The commissioners prepare the plan of reclamation or improvement and let contracts for construction. For a pumping district the board of state engineers must investigate and report favorably before the work is undertaken. An act of 1906 (No. 103) provides that the board of state engineers shall make surveys and perform such services as may be required by the commissioners of any drainage district for the construction of public works necessary for drainage, but the cost of these services is to be paid by the district. The cost of the enterprise is paid by an ad valorem tax or an acreage tax, as provided by the state constitution. The parish assessor makes the assessment against the property in the district, subject to review by the police jury. Whenever an acreage tax is levied any landowner may appeal to the courts to test the validity of the proceedings. Bonds may be issued if authorized by vote of the landowners or, in the case of a pumping district, by petition from the owners of two-thirds of the acreage.

Subdrainage districts within a drainage district may be established by order of the commissioners of the main district or by petition from two-thirds (but not less than 10) of the property owners concerned. The district commissioners appoint a committee of not more than three members to conduct the work of drainage under the direction of the commissioners.

Before the law of July 12, 1888 (act No. 107), drainage districts were formed only by special acts of the state legislature. That law authorized the establishment of drainage districts and the appointment of commissioners for such districts by the police juries of the parishes. The cost was to be paid by taxes not exceeding 15 mills on the dollar of assessed value of the land to be drained, to be approved by vote of the landowners. This statute was superseded by an act of June 28, 1894 (No. 37), which was similar but required that the district must be established if petition for it was signed by a majority of the landowners. An act of July 9, 1896, provided condemnation of right of way for a private drain across the land of an objecting owner. Upon petition for such drain, the police jury should assess the damages to be paid for the privilege sought.

After the constitution of 1898 was adopted, the earlier drainage district laws were superseded in turn by acts of June 27, 1900 (No. 12), of July 9, 1902 (No. 159), and the present statute of 1910, and the amendments to those laws. The greatest number of changes in these laws have dealt with the matters of petition from and referendum to the voters regarding drainage taxes and bond issues. An act of 1906 (No. 45) authorizes those districts organized under act No. 37 of 1894 and other acts adopted before the constitution of 1898 to levy annually a tax not exceeding 25 cents per acre, each levy to be authorized by vote of the landowners.

An act of July 10, 1902 (No. 211), provides that any drainage district organized under the laws of Louisiana, but not wishing to avail itself of the provisions of article 281 of the constitution of 1898, may levy an annual contribution not exceeding 50 cents per acre if authorized to do so by a majority in number and amount of property taxpayers.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	2,732,368	100.0	\$9,117,991	100.0	\$2,564,497
Operating enterprises.....	2,266,328	82.9	9,021,991	98.9	968,797
Drainage districts.....	2,229,885	81.6	8,537,991	93.8	712,297
Laws of 1894, act No. 37.....	128,000	4.7	352,949	3.9	70,000
Laws of 1900, act No. 12.....	188,000	6.9	190,000	2.1	.....
Laws of 1902, act No. 159.....	756,329	27.7	1,612,500	17.7	115,000
Laws of 1910, act No. 317.....	1,115,266	40.8	6,282,542	68.9	527,297
Special act.....	42,280	1.5	100,000	1.1	.....
Commercial developments <sup>1</sup> .....	36,468	1.3	484,000	5.3	256,500
Nonoperating enterprises.....	466,040	17.1	96,000	1.1	1,595,700
Drainage districts.....	466,040	17.1	96,000	1.1	1,595,700
Laws of 1902, act No. 159 <sup>2</sup> .....	110,000	4.0	45,000	0.5	375,000
Laws of 1910, act No. 317.....	356,040	13.0	51,000	0.6	1,220,700

<sup>1</sup> Includes 5,100 acres under individual ownership.  
<sup>2</sup> Includes one commercial development.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 1,771.6 miles of open ditches, 0.2 mile of tile drain, and 440.7 miles of levees; the additional lengths under construction were 162.7 miles of open ditches and 65.9 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of open ditches or tile drains. Of the operating enterprises, 30 are pumping districts.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each parish are shown in line 15 of Parish Table II. The maximum length, width, and depth of outlet shown in that table for any parish may not refer to the same enterprise.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	2,266,328	100.0	\$9,021,991	100.0	\$968,797
Open ditches only.....	1,913,870	84.4	4,225,779	46.8	642,472
Open ditches and levees.....	351,958	15.5	4,793,212	53.1	326,325
Open ditches and tile drains.....	500	( <sup>1</sup> )	3,000	( <sup>1</sup> )	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,266,328	100.0	\$9,021,991	100.0	\$968,797
Gravity drainage only.....	2,111,858	93.2	5,052,248	56.0	529,022
All drainage by pumping.....	137,250	6.1	3,836,743	42.5	424,775
Part gravity and part pumping.....	17,220	0.8	138,000	1.5	15,000
Total area served by pumps.....	140,809	6.2	.....	.....	.....

TABLE 9.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horsepower.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	7,665	100.0	5,245,150	100.0	140,809	100.0
Steam.....	5,105	66.6	4,281,800	81.6	104,684	74.3
Internal combustion.....	1,860	24.3	743,650	14.2	29,182	20.7
Electric and steam <sup>1</sup> .....	700	9.1	220,300	4.2	6,943	4.9

<sup>1</sup> Includes 500 electric and 200 steam horsepower.

TABLE 10.—PUMPING PLANTS OF OPERATING ENTERPRISES, AND ACREAGE SERVED, CLASSIFIED BY KIND OF PUMPS: 1920.

KIND OF PUMPS.	Number of pumps.	PUMP CAPACITY.		ENGINE CAPACITY.		ACREAGE SERVED.	
		Gallons per minute.	Per cent of total.	Horsepower.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	71	5,245,150	100.0	7,665	100.0	140,809	100.0
Centrifugal.....	57	4,603,900	87.8	6,420	83.8	89,736	63.7
Rotary.....	1	3,000	0.1	25	0.3	200	0.1
Screw.....	3	470,000	9.0	870	11.4	14,804	10.5
Centrifugal and rotary <sup>1</sup> .....	3	75,000	1.4	200	2.6	2,600	1.8
Centrifugal and screw <sup>2</sup> .....	3	84,000	1.6	125	1.6	4,200	3.0
Not reported.....	1	9,250	0.2	25	0.3	29,269	20.8

<sup>1</sup> Includes 1 rotary and 2 centrifugal pumps.  
<sup>2</sup> Includes 1 centrifugal and 2 screw pumps.

In Parish Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 5.5 instead of 5.1 feet.

## DRAINAGE—LOUISIANA.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	2,266,328	100.0
Less than 3 feet.....	55,247	2.4
3.0 to 3.9 feet.....	92,817	4.1
4.0 to 4.9 feet.....	395,590	17.5
5.0 to 5.9 feet.....	410,350	18.1
6.0 to 6.9 feet.....	204,756	9.0
7.0 to 7.9 feet.....	224,900	9.9
8.0 to 8.9 feet.....	21,629	1.0
9.0 to 9.9 feet.....	139,000	6.1
10 feet and more.....	722,039	31.9
Not reporting branches.....		

**Maintenance of works.**—An act of June 29, 1904 (No. 61), provides that the drainage and levee districts shall have control over all public drainage channels of their respective districts, for all purposes, and the present drainage district law authorizes the commissioners to perform all acts necessary to maintain the drainage of the districts and subdistricts. The expense that may be incurred is subject to the limitations on general and acreage taxes for drainage, placed by the constitution and statutes.

TABLE 12.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,266,328	100.0	\$9,021,991	100.0	\$968,797
By district forces.....	726,106	32.0	4,652,797	51.6	360,500
By contract.....	241,006	10.6	1,188,249	13.2	115,000
By landowners.....	28,670	1.3	200,500	2.2	256,500
By method not specified.....	16,013	0.7	55,000	0.6	.....
No maintenance provided.....	1,229,593	54.3	2,598,065	28.8	232,797
Not reporting.....	24,940	1.1	327,380	3.6	4,000

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of enterprises, which are the dates when the districts were established by the police juries, or when sub-districts were established by the drainage commissioners since there may be a period of one or more years between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including

extensions made after the original plan of reclamation was completed.

TABLE 13.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	2,266,328	100.0	2,342,034	100.0
1890 to 1899.....	142,230	6.3	142,230	6.1
1900 to 1904.....	251,498	11.1	251,498	10.7
1905 to 1909.....	789,758	34.8	845,758	36.1
1910 to 1914.....	687,387	30.3	704,687	30.1
1915 to 1919.....	395,405	17.4	397,811	17.0

TABLE 14.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$9,021,991	100.0	\$968,797
1890 to 1899.....	390,949	4.3	70,000
1900 to 1904.....	548,000	6.1	.....
1905 to 1909.....	1,784,500	19.8	115,000
1910 to 1914.....	4,848,140	53.7	320,275
1915 to 1919.....	1,452,402	16.1	463,522

TABLE 15.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	1,934.8	100.0	0.2	100.0	506.6	100.0
1890 to 1899.....	54.0	2.8	.....	.....	102.0	20.1
1900 to 1904.....	192.0	9.9	.....	.....	97.0	19.1
1905 to 1909.....	313.1	16.2	.....	.....	21.0	4.1
1910 to 1914.....	847.9	43.8	0.2	100.0	215.3	42.5
1915 to 1919.....	527.8	27.3	.....	.....	71.3	14.1

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are sugar cane, rice, and cotton. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in Parish Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

# DRAINAGE—LOUISIANA.

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PARISH TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Acadia.	Allen.	Ascension.	Assump- tion.	Avoyelles.	Bossier.	Caddo.
1	Number of all farms in the state or parish.....	135,463	3,088	763	1,630	438	5,028	4,227	4,902
2	Farms reporting land having drainage.....	21,271	34	43	777	92	304	49	109
3	Farms reporting land needing drainage.....	14,985	9	284	552	86	61	573	26
4	Farms in drainage and levee districts.....	10,516	16	1	675	4	16	50	111
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or parish..... acres..	29,061,760	414,080	424,320	186,240	309,760	542,080	552,320	563,200
6	All land in farms..... acres..	10,019,822	322,061	94,659	108,982	79,282	221,540	244,342	224,282
7	Improved land in farms..... acres..	5,626,226	278,939	42,328	72,530	53,856	147,425	150,207	160,411
8	Woodland in farms..... acres..	3,614,040	39,414	49,766	33,534	22,677	66,863	82,356	55,074
9	Other unimproved land in farms..... acres..	779,556	3,708	2,565	2,918	2,749	7,252	11,779	8,797
10	Farm land reported as provided with drainage..... acres..	1,004,935	3,794	5,983	40,166	7,858	7,845	3,392	2,958
11	Farm land reported as needing drainage..... acres..	1,095,769	705	21,900	17,692	4,280	9,706	33,991	4,714
12	Drainage only..... acres..	179,305	280	1,471	2,648	1,192	1,915	1,103	165
13	Drainage and clearing..... acres..	916,464	425	20,429	15,044	3,088	7,791	32,888	4,549

		Calcasieu.	Cameron.	Catahoula.	Claborne.	Concordia.	East Baton Rouge.	East Carroll.	East Feliciana.	Evange- line.
1	Number of all farms in the parish.....	922	620	1,827	4,024	2,028	2,427	2,286	2,405	3,550
2	Farms reporting land having drainage.....	130	167	403	223	761	722	342	9	176
3	Farms reporting land needing drainage.....	69	7	100	469	141	277	65	28	771
4	Farms in drainage and levee districts.....		14	5		795	53	207		
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the parish..... acres..	695,040	960,640	459,520	497,920	456,960	291,200	288,800	296,960	616,960
6	All land in farms..... acres..	145,591	132,513	118,707	362,808	160,429	177,776	107,323	201,527	179,229
7	Improved land in farms..... acres..	104,197	33,264	68,934	206,503	55,795	109,350	71,029	109,430	140,959
8	Woodland in farms..... acres..	30,131	14,605	67,817	127,307	102,072	63,233	34,645	69,384	33,804
9	Other unimproved land in farms..... acres..	11,263	84,644	1,956	28,998	2,562	5,193	1,649	22,713	4,466
10	Farm land reported as provided with drainage..... acres..	29,532	6,534	10,758	10,023	21,300	32,798	11,490	760	12,262
11	Farm land reported as needing drainage..... acres..	11,048	8,184	8,594	28,924	46,193	24,522	6,177	5,306	28,594
12	Drainage only..... acres..	4,945	8,184	1,343	3,936	1,482	2,163	1,091	548	25,068
13	Drainage and clearing..... acres..	6,103	20	7,251	24,988	44,711	22,339	5,086	4,758	3,526

		Franklin.	Grant.	Iberia.	Iberville.	Jefferson.	Jefferson Davis.	Lafayette.	Lafourche.	Living- ston.
1	Number of all farms in the parish.....	4,592	1,649	1,481	669	334	1,163	3,048	1,190	1,311
2	Farms reporting land having drainage.....	417	455	677	465	150	33	904	344	456
3	Farms reporting land needing drainage.....	745	21	75	167	8	70	399	389	344
4	Farms in drainage and levee districts.....	377		260	261	142	22	4	198	18
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the parish..... acres..	403,200	437,120	376,960	373,760	274,560	496,560	178,560	636,160	423,680
6	All land in farms..... acres..	210,198	101,307	110,646	113,802	14,983	264,063	141,154	238,433	79,463
7	Improved land in farms..... acres..	108,550	46,664	95,037	72,434	9,086	231,970	128,526	104,949	28,228
8	Woodland in farms..... acres..	87,247	49,380	9,495	32,763	3,080	24,371	8,748	49,799	43,926
9	Other unimproved land in farms..... acres..	14,401	5,263	6,114	8,605	2,817	7,722	3,882	83,716	7,309
10	Farm land reported as provided with drainage..... acres..	8,089	13,858	41,999	60,054	2,765	6,504	31,517	19,983	9,417
11	Farm land reported as needing drainage..... acres..	46,232	642	8,528	21,785	574	4,472	3,713	58,747	17,764
12	Drainage only..... acres..	2,769	142	1,441	5,381	422	2,006	1,702	10,810	2,159
13	Drainage and clearing..... acres..	43,463	500	2,087	16,404	152	2,466	2,011	47,937	15,605

## DRAINAGE—LOUISIANA.

PARISH TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Madison.	Morehouse.	Natchitoches.	Orleans.	Ouachita.	Plaquemines.	Pointe Coupee.	Rapides.	Richland.
1	2,071	3,239	5,408	246	2,666	571	3,303	3,368	3,383
2	683	801	180	37	390	240	2,085	1,423	256
3	50	90	200	5	112	233	313	312	407
4	677	248	2	27	14	262	1,939	663	576
<b>LAND AND FARM AREA.</b>									
5	416,000	531,840	824,960	113,920	410,880	647,040	368,640	876,800	361,600
6	150,866	173,777	283,450	9,068	159,490	69,348	194,964	219,284	167,845
7	87,222	94,419	147,933	6,669	79,381	22,419	120,536	118,312	89,357
8	62,698	75,230	125,328	896	77,115	8,823	65,196	93,091	71,833
9	946	3,928	10,189	1,603	2,994	38,106	9,232	12,881	6,656
10	39,074	25,336	5,238	2,899	10,171	9,789	71,989	55,383	4,786
11	27,789	16,002	14,400	2,521	7,581	20,770	31,974	23,635	29,543
12	2,764	1,106	1,642	1,207	647	12,535	10,943	1,901	255
13	25,026	14,896	12,758	1,314	6,934	8,235	21,031	21,734	29,288
	St. Bernard.	St. Charles.	St. Helena.	St. James.	St. John the Baptist.	St. Landry.	St. Martin.	St. Mary.	St. Tammany.
1	121	258	1,452	289	227	6,575	2,006	410	672
2	48	254	90	92	124	1,869	678	260	23
3	37	50	124	68	83	413	251	70	260
4	46	118	.....	22	113	1,033	87	168	.....
<b>LAND AND FARM AREA.</b>									
5	397,440	188,800	268,800	162,560	147,840	435,840	336,000	404,480	570,840
6	8,250	49,908	115,826	54,324	31,610	302,175	103,673	122,944	73,151
7	3,834	24,740	51,729	39,747	21,813	228,315	81,370	70,774	15,359
8	2,100	22,539	58,068	12,174	8,927	64,331	17,306	37,680	40,254
9	2,316	2,629	6,029	2,403	8,870	9,529	4,997	14,400	17,538
10	2,552	25,769	750	9,810	13,660	69,089	23,556	54,274	683
11	3,686	11,730	8,382	5,729	6,055	27,740	5,732	19,802	23,591
12	1,773	2,131	135	2,189	2,907	3,446	2,480	3,864	8,133
13	1,913	9,599	8,247	3,540	3,148	24,294	3,252	15,938	15,458
	Tangipahoa.	Tensas.	Terrebonne.	Union.	Vermilion.	Washington.	West Baton Rouge.	All other parishes. <sup>1</sup>	
1	2,735	2,089	855	3,426	2,958	2,165	402	28,376	
2	362	549	84	262	1,638	188	345	100	
3	463	12	165	628	467	396	133	3,927	
4	2	131	147	.....	806	.....	236	11	
<b>LAND AND FARM AREA.</b>									
5	505,600	404,480	1,126,400	587,520	776,320	419,200	136,960	5,825,440	
6	169,293	161,155	142,530	339,726	258,103	178,794	48,681	2,276,487	
7	56,977	82,826	56,815	137,362	201,001	62,002	36,337	1,070,576	
8	83,950	67,403	62,081	192,740	25,257	89,440	9,443	1,058,678	
9	28,366	10,926	33,634	9,624	31,845	26,752	901	147,233	
10	4,711	16,591	7,162	10,606	100,453	2,368	34,782	1,825	
11	18,991	5,972	18,066	39,280	39,957	1,148	14,886	252,820	
12	752	1,185	7,080	657	16,633	157	2,740	5,737	
13	18,239	4,787	10,966	38,623	23,324	991	12,146	247,068	

<sup>1</sup> No drainage on farms reported in Caldwell, Jackson, La Salle, Red River, and Webster Parishes.

DRAINAGE—LOUISIANA.

PARISH TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Acadia.	Allen.	Ascension.	Assumption.	Avoyelles.	Boissier.	Caddo.	Calcasieu.	Cameron.	
<b>LAND AREA.</b>											
1	Approximate land area of the state or parish.....acres..	29,061,760	414,080	424,320	186,240	309,760	542,080	552,320	563,200	695,040	960,640
2	All land in operating drainage enterprises.....acres..	2,266,328	159,000	12,500	94,500	53,500	55,509	20,000	100,000	101,930	45,587
3	Improved land.....acres..	1,299,391	154,000	12,500	56,100	20,625	35,228	12,000	75,000	62,601	21,025
4	Per cent of all improved land in farms.....	22.6	55.2	29.5	77.3	38.3	23.9	8.0	46.8	80.1	63.2
5	Timber and cut-over land.....acres..	467,822	5,000		38,400	31,675	20,281	6,000	25,000	6,909	
6	Other unimproved land.....acres..	529,115			1,200			2,000		32,420	24,562
7	Swampy or subject to overflow, in enterprises.....acres..	589,189	31,500		6,300	32,700	2,700	2,000	25,000	4,800	16,749
8	Suffering a loss of crops from defective drainage.....acres..	198,935	3,500		150	2,700	2,000	25,000	9,600	4,962	
9	Assessed acreage.....acres..	2,342,034	159,000	12,500	94,500	53,500	55,509	20,000	100,000	101,930	45,587
10	Excess over all land in operating enterprises.....acres..	75,706									
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....miles..	1,771.6	147.0	15.0	61.5	19.0	9.9	2.5	22.0	92.5	30.1
12	Additional under construction.....miles..	162.7	38.0		0.5		5.6			23.5	7.7
13	Maximum completed in any enterprise.....miles..	100.0	50.0	15.0	30.0	11.5	4.0	2.5	22.0	42.0	20.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	100	32	29	40	75	20	10	78	50	25
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	80.0	10.0	6.0	15.0	12.0	8.0	15.0	12.0	8.0	6.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	5.1	4.4	3.0	6.1		3.0	3.0		4.3	5.0
Tile drains:											
17	Completed.....miles..	0.2				0.2					
18	Additional under construction.....miles..										
19	Maximum completed in any enterprise.....miles..	0.2				0.2					
20	Maximum size of tile.....inches..	40				40					
Accessory levees and dikes:											
21	Completed.....miles..	440.7						78.0			21.0
22	Additional under construction.....miles..	65.9						24.0			2.0
Pumping plants:											
23	Engine capacity.....horsepower..	7,665									25
24	Pump capacity.....gallons per minute..	5,245,150									3,000
25	Area served by pumps.....acres..	140,809									200
26	Area drained by open ditches only <sup>1</sup> .....acres..	1,613,870	159,000	12,500	94,500	53,000	55,509	20,000		101,930	25,857
27	Length of these ditches.....miles..	1,366.4	183.0	15.0	62.0	18.5	15.5	2.5		116.0	16.0
28	Average length per acre.....feet..	3.8	6.1	6.3	3.5	1.8	1.5	0.7		6.0	3.3
29	Area having open ditches and levees <sup>1</sup> .....acres..	351,958							100,000		19,720
30	Length of these ditches.....miles..	567.4							22.0		21.8
31	Average length per acre.....feet..	8.5							1.2		5.8
32	Length of the accessory levees.....miles..	506.6							102.0		23.0
33	Area drained by open ditches and tile <sup>1</sup> .....acres..	500				500					
34	Length of these drains.....miles..	0.7				0.7					
35	Average length per acre.....feet..	7.4				7.4					
<b>DEVELOPMENT OF LAND.</b>											
36	Improved land in operating enterprises, 1920.....acres..	1,299,391	154,000	12,500	56,100	20,625	35,228	12,000	75,000	62,601	21,025
37	Improved land prior to drainage.....acres..	936,902	154,000	12,500	49,200	19,575	17,367	1,000	30,000	30,181	5,505
38	Increase since drainage.....acres..	362,489			6,900	1,050	17,861	11,000	45,000	32,420	15,520
39	Per cent of increase <sup>2</sup> .....	38.5			14.0	5.4	103.5		150.0	107.4	281.9
40	Per cent increase is of all improved land in farms, 1920.....	8.9			9.6	1.9	12.2	7.3	28.1	31.1	46.7
41	Timber and cut-over land, 1920.....acres..	467,822	5,000		38,400	31,675	20,281	6,000	25,000	6,909	
42	Timber and cut-over land prior to drainage.....acres..	580,418	5,000		45,300	31,925	38,202	9,000	70,000	6,909	
43	Decrease since drainage.....acres..	112,596			6,900	250	17,921	3,000	45,000		
44	Per cent of decrease.....	19.4			15.2	0.8	46.9	33.3	64.3		
45	Other unimproved land, 1920.....acres..	529,115				1,200		2,000		32,420	24,562
46	Other unimproved land prior to drainage.....acres..	749,008				2,000		10,000		64,840	40,082
47	Decrease since drainage.....acres..	219,893				800		8,000		32,420	15,520
48	Per cent of decrease.....	29.4				40.0		80.0		50.0	38.7
49	Swampy or subject to overflow, 1920.....acres..	589,189	31,500		6,300	32,700	2,700	2,000	25,000	4,800	16,749
50	Swampy or subject to overflow prior to drainage.....acres..	1,278,995	123,000	12,000	45,300	39,500	55,509	15,000	70,000	16,563	26,482
51	Decrease since drainage.....acres..	709,806	91,500	12,000	39,000	6,800	52,809	13,000	45,000	11,763	9,733
52	Per cent of decrease.....	55.5	74.4	100.0	86.1	17.2	95.1	86.7	64.3	71.1	36.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
53	Total capital invested in and required for completion of operating enterprises.....dollars..	9,990,798	388,000	80,000	357,740	99,800	71,500	12,000	360,949	260,000	203,000
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	9,021,991	370,500	80,000	346,740	99,800	56,500	12,000	290,949	197,500	88,000
55	Additional capital required to complete these enterprises.....dollars..	968,797	8,500		11,000		15,000		70,000	62,500	115,000
56	Average cost per acre when completed.....dollars..	4.41	2.44	6.40	3.79	1.67	1.29	0.60	3.61	2.55	4.45
57	Enterprises constructing open ditches only.....dollars..	4,868,251	388,000	80,000	357,740	96,800	71,500	12,000		260,000	160,000
58	Average cost per acre when completed.....dollars..	2.54	2.44	6.40	3.79	1.83	1.29	0.60		2.55	6.19
59	Enterprises constructing open ditches and levees.....dollars..	5,119,587							380,949		43,000
60	Average cost per acre when completed.....dollars..	14.55							3.61		2.18
61	Enterprises constructing open ditches and tile drains.....dollars..	3,000				3,000					
62	Average cost per acre when completed.....dollars..	6.00				6.00					
<b>CROPS.</b>											
63	Improved land in enterprises reporting—										
64	Sugar cane as principal crop on drained land.....acres..	466,273			5,700	20,625					
65	Rice as principal crop on drained land.....acres..	446,130	154,000	12,500	1,500					62,601	6,158
66	Cotton as principal crop on drained land.....acres..	241,430			30,000		35,228	12,000	75,000		14,867
67	Corn as principal crop on drained land.....acres..	103,608			18,900						
68	Vegetables as principal crop on drained land.....acres..	6,341									
69	Other crops as principal ones on drained land.....acres..	5,609									

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

## DRAINAGE—LOUISIANA.

PARISH TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	East Baton Rouge.	Evange- lins.	Iberia.	Iber- ville.	Jeffer- son.	Jeffer- son Davis.	La Salle.	Lafay- ette.	La- fourche.	Mad- son.	More- house.	
<b>LAND AREA.</b>												
1	Approximate land area of the parish.....acres..	291,200	616,960	376,960	373,760	274,560	466,560	409,600	178,560	636,160	416,000	531,840
2	All land in operating drainage enterprises.....acres..	28,508	9,100	121,990	102,515	29,293	55,020	5,000	77,990	51,147	25,000	18,075
3	Improved land.....acres..	9,693	9,100	87,789	66,836	8,737	53,472	500	75,490	30,075	12,500	14,460
4	Per cent of all improved land in farms.....	8.9	6.5	92.4	92.3	96.2	23.1	2.7	58.7	28.7	14.3	15.3
5	Timber and cut-over land.....acres..	9,408			18,189	7,569		4,500		6,867	12,500	3,615
6	Other unimproved land.....acres..	9,407		34,201	17,490	12,987	1,548		2,500	14,205		
7	Swampy or subject to overflow, in enterprises.....acres..			23,947	26,654	7,638	484	1,250		3,940	6,250	
8	Suffering a loss of crops from defective drainage.....acres..		2,730	9,137	2,392	2,091	484	50	10,948		3,125	6,336
9	Assessed acreage.....acres..	28,508	9,100	121,990	102,515	29,293	55,020	5,000	77,990	51,147	25,000	18,075
10	Excess over all land in operating enterprises.....acres..											
<b>DRAINAGE WORKS.</b>												
Open ditches:												
11	Completed.....miles..	10.0	3.6	72.6	86.4	72.9	90.7	6.4	86.9	89.9	18.5	22.5
12	Additional under construction.....miles..		2.4		4.4	0.8	1.6	1.6	23.1	4.5		
13	Maximum completed in any enterprise.....miles..	10.0	3.6	26.0	23.4	20.0	33.0	6.4	30.0	25.0	18.5	22.5
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	8	12	64	100	55	40	8	14	60	10	14
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	6.0	20.0	10.0	10.0	9.5	7.0		30.0	13.0	10.0	8.0
16	Mean depth of branch ditches <sup>3</sup> .....feet..			5.0	6.2	5.7	4.1		5.0	6.4		
Tile drains:												
17	Completed.....miles..											
18	Additional under construction.....miles..											
19	Maximum completed in any enterprise.....miles..											
20	Maximum size of tile <sup>1</sup> .....inches..											
Accessory levees and dikes:												
21	Completed.....miles..				9.0	20.6	10.0			86.3		1.0
22	Additional under construction.....miles..					8.4				9.7		
Pumping plants:												
23	Engine capacity.....horsepower..					2,120				2,040		
24	Pump capacity.....gallons per minute..					945,000				1,713,400		
25	Area served by pumps.....acres..					21,045				23,873		
26	Area drained by open ditches only <sup>3</sup> .....acres..	28,508	9,100	121,990	86,502	8,248	45,340	5,000	77,990	27,274	25,000	
27	Length of these ditches.....miles..	10.0	6.0	72.6	86.8	11.0	78.3	8.0	110.0	22.5	18.5	
28	Average length per acre.....feet..	1.9	3.5	3.1	5.3	7.0	9.1	8.4	7.4	4.4	3.9	
29	Area having open ditches and levees <sup>3</sup> .....acres..				16,018	21,045	9,680			23,873		18,075
30	Length of these ditches.....miles..				11.0	62.7	14.0			71.9		22.5
31	Average length per acre.....feet..				3.6	15.7	7.6			15.9		6.6
32	Length of the accessory levees.....miles..				9.0	29.0	10.0			96.0		1.0
33	Area drained by open ditches and tile <sup>1</sup> .....acres..											
34	Length of these drains.....miles..											
35	Average length per acre.....feet..											
<b>DEVELOPMENT OF LAND.</b>												
36	Improved land in operating enterprises, 1920.....acres..	9,693	9,100	87,789	66,836	8,737	53,472	500	75,490	30,075	12,500	14,460
37	Improved land prior to drainage.....acres..	9,693	1,820	84,954	65,637	4,572		500	67,691	6,818	12,500	14,460
38	Increase since drainage.....acres..		7,280	2,835	1,199	4,165	38,472		7,799	23,257		
39	Per cent of increase.....		400.0	3.3	1.8	91.1			11.5	341.1		
40	Per cent increase is of all improved land in farms, 1920.....		5.2	3.0	1.6	45.8	23.1		6.1	22.2		
41	Timber and cut-over land, 1920.....acres..	9,408			18,189	7,569		4,500		6,867	12,500	3,615
42	Timber and cut-over land prior to drainage.....acres..	9,408			19,338	7,569		4,500	1,149	10,541	12,500	3,615
43	Decrease since drainage.....acres..				1,199				1,149	3,674		
44	Per cent of decrease.....				6.2				100.0	34.9		
45	Other unimproved land, 1920.....acres..	9,407		34,201	17,490	12,987	1,548		2,500	14,205		
46	Other unimproved land prior to drainage.....acres..	9,407	7,280	37,036	17,490	17,152	55,020		9,150	33,788		
47	Decrease since drainage.....acres..		7,280	2,835		4,165	53,472		6,660	19,583		
48	Per cent of decrease.....		100.0	7.7		24.3	97.2		72.7	58.0		
49	Swampy or subject to overflow, 1920.....acres..			23,947	26,654	7,638	484	1,250		3,940	6,250	
50	Swampy or subject to overflow prior to drainage.....acres..	9,408	7,280	27,597	32,899	14,945	22,201	1,250	39,990	44,065	12,500	3,615
51	Decrease since drainage.....acres..	9,408	7,280	3,650	6,245	7,307	21,717		39,990	40,125	6,250	3,615
52	Per cent of decrease.....	100.0	100.0	13.2	19.0	48.9	97.8		100.0	91.1	50.0	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
53	Total capital invested in and required for completion of operating enterprises.....dollars..	20,000	18,000	150,375	484,974	595,400	257,820	3,100	141,500	1,162,077	40,000	35,000
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	20,000	10,000	150,375	447,070	524,100	258,820	2,500	107,000	1,067,077	40,000	35,000
55	Additional capital required to complete these enterprises.....dollars..		8,000		17,904	71,300	4,000	600	34,500	75,000		
56	Average cost per acre when completed.....dollars..	0.70	1.98	1.23	4.54	20.33	4.69	0.62	1.81	22.72	1.60	1.94
57	Enterprises constructing open ditches only.....dollars..	20,000	18,000	150,375	409,974	58,000	161,000	3,100	141,500	171,577	40,000	
58	Average cost per acre when completed.....dollars..	0.70	1.98	1.23	4.74	7.03	3.55	0.62	1.81	6.29	1.60	
59	Enterprises constructing open ditches and levees.....dollars..				55,000	537,400	96,820			990,500		35,000
60	Average cost per acre when completed.....dollars..				3.43	25.54	10.00			41.49		1.94
61	Enterprises constructing open ditches and tile drains.....dollars..											
62	Average cost per acre when completed.....dollars..											
<b>CROPS.</b>												
Improved land in enterprises reporting—												
63	Sugar cane as principal crop on drained land.....acres..			87,789	57,722	4,019			22,990			
64	Rice as principal crop on drained land.....acres..		9,100		9,114		53,472		22,500			
65	Cotton as principal crop on drained land.....acres..						500				12,500	14,460
66	Corn as principal crop on drained land.....acres..	9,693				3,320			30,000	30,075		
67	Vegetables as principal crop on drained land.....acres..					1,398						
68	Other crops as principal ones on drained land.....acres..											

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the parish as determined by the census of agriculture.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> The reported figures have been reduced in proportion to the reduction made in improved land, 1920.



DRAINAGE—LOUISIANA.

PARISH TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Plaque- mines.	Pointe Coupee.	Rapides.	St. Bernard.	St. Charles.	St. James.	St. Mary.	Terre- bonne.	Ver- milien.	West Baton Rouge.	Other par- ishes. <sup>1</sup>	
<b>LAND AREA.</b>												
1	Approximate land area of the parish..... acres.....	647,040	368,040	876,800	397,440	188,800	162,560	404,480	1,126,400	776,320	136,960	693,760
2	All land in operating drainage enterprises..... acres.....	21,839	173,880	4,136	222,200	13,420	74,000	58,615	35,400	338,771	136,960	20,943
3	Improved land..... acres.....	14,999	96,522	3,308	13,510	11,164	22,200	42,363	26,550	186,912	38,337	15,794
4	Per cent of all improved land in farms.....	66.9	80.1	2.9	81.5	45.1	55.9	59.9	46.7	93.0	100.0	26.3
5	Timber and cut-over land..... acres.....	5,985	77,358	827	1,655	751	51,800	4,055	8,850	17,231	98,623	4,774
6	Other unimproved land..... acres.....	855			217,035	1,505		12,197		134,628		10,375
7	Swampy or subject to overflow, in enterprises..... acres.....	855	32,013	827	176,330	1,505	51,800	12,197		44,391	54,784	2,575
8	Suffering a loss of crops from defective drainage..... acres.....		20,902		34,240			540		57,923		125
9	Assessed acreage.....	21,839	173,880	4,136	222,200	13,420	74,000	58,615	41,500	341,177	204,160	20,943
10	Excess over all land in operating enterprises..... acres.....							6,100	2,406	67,200		
<b>DRAINAGE WORKS.</b>												
<b>Open ditches:</b>												
11	Completed..... miles.....	82.5	42.0	6.0	98.8	45.3	19.0	71.0	35.0	313.5	45.2	46.4
12	Additional under construction..... miles.....	3.1			8.0					32.6	3.0	4.3
13	Maximum completed in any enterprise..... miles.....	57.0	24.0	6.0	72.0	35.0	19.0	30.0	14.0	100.0	17.0	21.5
14	Maximum width at bottom of ditch <sup>2</sup> ..... feet.....	55	50	24	80	40	40	60	45	40	80	55
15	Maximum of average depths of outlet ditches <sup>3</sup> ..... feet.....	9.5	7.0	5.0	13.5	8.0	8.0	8.0	8.0	12.0	10.0	12.0
16	Mean depth of branch ditches <sup>4</sup> ..... feet.....	6.0	4.0		7.0	8.0		4.1	4.0	4.7	6.0	8.0
<b>Tile drains:</b>												
17	Completed..... miles.....											
18	Additional under construction..... miles.....											
19	Maximum completed in any enterprise..... miles.....											
20	Maximum size of tile <sup>5</sup> ..... inches.....											
<b>Accessory levees and dikes:</b>												
21	Completed..... miles.....	8.8			22.9	20.5		30.0	7.6	101.0		24.0
22	Additional under construction..... miles.....	5.0				6.5			1.3	9.0		
<b>Pumping plants:</b>												
23	Engine capacity..... horsepower.....	345			150	600		860	125	525		875
24	Pump capacity..... gallons per minute.....	138,250			206,800	434,000		1,230,000	84,000	272,500		220,200
25	Area served by pumps..... acres.....	21,839			5,000	13,420		20,725	4,200	11,564		18,943
<b>Area drained by open ditches only<sup>6</sup>:</b>												
26	Area..... acres.....	1,770	173,880	4,136	214,000		74,000	28,790	35,400	276,176	186,960	11,500
27	Length of these ditches..... miles.....	57.0	42.0	6.0	80.0		19.0	18.0	26.0	205.8	48.2	12.2
28	Average length per acre..... feet.....	170.0	1.3	7.7	2.0		1.4	3.3	3.9	3.9	1.9	5.6
<b>Area having open ditches and levees<sup>7</sup>:</b>												
29	Area..... acres.....	20,069			8,200	13,420		29,825	(*)	62,595		9,443
30	Length of these ditches..... miles.....	28.6			26.8	45.3		53.0	9.0	140.3		38.5
31	Average length per acre..... feet.....	7.5			17.3	17.8		9.4		11.8		21.5
32	Length of the accessory levees..... miles.....	13.8			22.9	27.0		30.0	8.9	110.0		24.0
<b>Area drained by open ditches and tile<sup>8</sup>:</b>												
33	Area..... acres.....											
34	Length of these drains..... miles.....											
35	Average length per acre..... feet.....											
<b>DEVELOPMENT OF LAND.</b>												
36	Improved land in operating enterprises, 1920..... acres.....	14,999	96,522	3,308	13,510	11,164	22,200	42,363	26,550	186,912	38,337	15,794
37	Improved land prior to drainage..... acres.....	8,125	73,677	3,102	13,510	215	22,200	35,077	17,700	146,291	34,492	4,600
38	Increase since drainage..... acres.....	6,874	22,845	207		10,949		7,286	8,850	40,621	3,845	1,194
39	Per cent of increase <sup>9</sup> .....	84.6	31.0	6.7				20.8	50.0	27.8	11.1	26.0
40	Per cent increase is of all improved land in farms, 1920.....	30.7	19.0	0.2		44.3		10.3	15.6	20.2	10.0	5.4
41	Timber and cut-over land, 1920..... acres.....	5,985	77,358	827	1,655	751	51,800	4,055	8,850	17,231	98,623	4,774
42	Timber and cut-over land prior to drainage..... acres.....	5,985	100,203	1,034	1,655	751	51,800	6,314	8,850	20,938	102,468	5,414
43	Decrease since drainage..... acres.....		22,845	207				2,259		3,707	3,845	640
44	Per cent of decrease.....		22.8	20.0				35.8		17.7	3.8	11.8
45	Other unimproved land, 1920..... acres.....	855			217,035	1,505		12,197		134,628		10,375
46	Other unimproved land prior to drainage..... acres.....	7,729			217,035	12,454		17,224	8,850	171,542		10,929
47	Decrease since drainage..... acres.....	6,874				10,949		5,027	8,850	36,914		554
48	Per cent of decrease.....	88.9				87.9		29.2	100.0	21.5		5.1
49	Swampy or subject to overflow, 1920..... acres.....	855	32,013	827	176,330	1,505	51,800	12,197		44,391	54,784	2,575
50	Swampy or subject to overflow prior to drainage..... acres.....	14,854	100,203	1,034	178,030	12,454	51,800	22,938	8,850	177,511	75,328	16,859
51	Decrease since drainage..... acres.....	13,999	68,190	207	1,700	10,949		10,741	8,850	133,120	20,544	14,284
52	Per cent of decrease.....	94.2	68.1	20.0	1.0	87.9		46.8	100.0	75.0	27.3	84.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
53	Total capital invested in and required for completion of operating enterprises..... dollars.....	530,550	167,000	12,500	1,207,380	465,438	76,960	756,625	205,000	1,158,000	226,750	462,750
54	Capital invested in these enterprises to Dec. 31, 1919..... dollars.....	443,800	167,000	12,500	1,122,380	446,438	76,960	756,625	192,225	958,082	213,750	404,300
55	Additional capital required to complete these enterprises..... dollars.....	86,750			85,000	19,000			12,775	200,518	13,000	58,450
56	Average cost per acre when completed..... dollars.....	24.29	0.96	3.02	5.43	34.68	1.04	12.91	5.79	3.42	1.66	22.10
57	Enterprises constructing open ditches only..... dollars.....	65,000	167,000	12,500	885,000		76,960	126,625	65,000	476,100	226,750	167,750
58	Average cost per acre when completed..... dollars.....	36.72	0.96	3.02	4.14		1.04	4.40	1.84	1.72	1.66	14.59
59	Enterprises constructing open ditches and levees..... dollars.....	465,550			322,330	465,438		630,000	140,000	682,500		295,000
60	Average cost per acre when completed..... dollars.....	23.20			39.31	34.68		21.12		10.90		31.24
61	Enterprises constructing open ditches and tile drains..... dollars.....											
62	Average cost per acre when completed..... dollars.....											
<b>CROPS.</b>												
<b>Improved land in enterprises reporting—</b>												
63	Sugar cane as principal crop on drained land..... acres.....	10,260	49,647		2,422		22,200	42,363	26,550	72,896	38,337	2,753
64	Rice as principal crop on drained land..... acres.....	669								114,016		500
65	Cotton as principal crop on drained land..... acres.....		46,875									
66	Corn as principal crop on drained land..... acres.....				456	11,164						
67	Vegetables as principal crop on drained land..... acres.....	1,770			632							2,541
68	Other crops as principal ones on drained land..... acres.....	2,300		3,309								

<sup>1</sup> Includes only Orleans and St. Tammany Parishes.  
<sup>2</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the parish as determined by the census of agriculture.  
<sup>3</sup> When works under construction have been completed.  
<sup>4</sup> Included in acreage drained by open ditches only.  
<sup>5</sup> The reported figures have been reduced in proportion to the reduction made in improved land, 1920.  
<sup>6</sup> Per cent not shown when more than 1,000.

# MICHIGAN.

The following pages present the statistics of drainage for Michigan collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. Drainage work done by organized enterprises before 1897, when the present county drain law was enacted, is not included. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of timber and other unim-

proved land not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

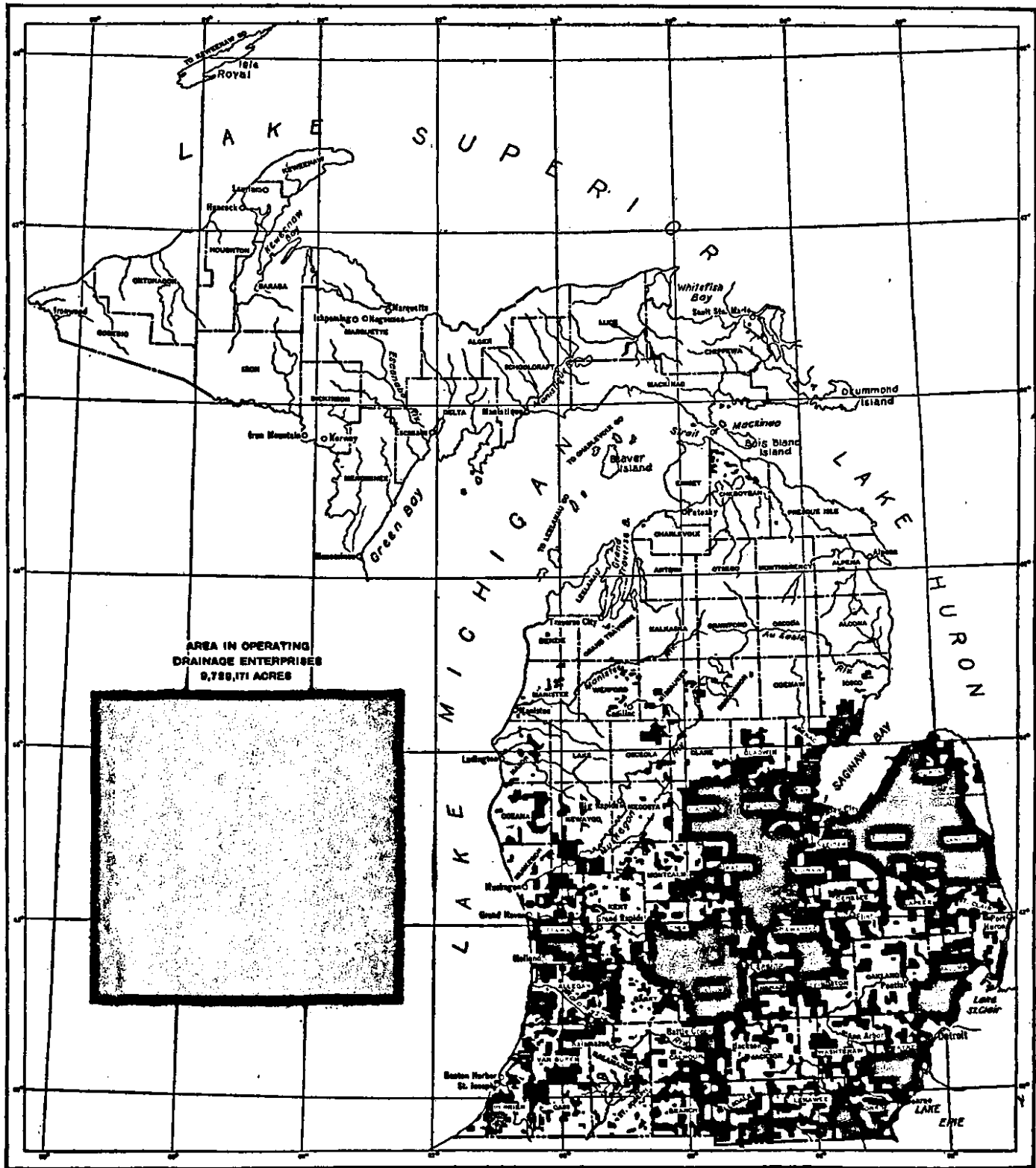
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	196, 447	100. 0
Farms reporting land having drainage.....	66, 948	34. 1
Farms reporting land needing drainage.....	64, 310	32. 7
All land in farms..... acres..	19, 032, 961	100. 0
Improved land in farms..... acres..	12, 925, 521	67. 9
Farm land reported as provided with drainage..... acres..	3, 156, 692	16. 6
Farm land reported as needing drainage..... acres..	2, 070, 387	10. 9
Needing drainage only..... acres..	579, 813	3. 0
Needing drainage and clearing..... acres..	1, 490, 574	7. 8
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	36, 787, 200	100. 0
All land in operating drainage enterprises..... acres..	9, 729, 171	26. 4
Improved land..... acres..	7, 182, 352	19. 5
Per cent of all improved land in farms.....	55. 6	.....
Timber and cut-over land..... acres..	2, 195, 562	6. 0
Other unimproved land..... acres..	351, 257	1. 0
Swampy, subject to overflow, seeped, or alkali..... acres..	1, 020, 207	2. 8
Suffering a loss of crops from defective drainage..... acres..	692, 224	1. 9
Improved land prior to drainage..... acres..	2, 046, 613	5. 6
Increase since drainage began..... acres..	5, 135, 739	14. 0
Land in nonoperating enterprises..... acres..	25, 508	(1)
Open ditches in operating enterprises..... miles..	16, 142. 2	100. 0
Completed..... miles..	16, 023. 8	99. 3
Additional under construction..... miles..	118. 4	0. 7
Tile drains in operating enterprises..... miles..	2, 182. 3	100. 0
Completed..... miles..	2, 173. 9	99. 6
Additional under construction..... miles..	8. 4	0. 4
Total capital invested in and required for completion of operating enterprises...	\$25, 048, 980	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	24, 683, 715	98. 5
Additional capital required to complete these enterprises.....	365, 265	1. 5
Average cost per acre when completed.....	2. 57	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

# MICHIGAN

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence. They may include those that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also others that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,754,679	100.0	\$24,686,729	100.0	\$537,645
Operating enterprises.....	9,729,171	99.7	24,683,715	100.0	365,265
With works completed.....	9,511,555	97.5	24,100,929	97.6	.....
With works under construction.....	217,616	2.2	582,786	2.4	365,265
Nonoperating enterprises.....	25,508	0.3	3,014	( <sup>1</sup> )	172,380

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."  
<sup>2</sup> Less than one-tenth of 1 per cent.

Location of enterprises.—The drainage enterprises in Michigan are located almost entirely in the 47 southern counties which comprise approximately two-thirds of the southern peninsula. The division between the southern section in which a large part of the land has been included in drainage enterprises and the northern section where little drainage has been done is remarkably sharp, as shown by the map on page 2.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,754,679	100.0	\$24,686,729	100.0	\$537,645
Operating enterprises.....	9,729,171	99.7	24,683,715	100.0	365,265
Lake Superior.....	15,424	0.2	66,731	0.3	.....
Lake Michigan.....	3,937,263	40.4	9,058,920	36.7	74,945
Lake Huron.....	4,133,145	42.4	11,948,569	48.4	221,174
Lake Erie.....	1,640,339	16.8	3,609,495	14.6	69,148
Nonoperating enterprises.....	25,508	0.3	3,014	( <sup>1</sup> )	172,380
Lake Michigan.....	17,765	0.2	2,532	( <sup>1</sup> )	80,620
Lake Huron.....	6,065	0.1	453	( <sup>1</sup> )	83,500
Lake Erie.....	1,688	( <sup>1</sup> )	.....	.....	8,260

<sup>1</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—The greater number of enterprises was reported as organized to reclaim or improve land that was swampy or too wet for profitable cultivation. The smaller number, located mainly in the southwestern part of the state, was reported as intended to secure relief for land subject to overflow by stream floods. Prior to undertaking the drainage improvements, approximately 21 per cent of the total area in drainage enterprises was improved land and 70 per cent timbered or cut-over, while about 49 per cent was reported as being then swampy, subject to overflow, or too wet for cultivation.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the drainage improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	9,729,171	100.0	9,511,555	217,616	25,508
Improved land.....	7,182,352	73.8	7,015,644	166,708	8,245
Timber and cut-over land.....	2,196,562	22.6	2,149,652	45,910	15,039
Other unimproved land.....	351,257	3.6	346,259	4,998	2,224
Swampy or subject to overflow..	1,020,207	10.5	987,216	32,991	12,316
Suffering a loss of crops.....	692,224	7.1	676,337	15,887	1,468

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 10,453 operating drainage enterprises are counted in Michigan, from 1897 to 1919, with an average area of 1,508 acres assessed. There are 4,196 of these enterprises embracing less than 500 acres each, 5,970 between 500 and 5,000 acres, and 287 of 5,000 acres or over.

The assessed acreage exceeds the land in enterprises by 6,037,307 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acres.	Per cent of total.
All operating enterprises.....	9,729,171	15,766,478	100.0
Less than 200 acres.....	109,428	155,089	1.0
200 to 499 acres.....	648,405	967,221	6.1
500 to 999 acres.....	1,232,901	1,849,136	11.7
1,000 to 4,999 acres.....	5,359,782	7,902,624	50.1
5,000 to 9,999 acres.....	2,059,229	3,251,318	20.6
10,000 to 49,999 acres.....	199,256	1,072,885	6.8
50,000 to 99,999 acres.....	120,170	568,205	3.6

**Character of enterprises.**—Nearly all the drainage enterprises in Michigan for which statistics are given, except the few commercial land developments and private undertakings by individual owners, are county drains established in accordance with the provisions of the general drainage law approved June 2, 1897 (act 254). That statute repealed all previous drainage laws of the state, but drains previously established under act 227 of 1885 might be completed under it.

The census did not undertake to secure information relating to the drains established before 1897, in Michigan, because the records regarding them were very fragmentary or entirely lacking, except in a few counties. The statistics do include, however, as shown by Table 6, figures for drains established in that year under the earlier law.

The drainage law of 1897, as amended, provides for a county drain commissioner to be elected every two years by the qualified electors, in every organized county in the state. This commissioner is to have jurisdiction over all drains within his county, but drains affecting land in more than one county are under joint jurisdiction of the commissioners of all those counties. Appointment of a special drain commissioner, in case the elected commissioner has an interest in the assessment of benefits, is authorized by statutes of 1901 (act 27) and 1917 (act 109).

An application for a drain must be signed by not less than one-half the freeholders through whose land the drain will pass. The necessity and public utility of the enterprise are determined by the township board or boards of the township or townships in which the drain is to be located, after public hearing. Upon favorable finding, a survey is made by the drain commissioner or a surveyor employed by him, and if the improvement is found practicable the commissioner issues a first order of determination establishing the location and dimensions of the drain. Appeal from this order may be taken to the probate court of the county, and an engineer appointed by the state highway commissioner investigates and decides the necessity and route for the drain. Land for right of way is secured by release or by condemnation proceedings before the probate court. Damages are

determined by three special commissioners appointed by the court or, upon demand, by a jury. Final order of determination is issued by the drain commissioner when right of way has been obtained, defining the special assessment district that shall bear the cost of the undertaking. The cost is apportioned according to benefits assessed by the drain commissioner and determined by him at public hearing. Any township may be assessed for benefits to public health and welfare or for benefits to highways. The assessments are subject to review by three disinterested freeholders appointed by the probate court. The award of damages to each landowner is deducted from his assessment of benefits. Contracts for construction are let by the drain commissioner. The number of installments in which the landowners shall pay their assessments is determined by the drain commissioner, who is authorized by an act of March 18, 1919 (No. 16), to issue bonds for not exceeding 10 years if the number of installments exceeds three. For a drain to be located or to affect land in more than one county, application may be filed with the drain commissioner of any county affected. Proceedings are similar to those for a drain in only one county, but are under the joint control of the drain commissioners of all the counties affected. Also, the necessity for the drain is determined by the drain commissioners instead of by the township boards; in case of disagreement, the state highway commissioner decides.

As originally enacted, the drainage law provided for appointment of the county drain commissioner by the county board of supervisors. The petition for a drain then required the signatures of 10 or more freeholders of the township or townships, including at least 3 liable to assessment for the drain.

Before 1909, the necessity for the drain was determined by the drain commissioner instead of by the township board, and appeals regarding apportionment of benefits were decided by that board.

A few other statutes relating to drainage have been enacted since 1897, which do not affect the character of enterprises as described.

A law of June 20, 1885 (act 227), provided for township and county drain commissioners, the former to be elected and the latter to be appointed by the county board of supervisors. The jurisdiction of the township commissioners was limited to drains located wholly within their respective townships and not affecting land in any other township. The county commissioners were given concurrent jurisdiction with township commissioners for drains wholly within one township, and jurisdiction over the other drains in the county. Drains were located upon petition from five or more freeholders, at least one of whom owned land liable to be assessed for benefits. The drain commissioner determined the necessity and

location for the drain, apportioned the cost, and let contracts for construction. Right of way was secured by voluntary release or by proceedings before the probate court. Drains located or benefiting land in more than one county were under the joint control of the drain commissioners for the counties affected. This act was repealed by the drainage law of 1897.

The first general drainage law of this state was enacted in 1839 (ch. 80), providing means for one landowner to secure drainage outlet across the land of an objecting owner through application to a justice of the peace and payment of damages assessed by a jury. An act of 1847 (No. 104) authorized each board of county commissioners to appoint three drainage commissioners to secure the drainage of the marshes and lowland of the county. The plans and estimates for each project must be approved by the county court. The cost was apportioned by the commissioners against the land to be benefited, subject to review by three appraisers and confirmation by the court. In 1859 it was provided (act 178) that the drainage commissioners should make surveys for drainage upon petition from 10 resident freeholders. These and other drainage laws were repealed by that of 1897.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	9,754,679	100.0	\$24,688,729	100.0	\$537,045
Operating enterprises.....	9,729,171	99.7	24,683,715	100.0	365,265
County drains.....	9,708,891	99.5	24,434,715	99.0	865,265
Laws of 1835, act 227....	53,273	0.5	65,242	0.3	.....
Laws of 1897, act 254....	9,049,302	98.9	24,363,246	98.7	361,765
Not reported.....	4,316	(1)	6,227	(1)	3,500
Commercial developments..	10,960	0.1	199,500	0.8	.....
Individual ownerships....	11,320	0.1	49,600	0.2	.....
Nonoperating enterprises.....	25,508	0.3	3,014	(1)	172,380
County drains, laws of 1897..	25,508	0.3	3,014	(1)	172,380

<sup>1</sup> Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 16,023.8 miles of open ditches, 2,173.9 miles of tile drains, and 33.1 miles of accessory levees; the additional lengths under construction were 118.4 miles of ditches and 8.4 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There are three pumping districts for land drainage among the enterprises in Michigan, which have completed con-

struction. The pumping plants are equipped with 7 centrifugal pumps of 62,000 gallons per minute total capacity and are operated by steam power.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	9,729,171	100.0	\$24,683,715	100.0	\$365,265
Open ditches only.....	8,541,556	87.8	18,098,893	75.8	342,612
Open ditches and levees.....	2,000	(1)	176,284	0.7	.....
Tile drains only.....	318,514	3.3	2,270,188	9.2	16,868
Open ditches and tile drains....	867,101	8.9	3,538,360	14.3	5,785

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,729,171	100.0	\$24,683,715	100.0	\$365,265
Gravity drainage only.....	9,718,471	99.9	24,513,276	99.3	365,265
All drainage by pumping.....	1,100	(1)	22,139	0.1	.....
Part gravity and part pumping..	9,600	0.1	148,300	0.6	.....
Total area served by pumps.....	10,100	0.1	.....	.....	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and over were omitted, as it seemed they did not represent so well the average depths of outlet provided for all the farms in those districts; to include both of these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.2 instead of 4.3 feet.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	9,729,171	100.0
Less than 3 feet.....	89,345	0.9
3.0 to 3.9 feet.....	472,542	4.9
4.0 to 4.9 feet.....	773,674	8.0
5.0 to 5.9 feet.....	337,024	3.5
6.0 to 6.9 feet.....	125,383	1.3
7.0 to 7.9 feet.....	115,603	1.2
8.0 to 8.9 feet.....	15,500	0.2
9.0 to 9.9 feet.....	2,844	( <sup>1</sup> )
10 feet and more.....	1,280	( <sup>1</sup> )
Not reporting branches.....	7,795,976	80.1

<sup>1</sup> Less than one-tenth of 1 per cent.

**Maintenance of works.**—For cleaning out, deepening, widening, and straightening county drains in this state, proceedings are similar to those for securing construction of a new drain, the cost being paid by the land benefited by this work. The petition for cleaning out a drain requires only the signatures of five freeholders of the township or townships in which the drain is located, one or more of whom shall own land liable to be assessed. However, an act of May 10, 1917 (No. 316), provides that upon written request from one or more taxpayers on any drain the county drain commissioner, where he deems that an emergency exists threatening crops or property, may expend not more than 10 per cent of the original cost of the drain.

For cleaning out, deepening, widening, and extending a drain previously constructed in more than one county, application shall be made, according to a statute of May 3, 1919 (act 162), by freeholders numbering at least 10 per cent of those assessed for construction of the drain and who shall be owners of land that was assessed for the construction.

TABLE 10.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,729,171	100.0	\$24,683,715	100.0	\$365,265
By district forces.....	3,200	( <sup>1</sup> )	44,261	0.2	1,790
By contract.....	1,872,052	19.2	4,763,980	19.3	38,964
By landowners.....	9,280	0.1	169,490	0.7	.....
No maintenance provided.....	7,243,624	74.5	18,781,212	76.1	286,393
Not reporting.....	601,015	6.2	919,772	3.7	38,118

<sup>1</sup> Less than one-tenth of 1 per cent.

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the drains were established by the county drain commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work

of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	9,729,171	100.0	15,766,478	100.0
1897 to 1899.....	1,151,668	11.8	1,463,231	9.3
1900 to 1904.....	2,763,584	28.4	3,846,251	24.4
1905 to 1909.....	2,358,660	24.2	3,886,383	24.6
1910 to 1914.....	1,900,100	19.5	3,499,884	22.2
1915 to 1919.....	1,535,174	15.8	3,043,271	19.3
Not reported.....	19,985	0.2	27,458	0.2

TABLE 12.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$24,683,715	100.0	\$365,265
1897 to 1899.....	2,017,054	8.2	.....
1900 to 1904.....	5,724,176	23.2	.....
1905 to 1909.....	5,543,384	22.5	.....
1910 to 1914.....	5,315,603	21.5	.....
1915 to 1919.....	6,013,764	24.4	365,265
Not reported.....	69,754	0.3	.....

TABLE 13.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	16,142.2	100.0	2,182.3	100.0	33.1	100.0
1897 to 1899.....	1,637.2	10.1	84.4	3.9	6.0	18.1
1900 to 1904.....	4,542.3	28.1	274.9	12.6	27.0	81.6
1905 to 1909.....	4,330.9	26.8	321.1	14.7	0.1	0.3
1910 to 1914.....	3,373.8	20.9	746.7	34.2	.....	.....
1915 to 1919.....	2,224.0	13.8	750.8	34.4	.....	.....
Not reported.....	34.0	0.2	4.4	0.2	.....	.....

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are wheat, corn, and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—MICHIGAN.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Alcona.	Allegan.	Alpena.	Arenac.	Barry.	Bay.	Berrien.	Branch.
1	Number of all farms in the state or county.....	198,447	932	5,734	1,275	1,392	3,313	3,216	5,443	3,222
2	Farms reporting land having drainage.....	66,943	26	982	39	195	158	1,854	469	1,333
3	Farms reporting land needing drainage.....	64,310	228	889	541	299	170	1,270	174	1,309
4	Farms in drainage and levee districts.....	23,356	4	369	3	29	7	458	95	566
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county..... acres..	38,787,200	437,760	533,120	373,760	239,360	355,940	253,520	364,160	318,080
6	All land in farms..... acres..	19,032,961	131,388	436,616	153,729	135,334	332,369	227,932	326,690	308,895
7	Improved land in farms..... acres..	12,925,521	49,577	327,395	63,237	72,851	245,963	167,998	262,917	227,781
8	Woodland in farms..... acres..	3,217,000	32,998	46,849	50,243	49,220	42,617	43,725	32,633	27,123
9	Other unimproved land in farms..... acres..	2,890,440	48,813	62,372	40,249	13,263	43,769	16,209	31,140	58,901
10	Farm land reported as provided with drainage..... acres..	3,156,632	878	28,686	766	8,225	4,376	92,782	23,802	42,281
11	Farm land reported as needing drainage..... acres..	2,070,387	16,399	19,738	28,770	14,199	2,765	37,434	2,656	32,587
12	Drainage only..... acres..	579,813	1,522	6,004	7,364	3,888	1,126	7,948	855	18,649
13	Drainage and clearing..... acres..	1,490,574	14,817	13,734	21,406	10,311	1,639	29,486	1,801	13,938

		Calhoun.	Cass.	Cheboygan.	Chippewa.	Clare.	Clinton.	Delta.	Eaton.	Genesee.
1	Number of all farms in the county.....	3,646	2,572	1,186	1,589	1,248	3,323	1,395	3,719	3,639
2	Farms reporting land having drainage.....	928	82	37	73	187	1,932	139	2,621	2,391
3	Farms reporting land needing drainage.....	1,067	158	253	578	823	1,407	531	1,674	2,020
4	Farms in drainage and levee districts.....	477	43	1	2	25	944	31	1,028	513
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	443,520	315,520	464,000	1,006,720	372,480	365,440	748,160	365,440	419,200
6	All land in farms..... acres..	407,958	286,991	127,197	185,202	186,581	343,965	142,127	342,500	368,520
7	Improved land in farms..... acres..	301,566	219,426	55,937	105,870	65,801	275,734	53,021	263,959	291,624
8	Woodland in farms..... acres..	38,449	38,302	38,921	68,783	67,610	47,496	63,821	32,351	38,336
9	Other unimproved land in farms..... acres..	67,943	29,263	32,339	10,549	53,170	20,735	35,295	46,190	38,560
10	Farm land reported as provided with drainage..... acres..	30,337	1,759	899	3,282	5,225	84,362	2,851	123,106	151,901
11	Farm land reported as needing drainage..... acres..	28,105	3,603	13,581	28,340	69,183	31,584	29,939	37,343	54,353
12	Drainage only..... acres..	14,328	1,933	323	1,368	2,144	12,828	2,859	16,049	18,474
13	Drainage and clearing..... acres..	13,777	1,870	13,258	27,472	67,039	18,756	20,080	21,294	35,879

		Gladwin.	Grand Traverse.	Gratiot.	Hillsdale.	Houghton.	Huron.	Ingham.	Ionia.	Iosco.	Isabella.
1	Number of all farms in the county.....	1,452	1,725	3,859	4,025	1,741	4,604	3,224	3,223	929	3,338
2	Farms reporting land having drainage.....	566	82	2,813	2,755	134	1,267	2,295	1,552	170	1,701
3	Farms reporting land needing drainage.....	843	332	2,287	1,974	225	1,419	1,541	1,403	429	1,995
4	Farms in drainage and levee districts.....	461	10	2,196	778	2	808	562	401	44	1,118
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	332,160	298,880	370,560	382,080	652,160	546,560	353,920	370,560	364,800	366,080
6	All land in farms..... acres..	154,633	170,188	328,074	362,815	134,790	480,988	323,196	344,102	121,694	316,771
7	Improved land in farms..... acres..	73,001	113,852	251,326	283,071	56,798	383,584	238,492	266,698	49,673	211,812
8	Woodland in farms..... acres..	30,703	35,000	37,118	38,190	55,812	38,687	31,482	34,877	36,920	34,524
9	Other unimproved land in farms..... acres..	50,869	21,336	39,632	41,554	22,180	58,717	53,222	42,527	35,101	70,435
10	Farm land reported as provided with drainage..... acres..	28,697	1,001	127,510	127,028	3,654	83,953	98,700	63,963	5,890	62,330
11	Farm land reported as needing drainage..... acres..	49,127	5,494	79,440	38,048	13,396	43,456	43,840	29,905	27,324	62,680
12	Drainage only..... acres..	631	1,082	33,508	17,352	660	2,689	27,466	12,578	1,722	12,882
13	Drainage and clearing..... acres..	48,496	4,412	45,932	20,696	12,736	40,767	16,374	17,327	25,601	49,798

		Jackson.	Kalamazoo.	Kent.	Lapeer.	Leelanau.	Lemawee.	Livingston.	Macomb.	Manistee.	Marquette.
1	Number of all farms in the county.....	3,544	3,161	5,605	3,614	1,347	5,080	2,632	3,570	1,499	846
2	Farms reporting land having drainage.....	1,103	543	1,424	1,897	28	4,136	1,119	2,510	149	49
3	Farms reporting land needing drainage.....	1,335	442	1,589	1,778	259	2,678	633	1,121	378	157
4	Farms in drainage and levee districts.....	253	143	285	587	.....	1,088	110	553	8	1
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	452,480	359,680	550,400	426,240	216,320	475,520	363,520	302,080	359,680	1,196,800
6	All land in farms..... acres..	411,877	311,934	469,924	395,932	165,399	456,708	333,339	272,357	147,569	68,450
7	Improved land in farms..... acres..	296,871	247,905	352,740	291,706	90,825	370,047	231,346	221,453	85,292	27,944
8	Woodland in farms..... acres..	43,783	27,565	66,204	43,022	60,657	46,188	41,135	30,006	41,233	45,140
9	Other unimproved land in farms..... acres..	72,073	36,464	50,980	61,204	13,917	40,475	60,858	20,898	21,044	17,366
10	Farm land reported as provided with drainage..... acres..	31,241	12,991	32,156	86,678	639	240,707	40,228	129,008	1,877	899
11	Farm land reported as needing drainage..... acres..	35,968	13,069	33,485	52,005	14,799	66,930	20,053	21,332	9,915	8,459
12	Drainage only..... acres..	21,920	4,865	12,636	15,358	1,608	27,822	14,418	8,687	1,796	893
13	Drainage and clearing..... acres..	14,048	3,234	20,849	36,947	13,191	39,106	5,635	12,645	8,119	7,566



DRAINAGE—MICHIGAN.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Mason.	Mecosta.	Menominee.	Midland.	Missaukee.	Monroe.	Montcalm.	Montmorency.	Muskegon.
1	Number of all farms in the county.....	2,011	2,676	2,106	2,163	1,359	4,108	4,483	421	2,036
2	Farms reporting land having drainage.....	711	267	63	1,292	79	3,442	965	40	760
3	Farms reporting land needing drainage.....	822	1,255	1,858	1,449	524	1,870	1,890	242	699
4	Farms in drainage and levee districts.....	228	94	8	1,215	79	693	532		354
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	316,160	385,440	675,840	338,560	272,480	366,720	463,360	359,040	322,560
6	All land in farms..... acres..	183,428	281,574	222,353	202,927	168,710	318,845	396,333	55,212	173,518
7	Improved land in farms..... acres..	108,180	165,492	85,305	108,762	78,386	271,485	269,145	22,801	107,679
8	Woodland in farms..... acres..	46,145	51,011	68,063	29,809	26,030	30,245	54,681	26,811	38,830
9	Other unimproved land in farms..... acres..	29,103	65,071	68,985	64,356	64,294	17,115	72,507	5,600	27,009
10	Farm land reported as provided with drainage..... acres..	19,784	4,823	1,079	53,870	11,100	201,397	27,289	1,407	89,184
11	Farm land reported as needing drainage..... acres..	28,640	40,111	53,321	72,019	34,942	45,840	45,515	17,277	23,492
12	Drainage only..... acres..	2,307	5,601	1,979	13,581	1,486	28,999	11,139	917	3,794
13	Drainage and clearing..... acres..	26,333	34,510	51,342	58,428	33,456	19,841	34,376	16,360	19,698

		Newaygo.	Oakland.	Oceana.	Ogemaw.	Ontonagon.	Osceola.	Ottawa.	Roscommon.	Saginaw.	St. Clair.
1	Number of all farms in the county.....	2,836	4,035	2,357	1,281	917	2,810	4,296	267	5,143	4,159
2	Farms reporting land having drainage.....	681	1,757	188	19	30	292	1,738	13	1,634	1,659
3	Farms reporting land needing drainage.....	1,080	1,646	43	575	111	993	685	126	1,221	1,135
4	Farms in drainage and levee districts.....	250	301	22	6		63	411	8	924	553
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	544,640	567,040	347,520	371,200	853,120	369,280	361,600	344,320	529,920	454,400
6	All land in farms..... acres..	317,091	462,018	231,030	166,463	80,170	259,130	308,872	51,849	429,649	395,921
7	Improved land in farms..... acres..	167,559	340,567	150,118	67,052	25,025	147,382	238,248	10,419	317,270	311,491
8	Woodland in farms..... acres..	87,853	55,840	48,347	72,995	44,433	42,884	29,446	31,115	53,335	46,912
9	Other unimproved land in farms..... acres..	61,679	65,611	32,565	26,416	10,712	68,864	41,178	9,315	59,044	37,518
10	Farm land reported as provided with drainage..... acres..	25,834	66,741	5,176	2,177	510	7,354	71,682	586	90,120	126,975
11	Farm land reported as needing drainage..... acres..	34,215	38,074	773	32,925	3,012	31,451	17,099	32,048	48,759	31,810
12	Drainage only..... acres..	5,995	19,078	585	723	27	4,205	7,057	2,011	19,853	9,196
13	Drainage and clearing..... acres..	28,220	18,996	188	32,202	2,985	27,246	10,042	30,037	28,906	22,614

		St. Joseph.	Sanilac.	Shiawassee.	Tuscola.	Van Buren.	Washtenaw.	Wayne.	Wexford.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,436	5,112	3,359	4,658	4,682	3,550	3,858	1,583	12,418
2	Farms reporting land having drainage.....	108	2,148	2,107	2,467	872	1,210	2,378	37	252
3	Farms reporting land needing drainage.....	161	1,242	1,555	1,979	594	954	1,038	511	2,171
4	Farms in drainage and levee districts.....	17	729	746	871	238	237	742	21	21
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	321,920	624,640	356,480	529,280	394,880	450,560	396,800	269,280	8,873,600
6	All land in farms..... acres..	292,038	549,839	320,616	445,260	341,089	421,211	262,294	146,712	1,314,855
7	Improved land in farms..... acres..	234,521	454,204	258,781	335,519	266,009	318,748	213,443	88,408	569,409
8	Woodland in farms..... acres..	23,981	39,759	26,816	43,913	40,312	48,286	30,333	29,169	485,917
9	Other unimproved land in farms..... acres..	33,536	55,876	35,019	65,828	34,768	56,177	18,518	29,135	259,529
10	Farm land reported as provided with drainage..... acres..	4,810	168,750	109,115	129,591	22,476	67,819	108,978	738	4,509
11	Farm land reported as needing drainage..... acres..	3,543	37,324	40,414	59,606	14,193	23,626	30,969	17,636	95,709
12	Drainage only..... acres..	1,896	9,196	25,794	20,313	3,954	13,271	20,029	504	8,017
13	Drainage and clearing..... acres..	1,647	28,128	14,620	39,293	10,239	10,365	10,940	17,132	87,692

<sup>1</sup> No drainage on farms reported in Luce County.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Allegan.	Arenac.	Barry.	Bay.	Berrien.	Branch.	Calhoun.	Cass.	
<b>LAND AREA.</b>										
1	Approximate land area of the state or county.....acres..	36,787,200	533,120	239,360	855,840	283,520	304,160	318,080	443,520	815,520
2	All land in operating drainage enterprises.....acres..	9,729,171	312,915	143,734	143,508	241,501	122,877	148,460	252,397	64,027
3	Improved land.....acres..	7,182,352	298,843	158,386	116,347	160,748	97,743	77,102	191,570	44,870
4	Per cent of all improved land in farms.....	65.6	91.3	80.1	47.3	65.7	37.2	33.8	68.5	20.4
5	Timber and cut-over land.....acres..	2,195,562	14,072	85,348	16,729	79,740	1,093	7,449	36,550	5,074
6	Other unimproved land.....acres..	351,257			10,432	1,013	24,041	63,909	24,277	14,083
7	Swampy or subject to overflow, in enterprises.....acres..	1,020,207	6,324	17,893	10,410		225	322	38,350	3,213
8	Suffering a loss of crops from defective drainage.....acres..	692,224	3,932	3,051	10,290	1,954		228	25,555	
9	Assessed acreage.....acres..	15,796,478	496,959	149,294	189,913	274,099	135,087	157,271	323,377	78,019
10	Excess over all land in operating enterprises.....acres..	6,037,307	184,044	8,560	46,405	22,598	12,210	8,811	70,980	13,992
<b>DRAINAGE WORKS.</b>										
11	Open ditches: Completed.....miles..	16,023.6	465.6	203.2	116.4	425.9	217.7	257.4	245.0	51.0
12	Additional under construction.....miles..	118.4	0.9	0.9						2.5
13	Maximum completed in any enterprise.....miles..	75.0	10.0	10.1	13.7	11.4	4.4	7.4	14.6	19.1
14	Maximum width at bottom of ditch.....feet..	70	40	30	22	60	10	18	16	30
15	Maximum of average depths of outlet ditches.....feet..	13.0	9.0	7.0	8.5	11.1	10.0	9.5	10.0	9.0
16	Mean depth of branch ditches.....feet..	4.3	4.1	4.0	4.0	4.2	5.5	3.2	5.0	3.0
17	Tile drains: Completed.....miles..	2,173.9	13.2	0.8	44.3	1.1	74.4	100.6	47.4	2.8
18	Additional under construction.....miles..	8.4	0.3		0.1					
19	Maximum completed in any enterprise.....miles..	10.5	1.3	0.3	10.5	0.7	10.0	4.9	2.5	0.9
20	Maximum size of tile.....inches..	48	18	12	24	20	36	28	20	18
21	Accessory levees and dikes: Completed.....miles..	83.1						0.1		
22	Additional under construction.....miles..									
23	Pumping plants: Engine capacity.....horsepower..	1,085								
24	Pump capacity.....gallons per minute..	62,000								
25	Area served by pumps.....acres..	10,100								
26	Area drained by open ditches only.....acres..	8,541,556	301,173	142,614	119,129	237,501	93,862	90,909	226,105	60,542
27	Length of these ditches.....miles..	14,725.0	445.4	202.0	100.5	421.0	193.0	212.3	205.9	77.5
28	Average length per acre.....feet..	9.1	7.8	7.6	4.5	9.4	10.9	12.3	4.8	6.8
29	Area having open ditches and levees.....acres..	*2,000						1,000		
30	Length of these ditches.....miles..	93.6						4.6		
31	Average length per acre.....feet..							24.3		
32	Length of accessory levees.....miles..	33.1						0.1		
33	Area drained by tile only.....acres..	318,514	2,281		8,460		15,292	22,955	6,971	320
34	Length of these tile.....miles..	1,303.7	5.2		17.4		52.9	68.6	28.9	0.5
35	Average length per acre.....feet..	21.6	12.0		10.9		18.3	15.8	21.9	8.3
36	Area drained by open ditches and tile.....acres..	867,101	9,461	1,120	15,919	4,000	18,728	33,596	19,321	3,165
37	Length of these ditches.....miles..	2,202.2	29.4	2.4	42.9	6.0	46.2	72.5	57.6	8.3
38	Average length per acre.....feet..	13.4	16.4	11.3	14.2	7.9	17.8	11.4	15.7	13.8
<b>DEVELOPMENT OF LAND.</b>										
39	Improved land in operating enterprises, 1920.....acres..	7,182,352	298,843	158,386	116,347	160,748	97,743	77,102	191,570	44,870
40	Improved land prior to drainage.....acres..	2,046,613	236,165	47,976	60,524	148,293	61,291	38,830	2,277	36,411
41	Increase since drainage.....acres..	5,135,739	62,678	10,411	55,823	12,455	36,452	38,272	189,293	8,459
42	Per cent of increase.....	250.9	26.5	21.7	92.2	8.4	59.5	98.6		23.2
43	Per cent increase of all improved land in farms, 1920.....	39.7	19.1	14.3	22.7	7.4	13.9	16.8	62.8	3.9
44	Timber and cut-over land, 1920.....acres..	2,195,562	14,072	85,348	16,729	79,740	1,093	7,449	36,550	5,074
45	Timber and cut-over land prior to drainage.....acres..	6,809,213	78,750	98,759	23,185	91,397	22,120	36,607	185,348	12,743
46	Decrease since drainage.....acres..	4,613,651	62,678	10,411	6,436	11,657	22,027	29,158	148,798	7,669
47	Per cent of decrease.....	67.8	81.7	10.9	27.8	12.8	95.3	79.7	60.3	60.2
48	Other unimproved land, 1920.....acres..	351,257			10,432	1,013	24,041	63,909	24,277	14,083
49	Other unimproved land prior to drainage.....acres..	873,345			59,819	1,811	38,406	73,023	64,772	14,873
50	Decrease since drainage.....acres..	522,088			49,387	798	14,425	9,114	40,495	790
51	Per cent of decrease.....	59.8			82.6	44.1	37.5	12.5	62.5	5.3
52	Swampy or subject to overflow, 1920.....acres..	1,020,207	6,324	17,893	10,410		225	322	38,350	3,213
53	Swampy or subject to overflow prior to drainage.....acres..	4,763,016	65,240	36,400	58,862	9,649	18,542	58,544	84,695	16,737
54	Decrease since drainage.....acres..	3,742,809	58,916	18,507	48,452	9,649	18,317	58,222	46,345	13,524
55	Per cent of decrease.....	78.6	90.3	50.8	82.3	100.0	98.3	99.4	54.7	80.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
56	Total capital invested in and required for completion of operating enterprises.....dollars..	25,048,980	416,121	475,212	198,350	500,910	315,540	515,941	421,011	158,793
57	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	24,683,715	414,461	473,012	197,771	500,910	315,540	515,941	421,011	150,293
58	Additional capital required to complete these enterprises.....dollars..	365,265	1,660	2,200	579					8,500
59	Average cost per acre when completed.....dollars..	2.57	1.33	3.31	1.38	2.07	2.57	3.48	1.67	2.48
60	Enterprises constructing open ditches only.....dollars..	19,041,485	386,967	473,111	121,104	488,210	216,521	239,893	267,842	148,663
61	Average cost per acre when completed.....dollars..	2.23	1.23	3.32	1.02	2.06	2.31	2.64	1.18	2.46
62	Enterprises constructing open ditches and levees.....dollars..	176,284						7,884		
63	Average cost per acre when completed.....dollars..	88.14						7.98		
64	Enterprises constructing tile drains only.....dollars..	2,287,056	6,143		29,964		49,855	124,064	41,847	556
65	Average cost per acre when completed.....dollars..	7.18	2.89		3.54		3.26	5.40	3.00	1.74
66	Enterprises constructing open ditches and tile drains.....dollars..	3,544,145	22,991	2,101	47,232	12,700	49,164	144,010	111,322	9,554
67	Average cost per acre when completed.....dollars..	4.09	2.43	1.88	2.97	3.18	3.58	4.29	5.76	3.02
<b>CROPS.</b>										
68	Improved land in enterprises reporting—Wheat as principal crop on drained land.....acres..	2,669,222	5,689					6,252	189,824	
69	Corn as principal crop on drained land.....acres..	1,525,685	212,621		106,348			70,804	1,746	
70	Sugar beets as principal crop on drained land.....acres..	1,140,880				28,994				
71	Peas and beans (dried) as principal crops on drained land.....acres..	616,142		58,386		131,754				
72	Hay as principal crop on drained land.....acres..	456,601	42,828		7,783					
73	Vegetables as principal crop on drained land.....acres..	272,843	27,674							
74	Potatoes as principal crop on drained land.....acres..	119,909								
75	Oats as principal crop on drained land.....acres..	10,032	570		2,216			45		
76	Rye as principal crop on drained land.....acres..	7,516								
77	Other crops as principal ones on drained land.....acres..	351,835	8,977				97,743			44,870
78	Not reporting principal crop on drained land.....acres..	11,687	284							

1 Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 Additional area reported under "open ditches only."  
 4 The reported figures have been reduced by the same acreage as the improved land, 1920.  
 5 Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Cheboy- gan.	Chippe- wa.	Clare.	Clinton.	Eaton.	Genesee.	Gladwin.	Gratiot.	Hills- dale.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres..	464,000	1,006,720	372,480	365,440	365,440	419,200	332,160	370,560	382,080
2	All land in operating drainage enterprises.....acres..	22,483	15,424	21,164	272,709	347,032	188,943	124,029	324,969	197,849
3	Improved land.....acres..	13,915	5,508	13,215	187,269	261,989	136,149	68,182	249,338	185,866
4	Per cent of all improved land in farms.....	24.9	5.2	20.1	87.9	99.3	46.7	93.4	99.2	65.5
5	Timber and cut-over land.....acres..	8,568	9,916	7,949	85,440	85,043	52,443	55,847	75,631	6,889
6	Other unimproved land.....acres..						351			5,594
7	Swampy or subject to overflow, in enterprises.....acres..	4,021	6,750	7,640	28,948	41,544	24,061	23,302	28,147	3,956
8	Suffering a loss of crops from defective drainage.....acres..	490		3,854	27,219	41,997	23,461	17,762	17,416	2,392
9	Assessed acreage.....acres..	26,403	15,424	21,164	818,623	949,278	315,400	124,534	793,808	204,300
10	Excess over all land in operating enterprises.....acres..	8,920			545,914	602,246	126,467	595	468,889	6,541
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....miles..	29.8	15.7	42.0	546.7	447.5	342.6	224.4	798.5	174.1
12	Additional under construction.....miles..	0.4					0.4			
13	Maximum completed in any enterprise.....miles..	3.7	6.5	4.2	20.5	27.7	14.5	9.7	23.0	7.5
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	14	18	8	45	30	30	10	60	30
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	5.0	7.0	6.0	11.0	12.0	8.0	6.7	12.1	6.5
16	Mean depth of branch ditches <sup>1</sup> .....feet..		7.0	3.6	3.8	4.9	4.5	4.2	4.8	3.8
<b>Tile drains:</b>										
17	Completed.....miles..			8.6	97.1	185.7	106.9	0.9	174.8	173.8
18	Additional under construction.....miles..					2.3				
19	Maximum completed in any enterprise.....miles..			0.9	4.6	7.1	3.5	0.6	4.8	5.5
20	Maximum size of tile <sup>1</sup> .....inches..			12	24	30	24	18	27	24
<b>Accessory levees and dikes:</b>										
21	Completed.....miles..									
22	Additional under construction.....miles..									
<b>Pumping plants:</b>										
23	Engine capacity.....horsepower..									
24	Pump capacity.....gallons per minute..									
25	Area served by pumps.....acres..									
26	Area drained by open ditches only <sup>1</sup> .....acres..	22,483	15,424	18,607	225,436	294,285	124,607	123,375	309,998	95,204
27	Length of these ditches.....miles..	30.2	15.7	38.4	488.6	372.9	269.2	223.5	735.1	101.6
28	Average length per acre.....feet..	7.1	5.4	10.9	11.4	6.7	11.4	9.6	12.5	5.6
29	Area having open ditches and levees <sup>1</sup> .....acres..									
30	Length of these ditches.....miles..									
31	Average length per acre.....feet..									
32	Length of accessory levees.....miles..									
33	Area drained by tile only <sup>1</sup> .....acres..			919	11,033	14,116	15,420	59	2,830	33,868
34	Length of these tile.....miles..			2.3	40.5	123.0	57.4	0.6	127.3	98.4
35	Average length per acre.....feet..			18.2	19.4	46.0	19.7	53.7	237.5	15.3
36	Area drained by open ditches and tile <sup>1</sup> .....acres..			1,638	36,240	28,631	48,916	595	12,141	68,682
37	Length of these drains.....miles..			6.1	114.7	139.6	123.3	1.2	110.4	147.9
38	Average length per acre.....feet..			19.7	16.7	19.1	13.3	10.6	48.0	11.4
<b>DEVELOPMENT OF LAND.</b>										
39	Improved land in operating enterprises, 1920.....acres..	13,915	5,508	13,215	187,269	261,989	136,149	68,182	249,338	185,866
40	Improved land prior to drainage.....acres..	7,116	1,827	7,520	268	622	39,925	35,982		95,427
41	Increase since drainage.....acres..	6,799	3,681	5,695	187,001	261,367	96,224	32,200	249,338	89,939
42	Per cent of increase <sup>1</sup> .....	95.5	201.5	75.7			241.0	89.5		94.2
43	Per cent increase is of all improved land in farms, 1920.....	12.2	3.5	8.7	97.8	99.0	33.0	44.1	99.2	31.8
44	Timber and cut-over land, 1920.....acres..	8,568	9,916	7,949	85,440	85,043	52,443	55,847	75,631	6,889
45	Timber and cut-over land prior to drainage.....acres..	15,267	13,597	13,644	272,174	346,218	148,432	88,047	324,969	19,371
46	Decrease since drainage.....acres..	6,799	3,681	5,695	186,734	261,175	95,989	32,200	249,338	12,482
47	Per cent of decrease.....	44.2	27.1	41.7	68.6	75.4	64.7	36.6	76.7	64.4
48	Other unimproved land, 1920.....acres..						351			5,594
49	Other unimproved land prior to drainage.....acres..				267	192	586			83,051
50	Decrease since drainage.....acres..				267	192	235			77,457
51	Per cent of decrease.....				100.0	100.0	40.1			93.3
52	Swampy or subject to overflow, 1920.....acres..	4,021	6,750	7,640	28,948	41,544	24,061	23,302	28,147	3,956
53	Swampy or subject to overflow prior to drainage.....acres..	14,095	13,308	11,974	101,357	103,745	101,758	31,766	289,208	82,164
54	Decrease since drainage.....acres..	10,074	6,558	4,334	72,409	62,201	77,697	8,464	261,062	78,208
55	Per cent of decrease.....	71.5	49.3	36.2	71.4	60.0	76.4	26.6	90.3	95.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
56	Total capital invested in and required for completion of operating enterprises.....dollars..	28,994	36,731	66,261	1,026,932	1,065,948	705,917	366,320	1,506,847	587,573
57	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	28,994	36,731	66,261	1,026,932	1,065,948	704,672	366,320	1,506,847	587,573
58	Additional capital required to complete these enterprises.....dollars..	400				7,310	1,245			
59	Average cost per acre when completed.....dollars..	1.07	2.38	3.18	3.77	3.07	3.74	2.95	4.64	2.97
60	Enterprises constructing open ditches only.....dollars..	23,994	36,731	54,626	759,416	604,811	292,735	362,051	1,055,296	197,868
61	Average cost per acre when completed.....dollars..	1.07	2.38	2.94	3.37	2.06	2.35	2.93	3.40	2.08
62	Enterprises constructing open ditches and levees.....dollars..									
63	Average cost per acre when completed.....dollars..									
64	Enterprises constructing tile drains only.....dollars..			3,889	66,380	187,730	148,707	929	243,043	162,785
65	Average cost per acre when completed.....dollars..			4.23	6.02	13.30	9.64	15.75	85.88	4.81
66	Enterprises constructing open ditches and tile drains.....dollars..			7,746	201,136	273,407	264,475	3,340	208,508	226,920
67	Average cost per acre when completed.....dollars..			4.73	5.55	7.08	5.41	5.61	17.17	3.30
<b>CROPS.</b>										
<b>Improved land in enterprises reporting—</b>										
68	Wheat as principal crop on drained land.....acres..		2,529		77,122	261,259	123,875			184,469
69	Corn as principal crop on drained land.....acres..				461	618				
70	Sugar beets as principal crop on drained land.....acres..				108,462				244,558	122
71	Peas and beans (dried) as principal crops on drained land.....acres..			13,215			2,880			
72	Hay as principal crop on drained land.....acres..	18,915	2,979			112		68,182	4,600	
73	Vegetables as principal crop on drained land.....acres..									
74	Potatoes as principal crop on drained land.....acres..									
75	Oats as principal crop on drained land.....acres..									
76	Rye as principal crop on drained land.....acres..									
77	Other crops as principal ones on drained land.....acres..				84		9,394			
78	Not reporting principal crop on drained land.....acres..				1,120				180	775

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Huron.	Ingham.	Ionia.	Iosco.	Isabella.	Jackson.	Kalamazoo.	Kent.	Lapeer.	
<b>LAND AREA.</b>										
1	Approximate land area of the county..... acres..	546,560	353,920	370,560	364,800	366,080	452,480	359,680	550,400	426,240
2	All land in operating drainage enterprises..... acres..	430,219	222,114	286,153	31,974	307,024	76,139	79,511	145,370	238,235
3	Improved land..... acres..	1,357,924	177,928	228,743	14,348	1,201,061	61,747	61,329	143,084	168,308
4	Per cent of all improved land in farms.....	83.3	74.6	85.8	28.9	94.9	20.9	24.7	40.6	57.7
5	Timber and cut-over land..... acres..	72,295	9,905	43,188	14,731	105,963	4,273	10,653	55	69,638
6	Other unimproved land..... acres..		84,281	14,222	2,895		10,119	7,529	2,231	289
7	Swampy or subject to overflow, in enterprises..... acres..	5,939	33,929	28,618	13,450	63,895	9,437	5,715	1,572	25,258
8	Suffering a loss of crops from defective drainage..... acres..	5,547	33,701	28,618	5,070	22,200	9,381	5,208	139	22,480
9	Assessed acreage..... acres..	709,772	694,839	207,072	43,444	319,071	82,190	107,421	250,397	365,038
10	Excess over all land in operating enterprises..... acres..	279,553	472,725	20,919	11,470	12,047	6,051	27,910	105,027	126,803
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed..... miles..	651.1	322.1	243.4	32.1	289.5	112.6	145.5	208.2	372.2
12	Additional under construction..... miles..	7.4						2.6	1.7	7.1
13	Maximum completed in any enterprise..... miles..	17.5	11.4	13.7	4.4	10.2	5.1	7.5	10.0	10.1
14	Maximum width at bottom of ditch <sup>1</sup> ..... feet..	35	25	30	20	20	8	30	30	40
15	Maximum of average depths of outlet ditches <sup>1</sup> ..... feet..	8.0	10.0	9.0	7.0	7.2	10.0	10.0	9.0	10.0
16	Mean depth of branch ditches <sup>2</sup> ..... feet..	5.1	4.2	4.5	3.0	4.3	4.0	5.4	3.5	4.1
Tile drains:										
17	Completed..... miles..		154.6	98.8	0.2	277.3	10.5	4.0	14.1	20.2
18	Additional under construction..... miles..									0.2
19	Maximum completed in any enterprise..... miles..		4.9	6.9	0.2	7.4	0.9	0.8	1.5	1.6
20	Maximum size of tile <sup>3</sup> ..... inches..		48	36	12	27	24	48	36	16
Accessory levees and dikes:										
21	Completed..... miles..									
22	Additional under construction..... miles..									
Pumping plants:										
23	Engine capacity..... horsepower..									
24	Pump capacity..... gallons per minute..									
25	Area served by pumps..... acres..									
26	Area drained by open ditches only <sup>1</sup> ..... acres..	430,219	160,423	221,038	31,214	135,417	57,371	73,084	128,721	224,100
27	Length of these ditches..... miles..	658.5	243.8	204.4	31.0	137.3	94.9	135.8	180.0	352.2
28	Average length per acre..... feet..	8.1	8.0	4.9	5.2	5.4	8.7	9.8	7.4	8.5
29	Area having open ditches and levees <sup>1</sup> ..... acres..									
30	Length of these ditches..... miles..									
31	Average length per acre..... feet..									
32	Length of accessory levees..... miles..									
33	Area drained by tile only <sup>1</sup> ..... acres..		13,970	32,346		38,218	3,498	320	2,631	3,165
34	Length of these tile..... miles..		94.6	75.7		145.8	5.3	0.2	5.9	12.4
35	Average length per acre..... feet..		36.5	12.4		20.3	8.0	3.2	11.8	20.7
36	Area drained by open ditches and tile <sup>1</sup> ..... acres..		47,721	32,769	760	133,389	15,270	6,127	14,018	10,970
37	Length of these drains..... miles..		136.3	62.1	1.3	282.7	22.9	16.1	35.1	25.1
38	Average length per acre..... feet..		15.1	10.0	9.0	11.2	7.9	13.9	13.6	12.1
<b>DEVELOPMENT OF LAND.</b>										
39	Improved land in operating enterprises, 1920..... acres..	1,357,924	177,928	228,743	14,348	1,201,061	61,747	61,329	143,084	168,308
40	Improved land prior to drainage..... acres..	132,017	142,179	9,363	163,351	61,070	25,473	127,596	16,484	16,484
41	Increase since drainage..... acres..	357,924	45,911	86,584	4,985	47,710	10,577	35,856	16,488	151,824
42	Per cent of increase.....	34.8	60.9	53.2	31.1	20.9	140.8	12.1	92.1	921.0
43	Per cent increase is of all improved land in farms, 1920.....	93.3	19.3	32.5	10.0	22.5	3.6	14.5	4.4	53.0
44	Timber and cut-over land, 1920..... acres..	72,295	9,905	43,188	14,731	105,963	4,273	10,653	55	69,638
45	Timber and cut-over land prior to drainage..... acres..	430,219	27,001	129,752	18,672	153,673	8,029	16,661	55	220,904
46	Decrease since drainage..... acres..	357,924	17,096	86,584	3,941	47,710	3,756	6,008		151,266
47	Per cent of decrease.....	83.2	63.3	66.7	21.1	31.0	46.8	32.0		68.5
48	Other unimproved land, 1920..... acres..		34,281	14,222	2,895		10,119	7,529	2,231	289
49	Other unimproved land prior to drainage..... acres..		63,096	14,222	3,939		17,040	38,377	17,719	847
50	Decrease since drainage..... acres..		28,815		1,044		6,921	30,848	15,488	558
51	Per cent of decrease.....		45.7		26.5		40.6	80.4	87.4	65.9
52	Swampy or subject to overflow, 1920..... acres..	5,939	33,929	28,618	13,450	63,895	9,437	5,715	1,572	25,258
53	Swampy or subject to overflow prior to drainage..... acres..	835,762	66,544	114,196	19,179	126,126	17,077	35,857	20,711	124,366
54	Decrease since drainage..... acres..	329,813	32,615	85,578	5,729	62,231	7,640	30,142	19,139	99,108
55	Per cent of decrease.....	39.2	49.0	74.9	29.9	49.3	44.7	84.1	92.4	79.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
56	Total capital invested in and required for completion of operating enterprises..... dollars..	1,211,674	875,515	539,859	65,428	785,943	115,338	178,098	271,543	575,742
57	Capital invested in these enterprises to Dec. 31, 1919..... dollars..	1,180,924	875,515	539,859	65,428	785,943	115,338	167,351	241,543	568,317
58	Additional capital required to complete these enterprises..... dollars..	31,050						10,747	30,000	7,425
59	Average cost per acre when completed..... dollars..	2.82	3.94	1.89	2.05	2.56	1.51	2.24	1.87	2.41
60	Enterprises constructing open ditches only..... dollars..	1,211,674	322,084	336,709	52,694	163,750	84,201	155,330	204,778	521,372
61	Average cost per acre when completed..... dollars..	2.82	2.01	1.52	1.69	1.21	1.47	2.13	1.59	2.33
62	Enterprises constructing open ditches and levees..... dollars..									
63	Average cost per acre when completed..... dollars..									
64	Enterprises constructing tile drains only..... dollars..		283,644	103,573		197,453	9,447	604	34,947	18,455
65	Average cost per acre when completed..... dollars..		20.30	3.17		5.17	2.70	1.89	13.28	5.83
66	Enterprises constructing open ditches and tile drains..... dollars..		269,787	100,577	13,734	424,740	21,690	22,164	31,818	33,915
67	Average cost per acre when completed..... dollars..		6.65	3.07	10.76	3.18	1.42	5.62	2.27	3.09
<b>CROPS.</b>										
68	Improved land in enterprises reporting—									
69	Wheat as principal crop on drained land..... acres..		10,411	1,440			1,390	539		168,308
70	Corn as principal crop on drained land..... acres..		166,905	227,303			49,418	39,935	138,280	
71	Sugar beets as principal crop on drained land..... acres..	357,924								
72	Peas and beans (dried) as principal crops on drained land..... acres..					200,984				
73	Hay as principal crop on drained land..... acres..		612		14,348		9,538	6,567	1,659	
74	Vegetables as principal crop on drained land..... acres..					77		1,794	1,180	
75	Potatoes as principal crop on drained land..... acres..						2,351	140		
76	Oats as principal crop on drained land..... acres..							1,467		
77	Rye as principal crop on drained land..... acres..									
78	Other crops as principal ones on drained land..... acres..							10,887	1,935	
79	Not reporting principal crop on drained land..... acres..									

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The reported figures have been reduced by the same acreage as the improved land, 1920.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Lea- wee.	Living- ston.	Macomb.	Manis- tee.	Mason.	Mecosta.	Midland.	Missau- kee.	Monroe.	Mont- calm.	
<b>LAND AREA.</b>												
1	Approximate land area of the county.....	acres	475,520	363,520	302,080	359,680	316,160	365,440	333,560	372,480	365,720	463,360
2	All land in operating drainage enterprises.....	acres	275,535	213,481	258,359	12,128	26,333	23,590	326,890	26,802	251,387	153,613
3	Improved land.....	acres	245,775	173,083	208,052	6,885	18,431	21,563	101,210	10,388	215,029	110,816
4	Per cent of all improved land in farms.....	per cent	66.4	74.8	93.9	8.1	17.0	13.0	63.1	13.3	79.2	41.2
5	Timber and out-over land.....	acres	29,760	17,853	48,101	5,243	7,878	2,027	225,480	16,414	32,314	39,894
6	Other unimproved land.....	acres	22,545	206	206	24	24	24	24	24	4,044	2,803
7	Swampy or subject to overflow, in enterprises.....	acres	30,199	23,719	21,178	4,047	9,456	4,584	89,842	8,228	23,525	29,103
8	Suffering a loss of crops from defective drainage.....	acres	27,823	42,638	206	2,090	1,367	2,688	156	1,065	32,281	13,995
9	Assessed acreage.....	acres	568,882	249,667	303,572	12,128	26,755	31,910	415,628	26,862	564,982	205,161
10	Excess over all land in operating enterprises.....	acres	293,347	86,186	47,213	422	8,320	88,938	60	313,595	61,648	
<b>DRAINAGE WORKS.</b>												
Open ditches:												
11	Completed.....	miles	465.6	245.2	348.2	29.8	94.3	41.4	608.1	60.7	627.3	241.0
12	Additional under construction.....	miles	9.3	0.4	0.4	4.5	0.4	0.4	2.7	0.7	1.1	
13	Maximum completed in any enterprise.....	miles	10.9	10.9	10.2	7.6	9.4	4.2	16.4	17.0	18.9	21.5
14	Maximum width at bottom of ditch.....	feet	15	30	30	12	10	8	40	12	25	16
15	Maximum of average depths of outlet ditches.....	feet	10.0	9.0	8.0	4.0	5.5	7.8	8.2	5.0	10.0	7.5
16	Mean depth of branch ditches.....	feet	4.2	5.5	8.4	3.0	3.6	3.5	4.5	3.6	10.0	8.9
Tile drains:												
17	Completed.....	miles	233.3	65.2	12.1	0.3	0.4	1.7	58.0	0.2	24.1	10.7
18	Additional under construction.....	miles	1.9	0.3	0.3	0.3	0.4	1.3	1.4	1.4	2.5	2.0
19	Maximum completed in any enterprise.....	miles	3.2	4.2	4.0	0.2	0.4	1.3	6.9	0.2	2.5	2.0
20	Maximum size of tile.....	inches	32	20	24	15	15	24	15	15	20	18
Accessory levees and dikes:												
21	Completed.....	miles										
22	Additional under construction.....	miles										
Pumping plants:												
23	Engine capacity.....	horsepower										
24	Pump capacity.....	gallons per minute										
25	Area served by pumps.....	acres										
26	Area drained by open ditches only.....	acres	198,117	153,527	216,800	11,352	26,292	22,258	286,514	26,205	243,887	129,680
27	Length of these ditches.....	miles	414.8	164.5	338.0	38.8	94.3	39.3	630.8	58.1	622.6	201.5
28	Average length per acre.....	feet	11.1	5.7	8.2	15.7	18.9	9.3	9.8	11.7	13.5	8.2
29	Area having open ditches and levees.....	acres										
30	Length of these ditches.....	miles										
31	Average length per acre.....	feet										
32	Length of accessory levees.....	miles										
33	Area drained by tile only.....	acres	34,158	6,021	4,611		41	480	6,185		4,890	2,026
34	Length of these tile.....	miles	170.7	19.6	4.2		0.4	1.3	35.9		20.4	2.2
35	Average length per acre.....	feet	26.4	17.2	4.8		51.5	14.3	30.6		22.0	5.7
36	Area drained by open ditches and tile.....	acres	43,280	59,548	34,948	776		852	33,991	597	2,610	21,607
37	Length of these drains.....	miles	124.6	128.3	18.8	0.8		2.5	103.1	4.9	9.5	48.0
38	Average length per acre.....	feet	15.2	12.4	2.8	5.4		15.5	16.0	43.3	19.2	11.7
<b>DEVELOPMENT OF LAND.</b>												
39	Improved land in operating enterprises, 1920.....	acres	245,775	173,083	208,052	6,885	18,431	21,563	101,210	10,388	215,029	110,816
40	Improved land prior to drainage.....	acres	916	633	800	2,946	5,269	20,138	49,429	4,751	1,910	42,631
41	Increase since drainage.....	acres	244,859	172,450	207,252	3,939	13,162	1,425	51,781	5,637	213,119	68,185
42	Per cent of increase.....	per cent	26.4	26.4	67.8	133.7	249.8	7.1	104.8	118.6	159.9	159.9
43	Per cent increase is of all improved land in farms, 1920.....	per cent	66.2	74.5	93.6	4.6	12.2	0.9	47.6	7.2	78.5	25.3
44	Timber and out-over land, 1920.....	acres	29,760	17,853	48,101	5,243	7,878	2,027	225,480	16,414	32,314	39,894
45	Timber and out-over land prior to drainage.....	acres	254,249	134,160	254,993	9,182	21,040	3,452	277,261	22,051	189,383	108,079
46	Decrease since drainage.....	acres	224,489	116,307	206,892	3,939	13,162	1,425	51,781	5,637	157,069	68,185
47	Per cent of decrease.....	per cent	88.3	66.7	81.1	42.9	62.6	41.3	18.7	26.6	82.9	63.1
48	Other unimproved land, 1920.....	acres	22,545	206	206	24	24	24	24	24	4,044	2,803
49	Other unimproved land prior to drainage.....	acres	20,370	78,658	566	24	24	24	24	24	60,094	2,803
50	Decrease since drainage.....	acres	20,370	66,143	360						56,050	
51	Per cent of decrease.....	per cent	100.0	71.3	68.6						93.3	
52	Swampy or subject to overflow, 1920.....	acres	30,199	23,719	21,178	4,047	9,456	4,584	89,842	8,228	23,525	29,103
53	Swampy or subject to overflow prior to drainage.....	acres	195,491	59,688	141,109	9,182	14,980	11,384	228,063	18,630	209,472	119,008
54	Decrease since drainage.....	acres	165,292	35,969	119,931	5,135	5,533	6,800	138,221	10,402	185,947	89,905
55	Per cent of decrease.....	per cent	84.6	60.3	85.0	55.9	36.9	59.7	60.6	55.8	88.6	75.5
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
56	Total capital invested in and required for completion of operating enterprises.....	dollars	946,798	487,860	596,849	31,610	88,803	54,863	1,029,181	64,498	479,937	276,104
57	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	923,653	487,860	596,849	23,610	88,803	54,863	994,167	61,698	479,737	276,104
58	Additional capital required to complete these enterprises.....	dollars	23,145			8,000			85,014	2,800	900	
59	Average cost per acre when completed.....	dollars	3.44	2.29	1.55	2.61	3.37	2.33	8.15	2.41	1.91	1.80
60	Enterprises constructing open ditches only.....	dollars	482,193	245,113	304,282	29,620	88,515	48,661	880,323	58,976	454,154	197,115
61	Average cost per acre when completed.....	dollars	2.43	1.60	1.68	2.61	3.37	2.19	2.90	2.25	1.86	1.53
62	Enterprises constructing open ditches and levees.....	dollars										
63	Average cost per acre when completed.....	dollars										
64	Enterprises constructing tile drains only.....	dollars	261,739	41,476	18,594		288	2,957	37,317		20,434	6,468
65	Average cost per acre when completed.....	dollars	7.66	6.89	4.03		7.02	6.22	6.03		4.18	3.19
66	Enterprises constructing open ditches and tile drains.....	dollars	202,866	201,271	13,973	1,990		3,215	161,541	5,522	5,349	72,521
67	Average cost per acre when completed.....	dollars	4.69	5.73	0.40	3.56		8.77	4.75	9.25	2.05	3.36
<b>CROPS.</b>												
Improved land in enterprises reporting—												
68	Wheat as principal crop on drained land.....	acres	107,843	172,256	147,778						169,910	4,792
69	Corn as principal crop on drained land.....	acres	91,464	827				312	12,446		15,788	28,731
70	Sugar beets as principal crop on drained land.....	acres	24,635		49,349							1,073
71	Peas and beans (dried) as principal crops on drained land.....	acres										21,310
72	Hay as principal crop on drained land.....	acres				6,885	18,112	9,115		9,765		20,922
73	Vegetables as principal crop on drained land.....	acres			720						14,210	4,189
74	Potatoes as principal crop on drained land.....	acres	21,928		10,205		7			628	15,121	17,014
75	Oats as principal crop on drained land.....	acres										
76	Rye as principal crop on drained land.....	acres										
77	Other crops as principal ones on drained land.....	acres										7,762
78	Not reporting principal crop on drained land.....	acres										5,028

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Muskegon.	Newaygo.	Oakland.	Oceana.	Oscoda.	Ottawa.	Roscommon.	Saginaw.	St. Clair.	
<b>LAND AREA.</b>										
1	Approximate land area of the county..... acres	322,560	544,640	567,040	347,520	389,280	361,600	344,320	529,920	454,400
2	All land in operating drainage enterprises..... acres	85,919	116,695	179,541	84,587	48,829	252,928	8,360	444,570	194,825
3	Improved land..... acres	77,417	81,258	132,131	37,116	33,214	1,215,456	820	1,300,819	142,705
4	Per cent of all improved land in farms.....	71.9	48.5	38.8	24.7	22.5	90.4	7.9	94.8	45.8
5	Timber and cut-over land..... acres	8,146	35,437	47,410	47,063	15,615	37,472	2,436	143,751	52,120
6	Other unimproved land..... acres	356			408			5,104		
7	Swampy or subject to overflow, in enterprises..... acres	4,371	45,072	19,137	9,067	16,912	13,796	3,504	48,229	11,809
8	Suffering a loss of crops from defective drainage..... acres	3,306	6,575	244	1,743	7,075	1,516	120	40,241	1,622
9	Assessed acreage..... acres	88,589	116,695	213,739	85,903	48,829	386,806	8,360	998,319	290,383
10	Excess over all land in operating enterprises..... acres	2,670		34,198	1,316		133,878		563,749	95,658
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed..... miles	146.8	157.8	249.8	79.5	78.7	388.9	14.4	975.9	410.3
13	Additional under construction..... miles	0.7		3.7			0.1	8.2	5.4	3.1
14	Maximum completed in any enterprise..... miles	10.6	9.7	16.9	8.1	10.1	8.2	4.5	75.0	8.0
15	Maximum width at bottom of ditch..... feet	10	20	25	20	18	30	10	70	40
16	Maximum of average depths of outlet ditches..... feet	5.0	8.0	6.0	6.0	5.5	7.0	5.0	10.0	10.0
17	Mean depth of branch ditches..... feet	3.0	4.4	5.2	3.8	3.5	4.0	4.0	3.5	3.2
18	Tile drains:									
19	Completed..... miles	2.5	6.1	17.4	3.5	0.3	1.5		8.2	
20	Additional under construction..... miles			0.5					0.9	0.1
21	Maximum completed in any enterprise..... miles	0.7	1.1	1.5	0.7	0.3	0.6		1.4	
22	Maximum size of tile..... inches	18	20	30	24	8	24		18	6
23	Accessory levees and dikes:									
24	Completed..... miles							33.0		
25	Additional under construction..... miles									
26	Pumping plants:									
27	Engine capacity..... horsepower								1,060	
28	Pump capacity..... gallons per minute								60,000	
29	Area served by pumps..... acres								10,000	
30	Area drained by open ditches only..... acres	83,946	109,212	147,416	31,923	48,659	250,404	8,360	443,440	193,885
31	Length of these ditches..... miles	142.4	146.2	227.3	76.3	78.7	388.0	17.6	890.8	413.0
32	Average length per acre..... feet	9.0	7.1	8.1	4.9	8.5	8.1	11.1	10.6	11.2
33	Area having open ditches and levees..... acres								1,000	
34	Length of these ditches..... miles								89.0	
35	Average length per acre..... feet									
36	Length of accessory levees..... miles								33.0	
37	Area drained by tile only..... acres	80	1,763	13,093	154	170	230		555	
38	Length of these tiles..... miles	0.3	2.9	9.3	1.1	0.3	0.6		8.5	
39	Average length per acre..... feet	19.8	8.7	8.8	37.7	9.3	13.8			
40	Area drained by open ditches and tile..... acres	1,893	5,720	19,032	2,510		2,294		175	940
41	Length of these drains..... miles	7.3	14.8	34.8	5.6		6.9		2.1	0.5
42	Average length per acre..... feet	20.4	13.7	9.7	11.8		15.9			2.8
<b>DEVELOPMENT OF LAND.</b>										
43	Improved land in operating enterprises, 1920..... acres	77,417	81,258	132,131	37,116	33,214	1,215,456	820	1,300,819	142,705
44	Improved land prior to drainage..... acres	73,284	72,916	376	24,629	27,151	168,487			
45	Increase since drainage..... acres	4,133	8,342	181,755	12,487	6,063	48,969	820	300,819	142,705
46	Per cent of increase.....	5.6	11.4	50.7	33.9	18.2	40.4		23.1	100.0
47	Per cent increase in all improved land in farms, 1920.....	3.8	5.0	38.7	8.3	4.1	20.6		7.9	45.8
48	Timber and cut-over land, 1920..... acres	8,146	35,437	47,410	47,063	15,615	37,472	2,436	143,751	52,120
49	Timber and cut-over land prior to drainage..... acres	13,208	43,779	179,165	56,450	21,678	86,441	2,776	443,570	194,825
50	Decrease since drainage..... acres	4,062	8,342	131,755	12,337	6,063	48,969	340	269,819	142,705
51	Per cent of decrease.....	33.3	19.1	73.5	20.8	28.0	56.7	12.2	67.6	73.2
52	Other unimproved land, 1920..... acres	356			408			5,104		
53	Other unimproved land prior to drainage..... acres	427			508			5,584	1,000	
54	Decrease since drainage..... acres	71			100			480	1,000	
55	Per cent of decrease.....	16.6			19.7			8.6		
56	Swampy or subject to overflow, 1920..... acres	4,371	45,072	19,137	9,067	16,912	13,796	3,504	48,229	11,809
57	Swampy or subject to overflow prior to drainage..... acres	22,263	75,246	56,664	26,164	25,366	146,585	8,784	242,367	102,040
58	Decrease since drainage..... acres	17,892	30,174	37,527	17,097	8,444	134,789	5,280	194,138	90,231
59	Per cent of decrease.....	80.4	40.1	66.2	65.3	33.3	90.7	60.1	80.1	88.4
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
60	Total capital invested in and required for completion of operating enterprises..... dollars	92,498	165,830	382,647	93,641	84,744	285,763	14,925	1,547,635	408,033
61	Capital invested in these enterprises to Dec. 31, 1919..... dollars	90,748	165,830	371,331	93,641	84,744	285,666	11,425	1,525,615	395,198
62	Additional capital required to complete these enterprises..... dollars	1,750		11,316			97	3,500	22,020	12,835
63	Average cost per acre when completed..... dollars	1.08	1.34	2.13	1.11	1.74	1.13	1.79	3.48	2.09
64	Enterprises constructing open ditches only..... dollars	87,185	140,045	269,032	85,022	84,485	281,641	14,925	1,353,465	406,733
65	Average cost per acre when completed..... dollars	1.04	1.28	1.82	1.04	1.74	1.12	1.79	3.05	2.10
66	Enterprises constructing open ditches and levees..... dollars								168,300	
67	Average cost per acre when completed..... dollars									
68	Enterprises constructing tile drains only..... dollars	227	4,563	37,403	349	259	290		23,189	
69	Average cost per acre when completed..... dollars	2.84	2.59	2.86	2.27	1.52	1.26			
70	Enterprises constructing open ditches and tile drains..... dollars	5,095	11,216	76,212	8,270		3,832		2,681	1,300
71	Average cost per acre when completed..... dollars	2.69	1.96	4.00	3.29		1.67			1.38
<b>CROPS.</b>										
72	Improved land in enterprises reporting—									
73	Wheat as principal crop on drained land..... acres			65,095			29,696		73,713	
74	Corn as principal crop on drained land..... acres	955	39,300		2,427		89,592		3,180	139,855
75	Sugar beets as principal crop on drained land..... acres								62,743	365
76	Peas and beans (dried) as principal crops on drained land..... acres		2,695			25,094			75,588	
77	Hay as principal crop on drained land..... acres		38,940		34,934	8,120		820	55,012	
78	Vegetables as principal crop on drained land..... acres	76,402		49,305			85,095		29,541	2,466
79	Potatoes as principal crop on drained land..... acres			6,018					422	
80	Oats as principal crop on drained land..... acres				18					
81	Rye as principal crop on drained land..... acres							7,122		
82	Other crops as principal ones on drained land..... acres			11,713				3,951		
83	Not reporting principal crop on drained land..... acres								640	

1 Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.

2 When works under construction have been completed.

3 Additional area reported under "open ditches only."

4 Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		St. Joseph.	Sanilac.	Shia-wassee.	Tuscola.	Van Buren.	Wash-tenaw.	Wayne.	Wexford.	Other counties.
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres..	321,920	624,640	356,480	529,280	394,880	450,560	396,800	369,280	2,901,820
2	All land in operating drainage enterprises.....acres..	31,151	540,607	281,166	487,423	173,508	191,596	259,667	10,254	10,987
3	Improved land.....acres..	21,426	436,414	199,941	331,924	137,308	164,291	162,850	7,787	7,231
4	Per cent of all improved land in farms.....	9.1	66.1	77.3	98.9	51.6	51.5	76.3	8.8	1.6
5	Timber and cut-over land.....acres..	7,730	103,128	80,925	143,874	4,561	26,615	47,167	734	1,932
6	Other unimproved land.....acres..	1,995	1,065	300	11,625	31,639	690	49,650	1,733	1,804
7	Swampy or subject to overflow, in enterprises.....acres..	3,452	27,752	29,752	18,981	390	16,385	72,546	261	1,991
8	Suffering a loss of crops from defective drainage.....acres..	3,440	27,695	21,176	48,996	.....	45,731	46,243	.....	367
9	Assessed acreage.....acres..	39,977	843,961	584,026	837,194	182,686	268,899	388,322	14,489	11,467
10	Excess over all land in operating enterprises.....acres..	8,826	303,354	302,860	348,771	9,178	77,303	128,655	4,235	500
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....miles..	104.8	1,156.9	501.4	736.0	266.7	267.3	644.8	33.3	39.7
12	Additional under construction.....miles..	.....	2.1	.....	42.2	.....	3.9	10.4	.....	.....
13	Maximum completed in any enterprise.....miles..	9.8	25.6	14.9	23.2	25.2	10.0	20.5	9.7	13.1
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	16	25	40	70	30	30	30	12	14
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	9.5	8.0	10.0	13.0	10.0	8.0	8.0	3.0	7.0
16	Mean depth of branch ditches <sup>2</sup> .....feet..	5.2	3.9	3.3	5.1	3.9	4.1	.....	3.0	6.1
Tile drains:										
17	Completed.....miles..	6.5	0.5	64.1	2.0	10.8	23.8	8.8	0.1	0.5
18	Additional under construction.....miles..	0.4	.....	.....	.....	.....	.....	.....	.....	.....
19	Maximum completed in any enterprise.....miles..	1.1	0.5	3.5	0.9	1.1	2.7	2.8	0.1	0.3
20	Maximum size of tile <sup>3</sup> .....inches..	24	12	24	18	24	27	30	.....	10
Accessory levees and dikes:										
21	Completed.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pumping plants:										
23	Engine capacity.....horsepower.....	.....	.....	.....	.....	.....	.....	5	.....	.....
24	Pump capacity.....gallons per minute.....	.....	.....	.....	.....	.....	.....	2,000	.....	.....
25	Area served by pumps.....acres..	.....	.....	.....	.....	.....	.....	100	.....	.....
26	Area drained by open ditches only <sup>4</sup> .....acres..	24,831	540,502	249,737	485,853	159,872	168,420	246,347	10,154	10,642
27	Length of these ditches.....miles..	83.9	1,159.0	441.7	773.2	250.0	253.7	632.5	82.8	39.5
28	Average length per acre.....feet..	17.8	11.3	9.3	8.5	8.3	8.0	13.6	17.1	19.2
29	Area having open ditches and levees <sup>4</sup> .....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	Length of these ditches.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	Average length per acre.....feet..	.....	.....	.....	.....	.....	.....	.....	.....	.....
32	Length of accessory levees.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
33	Area drained by tile only <sup>4</sup> .....acres..	161	105	6,038	1,570	1,969	4,813	1,136	.....	100
34	Length of these tile.....miles..	1.2	0.5	31.0	2.0	4.3	16.8	4.0	.....	0.3
35	Average length per acre.....feet..	39.4	25.1	27.1	6.7	11.5	18.4	18.6	.....	15.8
36	Area drained by open ditches and tile <sup>4</sup> .....acres..	6,159	.....	25,393	.....	11,667	18,363	12,184	100	25
37	Length of these drains.....miles..	28.6	.....	92.8	.....	23.2	29.5	27.5	0.6	0.4
38	Average length per acre.....feet..	22.8	.....	19.3	.....	10.5	8.5	11.9	31.7	84.5
<b>DEVELOPMENT OF LAND.</b>										
39	Improved land in operating enterprises, 1920.....acres..	21,426	436,414	199,941	331,924	137,308	164,291	162,850	7,787	7,231
40	Improved land prior to drainage.....acres..	3,534	.....	1,759	.....	62,700	552	2,975	1,339	1,502
41	Increase since drainage.....acres..	17,892	436,414	198,182	331,924	74,608	163,739	159,875	6,448	5,729
42	Per cent of increase <sup>4</sup> .....	86.3	.....	.....	.....	119.0	.....	.....	431.6	381.4
43	Per cent increase is of all improved land in farms, 1920.....	7.6	96.1	76.6	98.9	28.0	51.4	74.9	7.3	1.2
44	Timber and cut-over land, 1920.....acres..	7,730	103,128	80,925	143,874	4,561	26,615	47,167	734	1,932
45	Timber and cut-over land prior to drainage.....acres..	25,408	539,340	278,672	476,798	50,098	189,346	135,835	734	5,566
46	Decrease since drainage.....acres..	17,678	436,212	197,747	331,924	45,537	162,731	88,668	.....	3,634
47	Per cent of decrease.....	69.6	80.9	71.0	69.8	90.9	85.9	65.3	.....	65.3
48	Other unimproved land, 1920.....acres..	1,995	1,065	300	11,625	31,639	690	49,650	1,733	1,804
49	Other unimproved land prior to drainage.....acres..	2,209	1,267	735	11,625	60,710	1,698	120,857	8,181	3,899
50	Decrease since drainage.....acres..	214	202	435	.....	29,071	1,008	71,207	6,448	2,095
51	Per cent of decrease.....	9.7	15.9	50.2	.....	47.9	59.4	58.9	78.8	53.7
52	Swampy or subject to overflow, 1920.....acres..	3,452	27,752	29,752	18,981	390	16,385	72,546	261	1,991
53	Swampy or subject to overflow prior to drainage.....acres..	21,629	400,351	58,739	302,199	28,332	34,068	199,269	8,286	7,775
54	Decrease since drainage.....acres..	18,177	372,599	58,987	283,218	27,942	17,683	126,723	8,025	5,784
55	Per cent of decrease.....	84.0	93.1	66.5	93.7	98.6	51.9	63.6	96.9	74.4
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
56	Total capital invested in and required for completion of operating enterprises.....dollars..	149,348	1,374,641	917,107	1,425,963	350,957	394,502	411,151	18,295	45,956
57	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	149,348	1,372,961	917,107	1,301,399	380,957	383,280	408,146	18,295	45,956
58	Additional capital required to complete these enterprises.....dollars..	.....	1,680	.....	127,565	.....	11,222	3,005	.....	.....
59	Average cost per acre when completed.....dollars..	4.79	2.54	3.26	2.93	2.90	2.06	1.58	1.78	4.19
60	Enterprises constructing open ditches only.....dollars..	128,756	1,373,241	708,764	1,425,277	351,910	307,444	378,957	17,862	45,037
61	Average cost per acre when completed.....dollars..	5.19	2.54	2.84	2.93	2.20	1.83	1.54	1.76	4.15
62	Enterprises constructing open ditches and levees.....dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....
63	Average cost per acre when completed.....dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....
64	Enterprises constructing tile drains only.....dollars..	1,273	1,400	67,219	3,686	9,291	33,496	11,229	.....	859
65	Average cost per acre when completed.....dollars..	7.91	13.33	6.48	2.35	4.72	6.96	9.88	.....	8.59
66	Enterprises constructing open ditches and tile drains.....dollars..	19,319	.....	151,124	.....	19,756	53,562	20,965	433	60
67	Average cost per acre when completed.....dollars..	3.14	.....	5.95	.....	1.69	2.92	1.72	4.33	2.40
<b>CROPS.</b>										
Improved land in enterprises reporting—										
68	Wheat as principal crop on drained land.....acres..	6,167	436,142	794	149,241	.....	164,003	108,480	.....	.....
69	Corn as principal crop on drained land.....acres..	7,069	.....	80,253	.....	.....	.....	.....	.....	.....
70	Sugar beets as principal crop on drained land.....acres..	.....	272	118,889	118,172	.....	288	.....	.....	.....
71	Peas and beans (dried) as principal crops on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
72	Hay as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	7,600	4,831
73	Vegetables as principal crop on drained land.....acres..	.....	.....	.....	.....	5,460	.....	51,210	.....	.....
74	Potatoes as principal crop on drained land.....acres..	3,329	.....	.....	42,674	.....	.....	.....	.....	.....
75	Oats as principal crop on drained land.....acres..	4,341	.....	.....	.....	.....	.....	1,374	.....	.....
76	Rye as principal crop on drained land.....acres..	394	.....	.....	.....	.....	.....	.....	.....	.....
77	Other crops as principal ones on drained land.....acres..	126	.....	.....	21,837	131,848	.....	68	.....	.....
78	Not reporting principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	1,718	187	3,400

<sup>1</sup> Includes only Alcona, Alpena, Benzie, Charlevoix, Emmet, Grand Traverse, Luce, and Presque Isle Counties.  
<sup>2</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>3</sup> When works under construction have been completed.  
<sup>4</sup> Per cent not shown when more than 1,000.



## MINNESOTA.

The following pages present the statistics of drainage for Minnesota collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timber and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

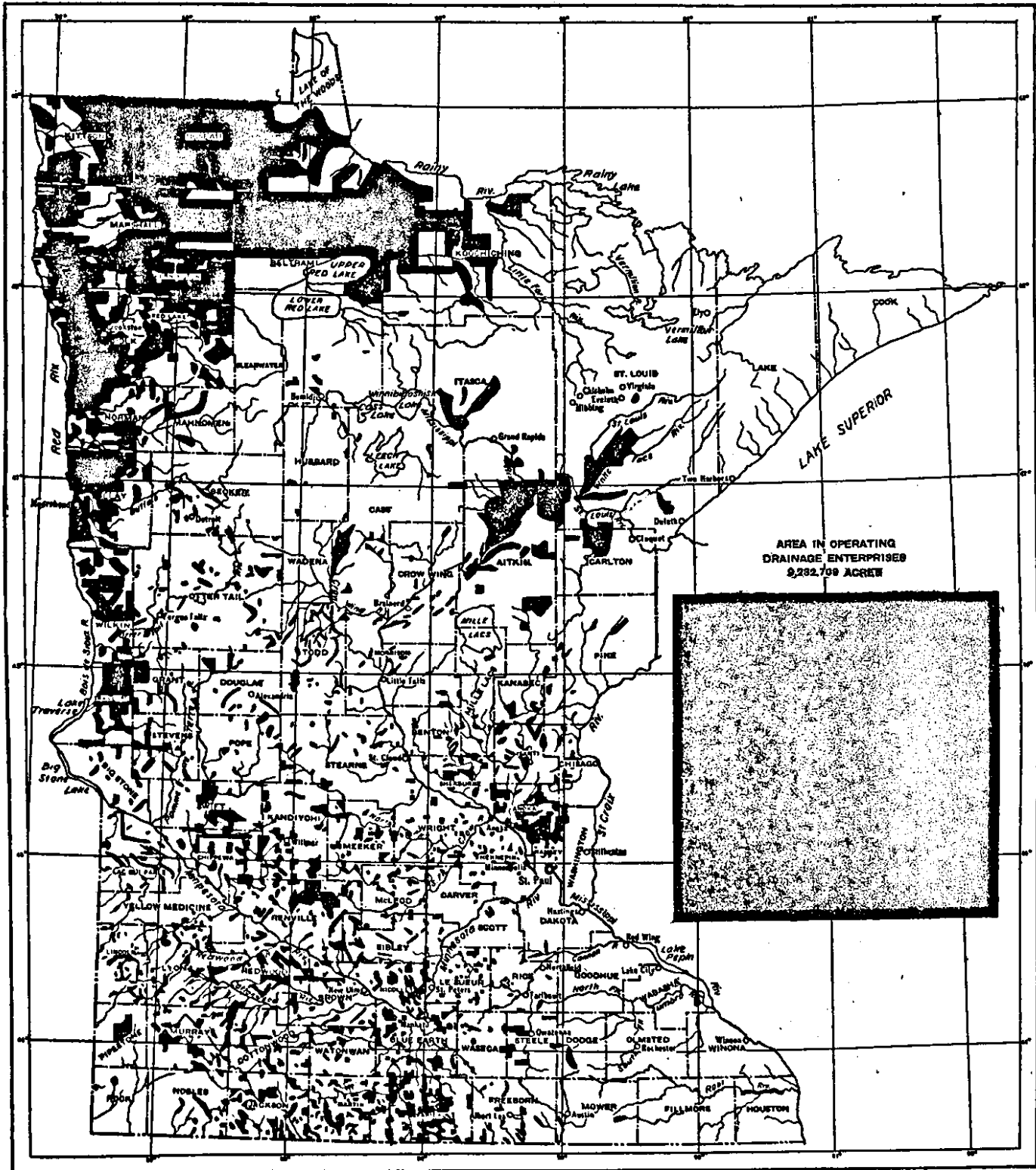
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	178, 478	100. 0
Farms reporting land having drainage.....	53, 011	29. 7
Farms reporting land needing drainage.....	73, 905	41. 4
All land in farms..... acres..	30, 221, 758	100. 0
Improved land in farms..... acres..	21, 481, 710	71. 1
Farm land reported as provided with drainage..... acres..	2, 993, 034	9. 9
Farm land reported as needing drainage..... acres..	3, 504, 574	11. 6
Needing drainage only..... acres..	1, 801, 457	6. 0
Needing drainage and clearing..... acres..	1, 703, 117	5. 6
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	51, 749, 120	100. 0
All land in operating drainage enterprises..... acres..	9, 232, 709	17. 8
Improved land..... acres..	3, 818, 490	7. 4
Per cent of all improved land in farms.....	17. 8	-----
Timber and cut-over land..... acres..	1, 370, 023	2. 6
Other unimproved land..... acres..	4, 044, 196	7. 8
Swampy, subject to overflow, seeped, or alkali..... acres..	1, 193, 136	2. 3
Suffering a loss of crops from defective drainage..... acres..	471, 094	0. 9
Improved land prior to drainage..... acres..	1, 722, 875	3. 3
Increase since drainage began..... acres..	2, 095, 615	4. 0
Land in nonoperating enterprises..... acres..	130, 235	0. 3
Open ditches in operating enterprises..... miles..	14, 823. 1	100. 0
Completed..... miles..	14, 657. 0	98. 9
Additional under construction..... miles..	166. 1	1. 1
Tile drains in operating enterprises..... miles..	6, 387. 3	100. 0
Completed..... miles..	5, 924. 6	92. 8
Additional under construction..... miles..	462. 7	7. 2
Total capital invested in and required for completion of operating enterprises ..	\$44, 183, 838	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	42, 017, 447	95. 1
Additional capital required to complete these enterprises.....	2, 166, 391	4. 9
Average cost per acre when completed.....	4. 79	-----



# MINNESOTA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation or improvement some years ago but were reconstructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include enterprises that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also others for which the orders of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,362,944	100.0	\$42,089,304	100.0	\$5,095,002
Operating enterprises.....	9,232,709	98.6	42,017,447	99.8	2,166,391
With works completed.....	8,552,900	91.3	36,764,850	87.3	.....
With works under construction.....	679,809	7.3	5,252,597	12.5	2,166,391
Nonoperating enterprises.....	130,235	1.4	71,857	0.2	2,928,611

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The drainage enterprises in Minnesota are spread rather generally over the state. The largest enterprises are located in the northwestern part; those in the central and southern sections are greater in number and of smaller average size. There is less land in drainage enterprises in the north central part than in the other sections mentioned, and there is very little in the northeastern part and in the southeastern corner, as shown by the map on page 2.

Nearly three-fourths of the area in the enterprises is drained through Red River and Lake of the Woods, and finally into Hudson Bay, as is shown by Table 3; almost one-fourth is drained through the Mississippi and its tributaries to the Gulf of Mexico; less than 4 per cent is drained, by way of Lake Superior, to St. Lawrence River. For enterprises in the Mississippi drainage basin, however, the capital invested is nearly two-thirds of the total.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,362,944	100.0	\$42,089,304	100.0	\$5,095,002
Operating enterprises.....	9,232,709	98.6	42,017,447	99.8	2,166,391
Big Sioux River.....	22,937	0.2	455,460	1.1	73,338
Missouri River.....	24,940	0.3	655,542	1.6	.....
Des Moines River.....	121,097	1.3	3,105,037	7.4	294,219
Cedar River.....	15,905	0.2	223,549	0.5	52,600
St. Croix River.....	140,154	1.5	665,007	1.6	.....
Minnesota River.....	815,340	8.7	16,042,816	38.1	1,188,591
Mississippi River.....	1,020,106	10.9	5,580,657	13.3	125,643
Red River.....	5,387,452	57.5	11,110,573	26.4	239,900
Lake of the Woods.....	1,368,366	14.6	2,927,292	7.0	187,200
Lake Superior.....	316,406	3.4	1,251,514	3.0	5,000
Nonoperating enterprises.....	130,235	1.4	71,857	0.2	2,928,611
Big Sioux River.....	999	( <sup>1</sup> )	.....	.....	46,475
Cedar River.....	1,609	( <sup>1</sup> )	2,316	( <sup>1</sup> )	85,000
Minnesota River.....	80,211	0.9	62,037	0.1	2,395,968
Mississippi River.....	3,781	( <sup>1</sup> )	4,420	( <sup>1</sup> )	163,702
Red River.....	15,312	0.2	2,484	( <sup>1</sup> )	79,700
Lake Superior.....	28,313	0.3	.....	.....	157,766

<sup>1</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—Approximately 83 per cent of the drainage enterprises in the state, embracing about 76 per cent of the area of all those enterprises, were reported as organized for the purpose of reclaiming or improving land swampy or generally too wet for profitable cultivation, while practically all the other enterprises were reported as established to prevent overflow of the land by stream floods.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	9,232,709	100.0	8,552,900	679,809	130,235
Improved land.....	3,818,490	41.4	3,701,524	116,966	84,494
Timber and cut-over land.....	1,370,023	14.8	1,103,858	266,165	7,153
Other unimproved land.....	4,044,196	43.8	3,747,518	296,678	85,568
Swampy or subject to overflow.....	1,193,136	12.9	1,022,667	170,471	78,922
Suffering a loss of crops.....	471,094	5.1	464,469	6,625	981

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 2,340 operating drainage enterprises are counted in Minnesota, with an average area of 4,263 acres assessed. There are 858 enterprises of less than 500 acres each, and 24 of 50,000 acres or larger.

The assessed acreage exceeds the land in enterprises by 741,953 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	9,232,709	9,974,662	100.0
Less than 200 acres.....	35,877	36,177	0.4
200 to 499 acres.....	188,974	191,751	1.9
500 to 999 acres.....	303,215	307,812	3.1
1,000 to 4,999 acres.....	1,335,447	1,385,737	13.9
5,000 to 9,999 acres.....	1,155,678	1,250,804	12.5
10,000 to 49,999 acres.....	4,150,542	4,630,974	46.4
50,000 to 99,999 acres.....	848,414	944,845	9.5
100,000 to 499,999 acres.....	1,214,562	1,226,562	12.3

**Character of enterprises.**—Most of the drainage enterprises in Minnesota are county ditches established by orders of the boards of county commissioners, or judicial ditches established by orders of the district courts of the state. The term ditch is defined to include drains of tile and other drainage works. There are also some ditches constructed by or under the control of the state.

County ditches and judicial ditches are generally similar in method of establishment; if proceedings are before the county board the enterprise is a county ditch, and if before the district court the enterprise is a judicial ditch. The county board now has jurisdiction only when the ditch is to benefit land wholly within the county. The district court has concurrent jurisdiction for ditches in one county, and exclusive jurisdiction for ditches in two or more counties within the district. For a ditch in more than one judicial district, proceedings may be in either district.

The law governing county and judicial ditches is the act of April 18, 1905 (ch. 230), as found in chapter 44 of the General Statutes of Minnesota, 1913, and amended to date. A petition for establishment must be filed with the county auditor if for a county ditch, or with the clerk of the district court if for a judicial ditch. It must be signed by eight owners of land to be benefited by the ditch, or by 25 per cent of all the owners of that land, or by the supervisor of any township or the officers of any city or village, or by the authorized agent of any public institution, corporation, or railroad whose land will be benefited, or by the state board of control. Plans and estimates for drainage are made by an engineer appointed by the county board or by the judge of the court, and damages and benefits are assessed by three viewers appointed by the same authority. The order of establishment is issued by the board or the judge after a public hearing upon the petition, the plans, and the assessments, if the enterprise will be of public utility, and if the benefits will exceed the cost. Appeals may be taken regarding damages and benefits, to the district court regarding county ditches and to jury trial regarding judicial ditches. The division of the cost among the counties, for a judicial ditch, is made by the judge of the court. Contracts for construction are let by the county auditor, or the county auditors in the case of a judicial ditch, with the chairman of the county board and the clerk of court of the county in which the proceedings are pending. The cost is apportioned in each county by the county auditor according to the benefits confirmed. Bonds for drainage may be issued by the county board, to run not more than 20 years.

The establishment and control of ditches for land drainage by the county commissioners first was authorized in 1883 (ch. 108). A petition for establishment was required from one or more owners of land to be benefited; damages and benefits were assessed by viewers appointed by the commissioners; ditches in two or more counties were established by joint action of the commissioners of those counties. A similar statute of 1887 (ch. 97) contained the additional provision that county bonds might be issued for drainage. A preliminary investigation by an engineer was required before the viewers were appointed, by the drainage law of 1901 (ch. 258), which repealed the earlier laws. Establishment of judicial ditches by the district courts, in case the ditches were to be located in more than one county, was provided by the act of 1905 (ch. 230), which superseded the law of 1901. Judicial ditches wholly within one county were

authorized in 1907 (ch. 448), and this provision continues in the act of 1909 (ch. 469) which repealed that of 1907 and amended that of 1905. Originally, the law of 1905 required 6 signers to the petition. The acts of 1907 and 1909 required only one, but that of 1917 (ch. 441) has increased the number to eight or one-fourth of all affected, except that only two are needed if all the drains will be of tile and will connect with a public ditch.

State ditches now are established in accordance with an act of April 25, 1919 (ch. 471), in much the same manner as judicial ditches. This statute creates a Department of Drainage and Waters, and abolishes the state Drainage Commission created by act of April 26, 1907 (ch. 470), consisting of the governor, the state auditor, and the secretary of state. The method of procedure is very similar to that prescribed by the earlier law. A petition for establishment, accompanied by plans and estimates for the work, is submitted by the commissioner of drainage and waters to the district court of the county in which all or a part of the ditch will be located. Assessments of damages and benefits are made by viewers, two appointed by the court and one by the commissioner. After public hearing, the court may establish the ditch. Construction and maintenance of the works are under control of the Department, the cost being borne by state, private, and other land in proportion to the benefits.

State ditches to be made at state expense were authorized in 1893, when \$100,000 was appropriated for improving watercourses in certain counties in the Red River Valley. The amount was increased by \$50,000 two years later. A board of state drainage commissioners to be appointed by the governor was authorized in 1897, to have control of all state drainage ditches, and to report their condition to the county commissioners who were charged with the maintenance of those ditches within their respective counties. A state Drainage Commission was created in 1901 (ch. 90) with authority to construct ditches.

Town ditches may be established by the town boards of supervisors, under authority of an act of March 29, 1909 (ch. 127), as amended. A petition must be signed by one or more persons or corporations owning land that probably will be benefited. The supervisors view the land and assess damages and benefits, or they appoint an engineer and viewers. Contracts for construction are let by the town board. The costs are advanced by the petitioners, who are reimbursed from tax levies made by the town board according to the benefits.

Drainage and flood control districts may be established under an act of April 23, 1917 (ch. 442), and drainage and conservancy districts under an act of September 22, 1919 (ch. 13, extra session), but no such districts were reported. Each act provides for

establishment of the enterprises as corporate bodies by the district courts, upon petition, and vests the executive authority in a board of three or five directors appointed by the court.

The first drainage law of Minnesota was enacted August 3, 1858 (ch. 73), providing that persons might associate together for draining land and enjoy corporate rights. An act of March 1, 1866 (ch. 27), provided for securing drainage across the land of an objecting owner, by application to a justice of the peace and determination by jury of the necessity for the drain and of benefits and damages to accrue. The establishment of public drains by the town supervisors was authorized by acts of 1887 (ch. 99) and 1889 (ch. 168). A great many other laws have been enacted relating to drainage, but those noted show the character of the enterprises reported.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,362,944	100.0	\$42,089,304	100.0	\$5,095,002
Operating enterprises.....	9,232,709	98.6	42,017,447	99.8	2,166,391
County ditches.....	4,384,341	46.8	22,213,139	52.8	766,565
Laws of 1883, ch. 108.....	5,965	0.1	28,183	0.1	.....
Laws of 1887, ch. 97.....	466,900	5.0	744,952	1.8	.....
Laws of 1901, ch. 258.....	679,307	7.3	1,862,226	4.4	.....
Laws of 1905, ch. 230 <sup>1</sup> .....	3,223,092	34.4	19,291,061	45.8	766,565
Laws of 1907, ch. 448.....	4,532	( <sup>2</sup> )	154,895	0.4	.....
Laws of 1917, ch. 441.....	4,546	( <sup>2</sup> )	131,222	0.3	.....
Judicial ditches.....	4,030,424	43.0	18,701,396	44.4	1,399,826
Laws of 1883, ch. 108.....	113,249	1.2	165,365	0.4	.....
Laws of 1887, ch. 97.....	14,916	0.2	24,794	0.1	.....
Laws of 1901, ch. 258.....	148,625	1.6	552,795	1.3	35,329
Laws of 1905, ch. 230.....	3,662,517	39.1	17,460,556	41.5	1,364,497
Laws of 1907, ch. 448.....	91,117	1.0	497,866	1.2	.....
State ditches.....	817,944	8.7	1,102,912	2.6	.....
Laws of 1893, ch. 221.....	30,053	0.3	40,982	0.1	.....
Laws of 1901, ch. 90.....	30,056	0.3	26,287	0.1	.....
Laws of 1907, ch. 470.....	757,835	8.1	1,035,643	2.6	.....
Nonoperating enterprises.....	130,235	1.4	71,857	0.2	2,928,611
County ditches.....	72,566	0.8	53,829	0.1	1,371,564
Laws of 1905, ch. 230.....	70,952	0.8	52,472	0.1	1,794,377
Laws of 1917, ch. 441.....	1,614	( <sup>2</sup> )	1,387	( <sup>2</sup> )	77,187
Judicial ditches.....	57,669	0.6	18,028	( <sup>2</sup> )	1,057,047
Laws of 1905, ch. 230.....	57,669	0.6	18,028	( <sup>2</sup> )	1,057,047

<sup>1</sup> Includes 800 acres under individual ownership.

<sup>2</sup> Less than one-tenth of 1 per cent.

<sup>3</sup> Includes 423 acres organized as a town ditch.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 14,657.0 miles of open ditches, 5,924.6 miles of tile drains, and 0.1 mile of accessory levees; the additional lengths under construction were 166.1 miles of ditches, 462.7 miles of tile drains, and 0.3 mile of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is no pumping district for land drainage among the enterprises in Minnesota.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	9,232,709	100.0	\$42,017,447	100.0	\$2,166,391
Open ditches only.....	8,440,187	91.4	22,753,563	54.2	485,429
Tile drains only.....	271,118	2.9	7,193,827	17.1	197,721
Open ditches and tile drains <sup>1</sup> .....	521,424	5.6	12,070,057	28.7	1,483,241

<sup>1</sup>Includes 4,642 acres constructing also 0.4 mile of levees.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted as it seemed they did not represent so well the average depths of outlet provided for all the farms in those districts; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.8 instead of 4.9 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	9,232,709	100.0
Less than 3 feet.....	873,377	4.0
3.0 to 3.9 feet.....	941,199	10.2
4.0 to 4.9 feet.....	1,234,445	13.4
5.0 to 5.9 feet.....	2,086,744	22.6
6.0 to 6.9 feet.....	1,427,852	15.5
7.0 to 7.9 feet.....	327,146	3.5
8.0 to 8.9 feet.....	57,034	0.6
9.0 to 9.9 feet.....	3,296	( <sup>1</sup> )
10 feet and more.....	77,929	0.8
Not reporting branches.....	2,708,657	29.3

<sup>1</sup> Less than one-tenth of 1 per cent.

Maintenance of works.—The county board of each county is required to keep in proper repair and free from obstruction, after original construction has been completed, all public drainage ditches or parts of such ditches located within the county, according to an act

of April 24, 1915 (ch. 300). The cost is to be paid from the funds to the credit of the ditch so repaired, or, in case those funds are not sufficient, by assessments against the land assessed for original construction of the ditch and in proportion to the original assessment of benefits. The cost of maintenance for any state ditch is to be apportioned according to benefits specially assessed by viewers appointed by the county board, against the land benefited by the construction of the ditch and of any lateral or spur ditch. If the cost of the repairs for any ditch exceeds 25 per cent of the cost of original construction, bonds may be issued. It was provided in 1917 (ch. 441) that in all counties where county and judicial ditches have been constructed costing in the aggregate \$50,000 or more, the county board shall appoint a county ditch inspector who shall examine all those ditches at least twice each season and report to the board what repairs or improvements are needed.

The maintenance of county and judicial ditches by the county boards was required by the original act of 1905 (ch. 230). An act of 1909 (ch. 207) provided that the Department of Drainage and Waters might repair or improve state ditches, and might require that any part of the cost be paid by the county, town, or individuals to be benefited by the work.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,232,709	100.0	\$42,017,447	100.0	\$2,166,391
By district forces.....	308,107	3.3	4,154,450	9.9	229,500
By contract.....	678,139	7.3	8,585,995	20.4	496,006
By method not specified.....	4,746	0.1	60,712	0.1	.....
No maintenance provided.....	8,003,874	86.7	28,471,873	67.8	1,430,885
Not reported.....	237,843	2.6	744,417	1.8	10,000

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the ditches were established by the county boards or district courts, since there may be a period of a year or more between the order of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

DRAINAGE—MINNESOTA.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	9,232,700	100.0	9,974,662	100.0
1880 to 1889.....	11,620	0.1	11,626	0.1
1890 to 1899.....	319,941	3.5	323,131	3.2
1900 to 1904.....	853,427	9.6	971,117	9.7
1905 to 1909.....	2,370,214	25.7	2,551,265	25.6
1910 to 1914.....	3,867,415	41.9	4,012,870	40.2
1915 to 1919.....	1,765,875	19.1	2,000,412	21.0
Not reported.....	14,211	0.2	14,211	0.1

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$42,017,447	100.0	\$2,166,391
1880 to 1889.....	83,643	0.2	.....
1890 to 1899.....	481,097	1.1	.....
1900 to 1904.....	1,673,222	4.0	.....
1905 to 1909.....	7,525,768	17.9	17,408
1910 to 1914.....	13,421,996	31.9	198,200
1915 to 1919.....	18,747,547	44.6	1,948,218
Not reported.....	79,175	0.2	2,565

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	14,823.1	100.0	6,387.3	100.0	0.4	100.0
1880 to 1889.....	48.9	0.3	.....	.....	.....	.....
1890 to 1899.....	483.1	3.3	15.7	0.2	.....	.....
1900 to 1904.....	1,459.1	9.8	16.0	0.3	.....	.....
1905 to 1909.....	4,332.8	29.2	606.4	9.5	.....	.....
1910 to 1914.....	4,625.5	31.2	1,780.9	27.6	.....	.....
1915 to 1919.....	3,799.1	25.6	3,976.5	62.3	0.4	100.0
Not reported.....	24.6	0.2	11.8	0.2	.....	.....

Crops.—The principal crops grown upon the drained land in the drainage enterprises are wheat, hay, and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Aitkin.	Anoka.	Becker.	Beltrami.	Benton.	Big Stone.	Blue Earth.	Brown.
	1 Number of all farms in the state or county.....	178,478	1,945	1,589	2,831	3,065	1,561	1,026	2,954
2 Farms reporting land having drainage.....	53,011	287	513	589	721	451	191	1,836	894
3 Farms reporting land needing drainage.....	73,905	1,054	576	1,551	1,470	632	318	1,984	1,083
4 Farms in drainage and levee districts.....	16,421	168	265	103	708	37	35	441	368
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the state or county.....acres..	51,749,120	1,171,200	293,760	863,360	2,446,080	259,200	314,240	487,680	391,680
6 All land in farms.....acres..	30,221,758	231,221	213,990	454,336	459,487	219,838	287,527	440,336	369,113
7 Improved land in farms.....acres..	21,481,710	61,884	121,603	250,946	89,821	126,949	251,992	355,374	290,808
8 Woodland in farms.....acres..	4,482,656	95,445	59,698	140,413	228,348	51,984	5,085	33,001	19,100
9 Other unimproved land in farms.....acres..	4,257,392	78,912	32,689	62,679	141,318	40,955	30,449	52,011	59,205
10 Farm land reported as provided with drainage.....acres..	2,993,034	13,341	22,124	14,100	58,377	17,529	11,723	99,629	38,078
11 Farm land reported as needing drainage.....acres..	3,504,574	77,588	26,332	84,349	156,097	36,701	13,576	69,318	39,385
12 Drainage only.....acres..	1,801,457	14,241	7,241	19,161	17,627	4,072	12,538	59,204	37,308
13 Drainage and clearing.....acres..	1,703,117	63,347	19,091	65,188	138,470	32,629	738	10,614	2,077
	Carlton.	Carver.	Cass.	Chippewa.	Chisago.	Clay.	Clearwater.	Cottonwood.	Crow Wing.
1 Number of all farms in the county.....	1,917	2,009	1,579	1,624	2,236	1,948	1,253	1,801	1,281
2 Farms reporting land having drainage.....	95	1,283	182	646	692	845	84	1,134	130
3 Farms reporting land needing drainage.....	702	999	603	558	888	560	256	862	776
4 Farms in drainage and levee districts.....	47	157	73	283	176	123	111	224	79
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county.....acres..	554,880	240,640	1,346,590	378,240	273,280	667,620	652,160	409,600	676,480
6 All land in farms.....acres..	185,199	218,382	240,733	355,036	243,819	580,717	203,168	330,043	190,100
7 Improved land in farms.....acres..	54,854	138,654	74,537	317,263	125,788	605,336	65,648	344,590	68,435
8 Woodland in farms.....acres..	70,501	41,430	101,143	7,329	83,185	24,366	97,991	6,613	77,312
9 Other unimproved land in farms.....acres..	59,844	38,298	65,053	30,444	34,846	51,015	39,529	28,940	44,353
10 Farm land reported as provided with drainage.....acres..	2,400	28,651	8,091	32,275	15,432	35,220	2,397	84,453	4,622
11 Farm land reported as needing drainage.....acres..	35,673	28,825	50,826	32,120	30,205	21,934	16,418	41,837	59,940
12 Drainage only.....acres..	1,763	12,895	4,886	31,312	7,238	11,862	8,617	40,961	2,785
13 Drainage and clearing.....acres..	33,910	15,930	45,940	808	22,967	10,072	7,801	876	57,155

DRAINAGE—MINNESOTA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Dakota.	Dodge.	Douglas.	Far- bault.	Fill- more.	Free- born.	Good- hue.	Grant.	Henne- pin.	Hub- bard.
1	2,373	1,636	2,505	2,358	3,177	2,574	3,128	1,317	3,954	1,262
2	153	203	1,020	1,867	58	1,626	70	503	1,035	61
3	412	403	1,458	1,458	160	2,059	515	659	1,522	414
4	27	39	222	852	1	292	11	65	158	23
<b>LAND AND FARM AREA.</b>										
5	383,360	281,600	414,720	460,160	555,520	470,400	400,880	353,920	361,600	613,120
6	324,708	247,027	372,869	430,461	506,850	413,988	457,795	319,290	271,782	191,996
7	258,581	209,445	242,629	361,478	378,279	315,445	347,792	284,049	186,755	80,323
8	36,347	13,484	64,409	18,541	85,324	20,568	49,350	6,542	51,823	79,434
9	20,780	24,118	65,831	50,442	45,247	77,980	60,644	28,699	33,184	32,239
10	3,554	10,999	22,290	178,974	3,676	77,597	1,453	16,897	15,640	2,265
11	19,315	13,841	47,839	86,969	4,761	97,435	10,661	16,097	33,003	31,891
12	11,573	11,238	18,466	81,188	3,465	80,176	4,638	14,567	8,178	1,633
13	7,742	2,603	29,373	5,781	1,296	17,259	6,023	1,530	24,825	30,258
	Isanti.	Itasca.	Jackson.	Kanabec.	Kandi- yohi.	Kittson.	Koochi- ong.	Lac qui Parle.	Le Sueur.	
1	2,212	1,436	2,218	1,568	2,432	1,409	944	2,008	2,269	
2	600	71	1,467	355	902	177	143	783	851	
3	1,003	733	1,234	444	1,609	427	647	930	1,131	
4	242	56	799	132	444	70	104	183	56	
<b>LAND AND FARM AREA.</b>										
5	282,890	1,747,200	449,280	341,760	512,640	711,040	2,010,240	505,600	298,240	
6	256,010	168,976	424,792	182,311	464,941	442,939	152,507	464,784	264,814	
7	138,810	33,637	372,670	67,535	360,306	342,087	22,450	419,986	178,913	
8	70,083	106,916	9,710	80,003	23,707	43,814	93,231	8,794	35,225	
9	47,117	28,423	42,412	84,773	80,928	57,038	36,826	36,004	50,676	
10	12,032	2,468	110,293	9,252	29,730	55,413	4,850	27,897	22,066	
11	30,169	62,768	77,482	16,642	67,963	32,400	70,919	27,051	31,637	
12	10,671	4,000	67,152	2,915	55,612	2,497	1,586	26,717	13,184	
13	19,498	58,768	10,930	13,727	12,351	29,903	69,333	334	18,453	
	Lincoln.	Lyon.	McLeod.	Mahno- man.	Marshall.	Martin.	Meeker.	Mille Lacs.	Morris- son.	Mower.
1	1,468	1,816	2,447	590	2,697	2,435	2,450	1,998	3,095	2,364
2	587	934	1,538	92	602	2,025	780	357	350	498
3	633	811	1,500	413	877	1,504	1,029	729	820	657
4	77	242	137	13	553	933	79	104	102	16
<b>LAND AND FARM AREA.</b>										
5	342,400	453,120	317,440	366,080	1,144,320	460,160	397,440	373,120	731,520	455,040
6	305,315	409,218	299,131	133,499	734,432	437,329	364,960	178,550	440,013	404,092
7	270,732	358,206	252,606	82,218	523,383	372,380	280,664	79,548	228,139	354,636
8	4,417	8,452	19,085	23,347	81,635	9,389	28,601	70,223	137,388	16,486
9	30,166	42,560	27,440	27,934	129,414	55,560	55,695	28,779	74,486	32,970
10	21,195	64,178	47,434	4,711	109,896	187,232	20,937	10,882	11,409	23,358
11	21,425	46,683	40,726	27,554	89,984	82,842	40,398	33,488	41,545	26,696
12	20,847	45,876	29,856	9,316	28,570	78,109	24,973	3,025	7,794	22,187
13	578	807	10,870	18,238	61,414	4,733	15,425	80,463	33,751	4,508
	Murray.	Nicollet.	Nobles.	Norman.	Olm- sted.	Otter Tail.	Fenn- ington.	Pine.	Pipe- stone.	Polk.
1	1,876	1,497	2,018	1,940	2,287	6,627	1,221	3,088	1,187	4,200
2	1,175	718	1,029	591	100	1,923	448	447	164	1,196
3	1,104	896	831	370	392	3,119	351	1,418	199	1,412
4	377	124	208	292	12	415	403	80	49	713
<b>LAND AND FARM AREA.</b>										
5	450,560	283,520	462,080	550,400	426,240	1,304,960	388,480	904,320	300,160	1,266,560
6	415,872	267,521	437,608	489,358	376,221	1,095,739	284,688	333,418	276,371	1,069,155
7	384,616	212,407	402,236	401,179	303,723	663,406	194,473	121,901	248,105	842,208
8	4,000	21,740	7,951	33,340	39,453	276,118	39,158	93,746	1,867	112,040
9	27,256	33,374	27,421	64,639	33,045	136,215	51,057	117,771	26,379	114,807
10	86,588	37,274	70,900	132,092	2,208	44,840	76,909	10,533	7,763	184,731
11	45,397	36,694	41,054	16,958	9,940	119,323	40,804	62,068	8,122	85,350
12	43,482	31,291	37,106	6,412	5,700	35,754	20,629	5,412	7,421	35,284
13	1,915	5,403	3,946	10,546	4,240	83,569	20,175	66,656	701	62,066

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Pope.	Ramsey.	Red Laka.	Redwood.	Renville.	Rice.	Rock.	Roseau.	St. Louis.
1	Number of all farms in the county.....	1,802	983	907	2,543	3,049	2,416	1,307	1,854	4,271
2	Farms reporting land having drainage.....	452	36	115	1,390	1,463	467	315	500	623
3	Farms reporting land needing drainage.....	819	67	277	1,577	1,916	992	454	567	1,900
4	Farms in drainage and levee districts.....	52	13	102	487	237	94	12	442	190
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	443,520	103,040	276,480	563,840	625,920	316,800	314,880	1,068,800	4,161,920
6	All land in farms.....acres..	381,123	52,498	224,729	525,074	585,156	297,038	292,804	416,294	402,351
7	Improved land in farms.....acres..	288,254	36,195	159,588	449,906	511,771	217,241	267,541	212,214	93,471
8	Woodland in farms.....acres..	16,260	9,761	43,101	10,581	23,912	22,041	5,194	90,517	210,620
9	Other unimproved land in farms.....acres..	76,614	6,542	23,042	64,587	49,473	67,756	20,069	113,563	98,260
10	Farm land reported as provided with drainage.....acres..	10,234	700	19,035	76,069	68,494	10,281	18,151	90,446	17,545
11	Farm land reported as needing drainage.....acres..	22,966	3,691	34,038	79,427	72,501	24,564	20,511	61,282	103,559
12	Drainage only.....acres..	19,359	1,312	10,628	73,946	71,117	14,277	19,661	12,523	10,218
13	Drainage and clearing.....acres..	3,607	2,279	23,410	5,481	1,384	10,277	850	48,739	93,341

		Scott.	Sher- burna.	Sibley.	Stearns.	Steele.	Stevens.	Swift.	Todd.	Trav- erse.
1	Number of all farms in the county.....	1,623	1,400	2,111	4,598	1,900	1,103	1,781	3,521	1,035
2	Farms reporting land having drainage.....	459	294	953	953	956	444	515	715	156
3	Farms reporting land needing drainage.....	710	503	1,208	1,363	1,323	536	832	856	130
4	Farms in drainage and levee districts.....	53	192	301	191	157	129	333	335	116
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	234,240	286,720	374,400	871,680	275,840	880,960	474,240	612,480	363,520
6	All land in farms.....acres..	210,218	224,929	355,809	730,899	259,215	816,008	447,789	474,951	321,002
7	Improved land in farms.....acres..	120,194	127,694	273,705	499,223	213,245	279,283	391,029	243,393	300,530
8	Woodland in farms.....acres..	38,740	66,401	27,870	162,081	12,611	3,419	7,855	135,567	5,120
9	Other unimproved land in farms.....acres..	51,284	40,634	54,234	119,585	33,369	33,306	48,905	95,991	15,352
10	Farm land reported as provided with drainage.....acres..	8,770	10,705	35,410	31,881	35,471	33,286	33,838	22,421	16,843
11	Farm land reported as needing drainage.....acres..	23,108	23,980	49,548	64,917	43,632	24,233	41,039	30,371	7,603
12	Drainage only.....acres..	6,321	5,612	42,733	32,292	35,917	19,533	33,014	7,512	7,283
13	Drainage and clearing.....acres..	14,787	18,468	6,815	22,625	7,715	4,700	3,025	22,859	325

		Wadena.	Waseca.	Wash- ington.	Waton- wan.	Wilkin.	Winona.	Wright.	Yellow Medicine.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,326	1,609	2,014	1,402	1,163	2,180	3,937	2,109	4,168
2	Farms reporting land having drainage.....	318	1,006	155	1,001	178	18	1,406	589	21
3	Farms reporting land needing drainage.....	619	1,179	482	947	64	47	1,622	1,077	480
4	Farms in drainage and levee districts.....	133	123	34	151	167	2	100	155	13
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	344,320	275,840	254,080	277,760	476,800	407,680	442,240	479,360	3,013,120
6	All land in farms.....acres..	206,503	248,191	221,953	259,566	402,139	373,215	403,305	458,050	696,487
7	Improved land in farms.....acres..	102,323	193,270	156,859	225,999	389,687	233,241	260,300	368,729	406,229
8	Woodland in farms.....acres..	69,640	13,543	40,414	4,606	2,671	111,730	71,878	11,924	205,911
9	Other unimproved land in farms.....acres..	34,540	41,378	24,680	28,961	9,781	28,244	71,129	57,397	84,347
10	Farm land reported as provided with drainage.....acres..	14,416	39,312	3,650	83,867	26,199	500	24,007	23,263	493
11	Farm land reported as needing drainage.....acres..	41,749	49,566	13,250	64,838	4,985	1,367	46,778	40,607	13,078
12	Drainage only.....acres..	4,654	37,582	5,504	53,139	4,573	673	14,358	39,655	850
13	Drainage and clearing.....acres..	37,095	11,984	7,746	1,699	412	694	32,413	952	12,426

<sup>1</sup> No drainage on farms reported in Wabasha County.



DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Aitkin.	Anoka.	Becker.	Beltrami.	Benton.	Big Stone.	Blue Earth.	
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres..	51,749,120	1,171,200	293,760	863,360	2,446,080	259,200	314,240	487,680
2	All land in operating drainage enterprises.....acres..	9,232,709	419,680	68,891	17,235	1,211,754	7,979	10,111	54,548
3	Improved land.....acres..	3,818,490	136,058	26,459	8,412	137,604	4,310	5,918	49,638
4	Per cent of all improved land in farms.....	17.8	53.3	21.8	3.4	41.9	3.4	2.3	14.0
5	Timber and out-over land.....acres..	1,370,023	115,255	1,384	200	574,444	316	.....	.....
6	Other unimproved land.....acres..	4,044,196	268,367	41,048	8,623	599,706	3,353	4,193	4,910
7	Swampy or subject to overflow, in enterprises.....acres..	1,193,136	31,557	7,959	6,042	17,818	153	589	.....
8	Suffering a loss of crops from defective drainage.....acres..	471,094	25,157	7,839	1,196	35,653	.....	1,371	.....
9	Assessed acreage.....acres..	9,974,662	419,680	68,891	17,701	1,211,754	7,979	10,111	54,548
10	Excess over all land in operating enterprises.....acres..	741,953	.....	.....	466	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
11	Completed.....miles..	14,657.0	530.0	303.4	104.8	1,635.5	62.3	34.4	93.0
12	Additional under construction.....miles..	166.1	.....	.....	.....	32.0	0.7	.....	2.0
13	Maximum completed in any enterprise.....miles..	216.0	80.0	23.0	27.4	216.0	11.0	8.1	20.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	72	20	15	12	35	12	8	16
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	24.0	8.0	8.0	10.0	8.0	5.0	6.0	9.0
16	Mean depth of branch ditches <sup>3</sup> .....feet..	4.9	5.6	3.5	4.2	5.0	3.3	.....	4.5
<b>Tile drains:</b>									
17	Completed.....miles..	5,924.6	.....	5.7	0.1	.....	.....	42.7	243.0
18	Additional under construction.....miles..	462.7	.....	.....	.....	.....	.....	.....	6.0
19	Maximum completed in any enterprise.....miles..	153.0	.....	2.0	0.1	.....	.....	13.5	18.0
20	Maximum size of tile <sup>4</sup> .....inches..	48	.....	36	36	.....	.....	36	42
<b>Accessory levees and dikes:</b>									
21	Completed.....miles..	0.1	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction.....miles..	0.3	.....	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only <sup>5</sup> .....acres..	8,440,167	419,680	63,881	16,545	1,211,754	7,979	5,528	9,847
24	Length of these ditches.....miles..	13,432.0	530.0	278.6	93.3	1,667.5	63.0	27.4	69.0
25	Average length per acre.....feet..	8.4	6.7	22.0	31.7	7.3	41.7	28.2	37.0
26	Area drained by tile only <sup>6</sup> .....acres..	271,118	.....	396	.....	.....	.....	2,902	34,192
27	Length of these tile.....miles..	2,816.1	.....	2.0	.....	.....	.....	31.6	209.0
28	Average length per acre.....feet..	54.8	.....	26.7	.....	.....	.....	57.5	32.3
29	Area drained by open ditches and tile <sup>7</sup> .....acres..	8,711,285	.....	4,614	690	.....	.....	1,681	10,509
30	Length of these drains.....miles..	4,962.3	.....	28.5	5.6	.....	.....	18.1	68.0
31	Average length per acre.....feet..	50.2	.....	32.6	42.9	.....	.....	58.9	33.2
<b>DEVELOPMENT OF LAND.</b>									
32	Improved land in operating enterprises, 1920.....acres..	3,818,490	136,058	26,459	8,412	137,604	4,310	5,918	49,638
33	Improved land prior to drainage.....acres..	1,722,875	49,079	9,097	2,273	.....	1,134	2,923	3,273
34	Increase since drainage.....acres..	2,095,615	26,979	17,362	6,139	37,604	3,176	2,995	46,365
35	Per cent of increase <sup>8</sup> .....	121.6	297.2	190.9	270.1	.....	280.1	102.6	.....
36	Per cent increase is of all improved land in farms, 1920.....	9.8	43.6	14.3	2.4	41.9	2.5	1.2	13.0
37	Timber and out-over land, 1920.....acres..	1,370,023	115,255	1,384	200	574,444	316	.....	.....
38	Timber and out-over land prior to drainage.....acres..	1,473,820	117,489	1,656	214	581,444	952	.....	.....
39	Decrease since drainage.....acres..	103,797	2,234	272	14	7,000	636	.....	.....
40	Per cent of decrease.....	7.0	1.9	16.4	6.5	1.2	66.8	.....	.....
41	Other unimproved land, 1920.....acres..	4,044,196	268,367	41,048	8,623	599,706	3,353	4,193	4,910
42	Other unimproved land prior to drainage.....acres..	6,036,014	263,112	68,138	14,748	630,310	5,893	7,188	51,275
43	Decrease since drainage.....acres..	1,991,818	24,745	17,090	6,125	30,604	2,540	2,995	46,365
44	Per cent of decrease.....	33.0	8.4	29.4	41.5	4.9	43.1	41.7	90.4
45	Swampy or subject to overflow, 1920.....acres..	1,193,136	31,557	7,959	6,042	17,818	153	589	.....
46	Swampy or subject to overflow prior to drainage.....acres..	4,634,841	168,488	37,128	16,603	154,889	4,118	5,702	43,043
47	Decrease since drainage.....acres..	3,441,505	136,911	29,169	10,561	137,071	3,963	5,113	43,043
48	Per cent of decrease.....	74.3	81.3	78.6	63.6	88.5	96.3	86.7	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
49	Total capital invested in and required for completion of operating enterprises.....dollars..	44,183,838	966,046	315,585	162,025	3,106,371	64,753	204,470	964,853
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	42,017,447	966,046	315,585	162,025	2,994,371	63,127	204,470	953,768
51	Additional capital required to complete these enterprises.....dollars..	2,166,391	.....	.....	.....	112,000	1,626	.....	11,090
52	Average cost per acre when completed.....dollars..	4.79	2.30	4.68	9.40	2.56	8.12	20.22	17.69
53	Enterprises constructing open ditches only.....dollars..	23,238,989	966,046	231,607	154,334	3,106,371	64,753	26,325	55,766
54	Average cost per acre when completed.....dollars..	2.75	2.30	8.63	9.33	2.56	8.12	15.62	5.66
55	Enterprises constructing tile drains only.....dollars..	7,391,548	.....	8,837	.....	.....	.....	62,885	657,744
56	Average cost per acre when completed.....dollars..	27.26	.....	22.32	.....	.....	.....	21.67	19.24
57	Enterprises constructing open ditches and tile drains.....dollars..	613,553,301	.....	75,141	7,681	.....	.....	55,280	251,348
58	Average cost per acre when completed.....dollars..	25.99	.....	16.29	11.15	.....	.....	32.87	23.92
<b>CROPS.</b>									
<b>Improved land in enterprises reporting—</b>									
59	Wheat as principal crop on drained land.....acres..	1,774,205	.....	215	5,435	.....	.....	5,918	.....
60	Hay as principal crop on drained land.....acres..	940,935	36,058	24,654	2,977	37,604	3,910	.....	7,804
61	Corn as principal crop on drained land.....acres..	927,801	.....	1,048	.....	.....	400	.....	41,834
62	Oats as principal crop on drained land.....acres..	166,239	.....	245	.....	.....	.....	.....	.....
63	Potatoes as principal crop on drained land.....acres..	5,639	.....	299	.....	.....	.....	.....	.....
64	Flax as principal crop on drained land.....acres..	2,184	.....	.....	.....	.....	.....	.....	.....
65	Not reporting principal crop on drained land.....acres..	1,187	.....	.....	.....	.....	.....	.....	.....

1 Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 Includes 4,842 acres constructing also 0.4 mile of levee.  
 4 The reported figures have been reduced in proportion to the reduction made in improved land, 1920.  
 5 Per cent not shown when more than 1,000.  
 6 Includes cost of 0.4 mile of levee.  
 7 Includes 4,802 acres reporting barley as principal crop.  
 8 Includes 499 acres reporting sugar beets as principal crop.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Brown.	Carlton.	Carver.	Cass.	Chippewa.	Chisago.	Clay.	Cotton-wood.	Crow Wing.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres	801,630	554,880	940,640	1,346,560	378,240	273,280	667,520	409,600	676,480
2	All land in operating drainage enterprises.....acres	27,538	42,500	6,282	71,871	50,782	17,368	379,975	33,524	24,402
3	Improved land.....acres	15,310	6,326	3,140	14,137	39,329	8,782	248,830	26,121	12,551
4	Per cent of all improved land in farms.....	5.3	11.6	2.3	19.0	12.4	7.0	49.2	7.6	18.3
5	Timber and cut-over land.....acres	33	5,381	99	23,900	—	8,054	4,092	—	2,789
6	Other unimproved land.....acres	12,195	30,793	8,043	33,834	11,453	5,632	127,053	7,403	9,062
7	Swampy or subject to overflow, in enterprises.....acres	3,961	9,520	1,637	—	1,672	1,238	76,878	3,892	328
8	Suffering a loss of crops from defective drainage.....acres	7,394	—	281	—	2,587	1,167	14,275	525	—
9	Assessed acreage.....acres	27,538	42,500	6,282	71,871	50,782	17,368	379,975	33,524	24,402
10	Excess over all land in operating enterprises.....acres	—	—	—	—	—	—	—	—	—
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....miles	137.9	54.0	52.8	166.0	175.6	74.5	244.5	11.0	105.0
12	Additional under construction.....miles	—	—	2.3	—	—	—	—	—	—
13	Maximum completed in any enterprise.....miles	19.7	37.0	11.6	30.0	42.6	8.0	21.6	5.0	20.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	12	20	20	12	20	10	20	8	12
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	10.0	8.0	5.0	7.0	10.0	8.0	8.5	8.6	7.0
16	Mean depth of branch ditches <sup>1</sup> .....feet	4.3	5.8	3.1	5.0	3.1	4.0	4.1	4.9	3.6
Tile drains:										
17	Completed.....miles	184.5	—	8.7	—	149.7	—	1.0	319.4	—
18	Additional under construction.....miles	43.8	—	1.7	—	—	—	—	28.6	—
19	Maximum completed in any enterprise.....miles	42.7	—	3.7	—	69.4	—	1.0	33.8	—
20	Maximum size of tile <sup>1</sup> .....inches	36	—	24	—	30	—	18	48	—
Accessory levees and dikes:										
21	Completed.....miles	—	—	—	—	—	—	—	—	—
22	Additional under construction.....miles	0.3	—	—	—	—	—	—	—	—
23	Area drained by open ditches only <sup>1</sup> .....acres	9,894	42,500	5,242	71,871	12,365	17,368	376,020	1,093	24,402
24	Length of these ditches.....miles	88.6	54.0	47.3	166.0	90.2	74.5	236.7	5.0	105.0
25	Average length per acre.....feet	52.6	6.7	47.6	12.2	38.5	22.6	3.3	24.2	22.7
26	Area drained by tile only <sup>1</sup> .....acres	6,336	—	156	—	23,527	—	—	15,078	—
27	Length of these tile.....miles	113.2	—	3.1	—	113.9	—	—	191.8	—
28	Average length per acre.....feet	94.3	—	104.9	—	25.6	—	—	67.2	—
29	Area drained by open ditches and tile <sup>1</sup> .....acres	11,308	—	884	—	14,890	—	3,955	17,353	—
30	Length of these drains.....miles	154.4	—	15.1	—	121.2	—	8.8	182.2	—
31	Average length per acre.....feet	72.1	—	90.2	—	43.0	—	11.7	49.4	—
<b>DEVELOPMENT OF LAND.</b>										
32	Improved land in operating enterprises, 1920.....acres	15,310	6,326	3,140	14,137	39,329	8,782	248,830	26,121	12,551
33	Improved land prior to drainage.....acres	8,910	3,949	814	—	23,576	2,569	121,358	10,114	4,059
34	Increase since drainage.....acres	6,400	2,377	2,326	14,137	15,753	6,213	127,472	16,007	8,492
35	Per cent of increase.....	71.8	60.2	411.4	—	66.8	241.8	105.0	153.3	209.2
36	Per cent increase is of all improved land in farms, 1920.....	2.2	4.3	1.8	19.0	5.0	4.9	25.2	4.6	12.4
37	Timber and cut-over land, 1920.....acres	33	5,381	99	23,900	—	8,054	4,092	—	2,789
38	Timber and cut-over land prior to drainage.....acres	33	5,633	170	24,672	—	8,054	4,508	—	4,255
39	Decrease since drainage.....acres	—	252	71	672	—	—	416	—	1,466
40	Per cent of decrease.....	—	4.5	41.8	2.7	—	—	9.2	—	34.5
41	Other unimproved land, 1920.....acres	12,195	30,793	3,043	33,834	11,453	5,632	127,053	7,403	9,062
42	Other unimproved land prior to drainage.....acres	18,595	32,918	5,498	47,299	27,206	11,745	254,109	23,410	16,088
43	Decrease since drainage.....acres	6,400	2,125	2,455	13,465	15,753	6,213	127,056	16,007	7,026
44	Per cent of decrease.....	34.4	6.5	44.7	28.5	57.9	52.9	50.0	68.4	43.7
45	Swampy or subject to overflow, 1920.....acres	3,961	9,520	1,637	—	1,672	1,238	76,878	3,892	328
46	Swampy or subject to overflow prior to drainage.....acres	10,555	26,563	6,253	63,317	16,571	8,906	168,989	13,299	11,246
47	Decrease since drainage.....acres	6,594	17,048	4,616	63,317	14,899	7,668	92,111	9,407	10,918
48	Per cent of decrease.....	62.5	64.2	73.8	100.0	89.9	86.1	54.5	70.7	97.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
49	Total capital invested in and required for completion of operating enterprises.....dollars	692,574	135,012	136,079	268,696	1,036,955	94,962	712,787	952,231	93,973
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars	660,195	125,012	117,570	268,696	1,036,955	94,962	712,787	844,801	93,973
51	Additional capital required to complete these enterprises.....dollars	132,379	—	18,500	—	—	—	—	107,430	—
52	Average cost per acre when completed.....dollars	25.15	3.18	21.66	3.74	20.42	5.47	1.86	28.40	3.85
53	Enterprises constructing open ditches only.....dollars	111,204	135,012	85,337	268,696	83,685	94,962	688,212	16,329	93,973
54	Average cost per acre when completed.....dollars	11.24	3.13	16.28	3.74	6.76	5.47	1.86	14.94	3.85
55	Enterprises constructing tile drains only.....dollars	236,319	—	16,831	—	510,630	—	—	395,732	—
56	Average cost per acre when completed.....dollars	37.30	—	107.89	—	21.70	—	—	26.25	—
57	Enterprises constructing open ditches and tile drains.....dollars	345,051	—	33,911	—	442,690	—	14,575	540,170	—
58	Average cost per acre when completed.....dollars	30.51	—	38.36	—	29.73	—	3.69	31.13	—
<b>CROPS.</b>										
Improved land in enterprises reporting—										
59	Wheat as principal crop on drained land.....acres	—	—	—	—	39,329	—	29,067	—	—
60	Hay as principal crop on drained land.....acres	297	6,326	423	14,137	—	8,782	99,548	—	8,369
61	Corn as principal crop on drained land.....acres	15,013	—	2,717	—	—	—	—	26,121	4,152
62	Oats as principal crop on drained land.....acres	—	—	—	—	—	—	120,215	—	—
63	Potatoes as principal crop on drained land.....acres	—	—	—	—	—	—	—	—	—
64	Flax as principal crop on drained land.....acres	—	—	—	—	—	—	—	—	—
65	Not reporting principal crop on drained land.....acres	—	—	—	—	—	—	—	—	—

<sup>1</sup> When works under construction have been completed.

## DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Dodge.	Douglas.	Faribault.	Freeborn.	Grant.	Henne- pin.	Hubbard.	Isanti.	Itasca.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres..	281,600	414,720	460,160	470,400	353,920	361,600	613,120	282,880	1,747,200
2	All land in operating drainage enterprises.....acres..	13,902	30,677	118,685	19,084	60,365	13,375	14,302	19,168	99,527
3	Improved land.....acres..	7,028	16,752	101,504	11,403	60,365	8,030	3,305	9,615	99,527
4	Per cent of all improved land in farms.....	3.4	6.9	28.1	3.6	21.3	4.3	4.1	6.9	34,051
5	Timber and cut-over land.....acres..			236			1,292	5,173	4,937	34,051
6	Other unimproved land.....acres..	6,874	13,925	17,181	7,445		4,053	5,824	4,616	65,476
7	Swampy or subject to overflow, in enterprises.....acres..			15,959	4,914		2,629	3,560	1,031	
8	Suffering a loss of crops from defective drainage.....acres..			7,166	511		2,532			
9	Assessed acreage.....acres..	13,902	30,677	118,685	19,084	60,365	13,375	14,302	19,168	99,527
10	Excess over all land in operating enterprises.....acres..									
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed.....miles..	37.0	132.6	129.5	95.4	62.6	94.9	31.0	111.5	97.0
13	Additional under construction.....miles..						1.3			
14	Maximum completed in any enterprise.....miles..	33.0	28.9	27.9	12.0	10.6	7.8	7.0	11.0	36.0
15	Maximum width at bottom of ditch <sup>1</sup> .....feet..	10	16	40	25	18	30	16	16	8
16	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	5.0	14.0	9.7	12.0	9.0	5.0	5.0	9.0	8.0
17	Mean depth of branch ditches <sup>1</sup> .....feet..	4.0	3.8	7.5	6.0	4.4	3.4	3.4	4.7	5.8
18	Tile drains:									
19	Completed.....miles..	10.0	11.5	616.0	17.9	53.5	0.4			
20	Additional under construction.....miles..			23.8	11.3		0.2			
21	Maximum completed in any enterprise.....miles..	10.0	11.1	49.1	10.1	16.2	0.2			
22	Maximum size of tile <sup>1</sup> .....inches..	36	24	36	34	32	24			
23	Accessory levees and dikes:									
24	Completed.....miles..									
25	Additional under construction.....miles..									
26	Area drained by open ditches only <sup>1</sup> .....acres..	770	29,371	14,339	14,209	50,079	13,097	14,302	19,168	99,527
27	Length of these ditches.....miles..	4.0	122.2	32.3	74.6	56.2	89.9	31.0	111.5	97.0
28	Average length per acre.....feet..	27.4	22.0	11.9	27.7	5.9	36.2	11.4	30.7	6.1
29	Area drained by tile only <sup>1</sup> .....acres..			36,646		9,819				
30	Length of these tile.....miles..			244.3		52.7				
31	Average length per acre.....feet..			35.2		28.3				
32	Area drained by open ditches and tile <sup>1</sup> .....acres..	13,132	1,306	67,700	4,875	467	278			
33	Length of these drains.....miles..	43.0	21.9	492.7	50.0	7.2	6.9			
34	Average length per acre.....feet..	17.3	88.5	38.4	54.2	81.4	131.1			
<b>DEVELOPMENT OF LAND.</b>										
35	Improved land in operating enterprises, 1920.....acres..	7,028	16,752	101,504	11,403	60,365	8,030	3,305	9,615	
36	Improved land prior to drainage.....acres..	1,970	10,771	63,042	3,232	45,889	6,096		3,330	
37	Increase since drainage.....acres..	5,058	5,981	38,462	8,171	14,496	1,934	3,305	6,285	
38	Per cent of increase.....	256.8	55.5	61.0	252.8	31.6	31.7		188.7	
39	Per cent increase is of all improved land in farms, 1920.....	2.4	2.5	10.6	2.6	5.1	1.0	4.1	4.5	
40	Timber and cut-over land, 1920.....acres..				236		1,292	5,173	4,937	34,051
41	Timber and cut-over land prior to drainage.....acres..				358		1,623	6,997	6,270	34,051
42	Decrease since drainage.....acres..				122		331	1,724	1,333	
43	Per cent of decrease.....				34.1		20.4	25.0	21.3	
44	Other unimproved land, 1920.....acres..	6,874	13,925	17,181	7,445		4,053	5,824	4,616	65,476
45	Other unimproved land prior to drainage.....acres..	11,932	19,906	55,643	15,494	14,496	5,656	7,405	9,568	65,476
46	Decrease since drainage.....acres..	5,058	5,981	38,462	8,049	14,496	1,603	1,581	4,952	
47	Per cent of decrease.....	42.4	30.0	69.1	51.9	100.0	28.3	21.4	51.8	
48	Swampy or subject to overflow, 1920.....acres..			15,959	4,914		2,629	3,560	1,031	
49	Swampy or subject to overflow prior to drainage.....acres..	6,409	10,509	47,111	18,954		4,636	14,302	9,746	99,527
50	Decrease since drainage.....acres..	6,409	10,509	31,152	14,040		2,007	10,742	8,715	99,527
51	Per cent of decrease.....	100.0	100.0	56.1	74.1		43.3	75.1	89.4	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
52	Total capital invested in and required for completion of operating enterprises.....dollars..	55,960	197,536	2,317,116	313,283	584,823	237,777	30,887	194,885	241,490
53	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	55,960	197,536	2,191,616	265,283	584,823	227,377	30,887	194,885	241,490
54	Additional capital required to complete these enterprises.....dollars..			125,500	48,000		10,500			
55	Average cost per acre when completed.....dollars..	4.03	6.44	19.52	16.42	9.69	17.78	2.16	10.17	2.43
56	Enterprises constructing open ditches only.....dollars..	8,500	158,132	88,823	155,915	112,506	214,787	30,887	194,885	241,490
57	Average cost per acre when completed.....dollars..	11.04	5.38	6.19	10.97	2.25	16.40	2.16	10.17	2.43
58	Enterprises constructing tile drains only.....dollars..			642,854		464,166				
59	Average cost per acre when completed.....dollars..			17.54		47.27				
60	Enterprises constructing open ditches and tile drains.....dollars..	47,460	39,404	1,585,439	167,368	8,151	22,950			
61	Average cost per acre when completed.....dollars..	3.61	30.17	23.42	33.28	17.45	83.70			
<b>CROPS.</b>										
62	Improved land in enterprises reporting—									
63	Wheat as principal crop on drained land.....acres..					60,365	404			
64	Hay as principal crop on drained land.....acres..	7,028	16,752	1,823	340		322	3,305	9,070	
65	Corn as principal crop on drained land.....acres..			96,905	11,063		7,380			
66	Oats as principal crop on drained land.....acres..			2,776						
67	Potatoes as principal crop on drained land.....acres..						24		545	
68	Flax as principal crop on drained land.....acres..									
69	Not reporting principal crop on drained land.....acres..									

<sup>1</sup> When works under construction have been completed.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Jackson.	Kanabec.	Kandi-yohl.	Kittson.	Koochi-ching.	Lac qui Parle.	Le Sueur.	Lincoln.	Lyon.	
<b>LAND AREA.</b>										
1	Approximate land area of the county..... acres..	449,280	841,760	512,640	711,040	2,010,240	505,600	298,240	842,400	453,120
2	All land in operating drainage enterprises..... acres..	65,147	16,539	66,279	498,294	707,496	26,567	16,721	14,490	31,765
3	Improved land..... acres..	56,193	8,303	60,023	275,330	14,146	20,109	10,711	11,128	22,507
4	Per cent of all improved land in farms.....	15.1	12.3	16.7	80.5	83.0	4.8	6.0	4.1	6.3
5	Timber and cut-over land..... acres..	2,713	2,713	27,756	176,875	176,875	6,458	6,010	3,362	9,258
6	Other unimproved land..... acres..	8,954	5,523	6,256	195,208	516,475	6,458	6,010	3,362	9,258
7	Swampy or subject to overflow, in enterprises..... acres..	7,897	785	889	12,773	399,119	899	2,336	2,465	5,580
8	Suffering a loss of crops from defective drainage..... acres..	3,895	385	385	14,740	707,496	1,496	6,987	493	925
9	Assessed acreage..... acres..	65,147	16,539	66,279	498,294	707,496	26,567	17,492	14,490	31,765
10	Excess over all land in operating enterprises..... acres..						771			
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed..... miles..	70.4	76.0	320.4	395.0	542.0	226.0	168.8	132.2	54.5
12	Additional under construction..... miles..			3.5		25.0				1.3
13	Maximum completed in any enterprise..... miles..	18.0	18.0	62.0	48.6	86.0	46.4	13.5	17.0	8.6
14	Maximum width at bottom of ditch <sup>1</sup> ..... feet..	8	16	14	60	20	18	30	20	12
15	Maximum of average depths of outlet ditches <sup>2</sup> ..... feet..	9.8	7.0	12.9	10.0	7.0	12.0	6.3	8.5	8.7
16	Mean depth of branch ditches <sup>2</sup> ..... feet..	5.3	4.1	4.4	4.5	5.2	3.4	5.1	4.4	5.5
Tile drains:										
17	Completed..... miles..	652.1		70.3			111.4	0.2	62.9	303.1
18	Additional under construction..... miles..	17.3		12.7					22.1	42.3
19	Maximum completed in any enterprise..... miles..	56.8		21.0			17.0	0.2	12.7	19.8
20	Maximum size of tile <sup>3</sup> ..... inches..	36		24			36	16	30	36
Accessory levees and dikes:										
21	Completed..... miles..									0.1
22	Additional under construction..... miles..									
23	Area drained by open ditches only <sup>1</sup> ..... acres..		16,539	82,602	498,294	707,496	12,553	16,430	2,489	5,538
24	Length of these ditches..... miles..		75.0	276.6	395.0	567.0	130.3	167.5	58.9	58.7
25	Average length per acre..... feet..		24.3	27.8	4.2	4.2	50.6	53.8	82.5	35.0
26	Area drained by tile only <sup>1</sup> ..... acres..	17,920		1,958			3,066		1,081	16,176
27	Length of these tile..... miles..	236.7		32.2			59.9		23.3	251.1
28	Average length per acre..... feet..	69.7		86.8			102.5		113.8	82.0
29	Area drained by open ditches and tile <sup>1</sup> ..... acres..	47,227		11,719			10,928	291	10,920	10,051
30	Length of these drains..... miles..	503.1		88.1			157.2	1.5	155.0	113.4
31	Average length per acre..... feet..	59.2		44.2			76.0	27.2	74.9	59.6
<b>DEVELOPMENT OF LAND.</b>										
32	Improved land in operating enterprises, 1920..... acres..	56,193	8,303	60,023	275,330	14,146	20,109	10,711	11,128	22,507
33	Improved land prior to drainage..... acres..	19,077	2,859	30,336	160,169		12,545	6,794	1,546	9,146
34	Increase since drainage..... acres..	37,116	5,444	29,687	115,161	14,146	7,564	4,917	9,582	13,361
35	Per cent of increase.....	194.6	190.4	97.9	71.9		60.3	84.9	619.3	146.1
36	Per cent increase is of all improved land in farms, 1920.....	10.0	8.1	6.2	33.7	63.0	1.8	2.7	3.5	3.7
37	Timber and cut-over land, 1920..... acres..		2,713		27,756	176,875				
38	Timber and cut-over land prior to drainage..... acres..		3,093		53,707	176,875				
39	Decrease since drainage..... acres..		380		26,951					
40	Per cent of decrease.....		12.3		48.2					
41	Other unimproved land, 1920..... acres..	8,954	5,523	6,256	195,208	516,475	6,458	6,010	3,362	9,258
42	Other unimproved land prior to drainage..... acres..	46,070	10,587	35,943	284,418	530,621	14,022	10,927	12,944	22,619
43	Decrease since drainage..... acres..	37,116	5,064	29,687	89,210	14,146	7,564	4,917	9,582	13,361
44	Per cent of decrease.....	80.6	47.8	82.6	31.4	2.7	53.9	45.0	74.0	59.1
45	Swampy or subject to overflow, 1920..... acres..	7,897	785	889	12,773	399,119	899	2,336	2,465	5,580
46	Swampy or subject to overflow prior to drainage..... acres..	28,757	7,432	30,311	97,981	707,496	9,829	5,061	12,433	13,804
47	Decrease since drainage..... acres..	20,860	6,647	29,422	85,208	308,377	8,930	2,725	9,968	8,224
48	Per cent of decrease.....	72.6	89.4	97.1	87.0	43.6	90.9	53.8	80.2	59.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
49	Total capital invested in and required for completion of operating enterprises..... dollars..	1,624,563	105,760	687,928	758,425	1,356,438	738,907	238,951	389,256	989,490
50	Capital invested in these enterprises to Dec. 31, 1919..... dollars..	1,555,157	105,760	632,533	758,425	1,281,238	738,907	238,951	348,352	870,872
51	Additional capital required to complete these enterprises..... dollars..	69,406		55,395		75,200			40,904	118,608
52	Average cost per acre when completed..... dollars..	24.94	6.39	10.38	1.52	1.92	27.81	14.29	26.86	31.15
53	Enterprises constructing open ditches only..... dollars..		105,760	356,789	758,425	1,356,438	214,045	226,178	51,304	68,699
54	Average cost per acre when completed..... dollars..		6.39	6.78	1.52	1.92	17.05	13.77	20.61	12.41
55	Enterprises constructing tile drains only..... dollars..	578,332		96,585			103,256		62,663	525,911
56	Average cost per acre when completed..... dollars..	32.27		49.33			33.46		48.72	32.51
57	Enterprises constructing open ditches and tile drains..... dollars..	1,046,231		234,554			421,606	12,773	285,289	394,870
58	Average cost per acre when completed..... dollars..	22.15		20.01			38.58	45.89	26.13	39.29
<b>CROPS.</b>										
Improved land in enterprises reporting—										
59	Wheat as principal crop on drained land..... acres..		8,303	11,688	275,330		20	2,970		
60	Hay as principal crop on drained land..... acres..					14,146				
61	Corn as principal crop on drained land..... acres..						20,089	7,741	9,503	22,507
62	Oats as principal crop on drained land..... acres..	56,193		48,335						
63	Potatoes as principal crop on drained land..... acres..									
64	Flax as principal crop on drained land..... acres..								1,318	
65	Not reporting principal crop on drained land..... acres..								307	

<sup>1</sup> Office estimate; the reported figures are 98 per cent of the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	McLeod.	Mahno- man.	Marshall.	Martin.	Meeker.	Mille Lacs.	Morrison.	Mower.	
<b>LAND AREA.</b>									
1	Approximate land area of the county.....acres..	317,440	366,080	1,144,320	460,160	397,440	373,120	731,520	455,040
2	All land in operating drainage enterprises.....acres..	14,072	36,724	771,421	67,965	21,227	7,172	33,080	4,771
3	Improved land.....acres..	7,834	16,031	1,487,137	53,351	14,268	4,153	20,362	1,670
4	Per cent of all improved land in farms.....	3.1	19.5	93.1	14.3	5.1	5.2	8.9	0.5
5	Timber and cut-over land.....acres..	233	1,448	154,858	189	578	2,309	48	48
6	Other unimproved land.....acres..	6,005	19,245	129,426	14,614	6,770	2,441	10,409	3,053
7	Swampy or subject to overflow, in enterprises.....acres..	3,868	13,714	30,856	7,105	2,591	277	1,506	426
8	Suffering a loss of crops from defective drainage.....acres..	582	257	61,084	10,183	2,943	.....	.....	75
9	Assessed acreage.....acres..	14,495	86,724	1,150,927	67,965	21,227	7,172	33,080	4,771
10	Excess over all land in operating enterprises.....acres..	423	.....	379,506	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
11	Completed.....miles.....	96.6	41.1	834.5	82.7	128.6	42.0	117.2	6.1
12	Additional under construction.....miles.....	.....	53.3	.....	.....	.....	.....	0.8	.....
13	Maximum completed in any enterprise.....miles.....	9.8	15.8	110.0	13.9	12.0	12.0	13.0	5.1
14	Maximum width at bottom of ditch.....feet.....	16	12	40	14	24	8	10	16
15	Maximum of average depths of outlet ditches.....feet.....	10.0	6.4	10.0	13.0	10.0	6.0	6.0	6.2
16	Mean depth of branch ditches.....feet.....	4.2	4.8	4.9	7.2	4.7	3.4	3.2	.....
<b>Tile drains:</b>									
17	Completed.....miles.....	51.8	.....	.....	718.8	16.9	.....	.....	13.5
18	Additional under construction.....miles.....	1.0	.....	.....	16.0	.....	.....	.....	0.8
19	Maximum completed in any enterprise.....miles.....	12.0	.....	.....	51.9	6.0	.....	.....	7.5
20	Maximum size of tile.....inches.....	24	.....	.....	36	24	.....	.....	30
<b>Accessory levees and dikes:</b>									
21	Completed.....miles.....	.....	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction.....miles.....	.....	.....	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only.....acres..	8,757	36,724	771,421	2,166	19,785	7,172	33,080	.....
24	Length of these ditches.....miles.....	70.5	94.4	834.5	18.3	127.6	42.0	118.0	.....
25	Average length per acre.....feet.....	42.5	13.6	6.7	44.6	34.1	30.9	18.8	.....
26	Area drained by tile only.....acres..	1,404	.....	.....	23,136	1,318	.....	.....	1,021
27	Length of these tiles.....miles.....	14.3	.....	.....	343.6	14.9	.....	.....	6.7
28	Average length per acre.....feet.....	53.8	.....	.....	78.4	59.7	.....	.....	34.6
29	Area drained by open ditches and tile.....acres..	3,911	.....	.....	42,663	124	.....	.....	3,750
30	Length of these drains.....miles.....	64.1	.....	.....	455.6	3.0	.....	.....	12.7
31	Average length per acre.....feet.....	88.5	.....	.....	56.4	127.7	.....	.....	17.9
<b>DEVELOPMENT OF LAND.</b>									
32	Improved land in operating enterprises, 1920.....acres..	7,834	16,031	1,487,137	53,351	14,268	4,153	20,362	1,670
33	Improved land prior to drainage.....acres..	1,325	12,688	243,568	23,316	3,849	1,222	5,545	429
34	Increase since drainage.....acres..	6,509	3,363	243,569	30,035	10,419	2,931	14,817	1,241
35	Per cent of increase.....	491.2	26.5	100.0	128.8	270.7	239.9	267.2	289.3
36	Per cent increase is of all improved land in farms, 1920.....	2.6	4.1	46.5	8.1	3.7	3.7	6.5	0.3
37	Timber and cut-over land, 1920.....acres..	233	1,448	154,858	.....	189	578	2,309	48
38	Timber and cut-over land prior to drainage.....acres..	491	1,448	173,430	.....	245	1,027	5,120	48
39	Decrease since drainage.....acres..	258	.....	18,572	.....	56	449	2,811	.....
40	Per cent of decrease.....	52.5	.....	10.7	.....	22.9	43.7	54.9	.....
41	Other unimproved land, 1920.....acres..	6,005	19,245	129,426	14,614	6,770	2,441	10,409	3,053
42	Other unimproved land prior to drainage.....acres..	12,250	22,608	354,423	44,649	17,133	4,923	22,415	4,294
43	Decrease since drainage.....acres..	6,216	3,363	224,997	30,035	10,363	2,482	12,006	1,241
44	Per cent of decrease.....	51.0	14.9	63.5	67.3	60.5	50.4	53.6	28.9
45	Swampy or subject to overflow, 1920.....acres..	3,868	13,714	30,856	7,105	2,591	277	1,506	426
46	Swampy or subject to overflow prior to drainage.....acres..	14,072	20,696	331,708	37,486	11,702	3,608	14,641	4,771
47	Decrease since drainage.....acres..	10,204	6,982	300,852	30,381	9,111	3,331	13,135	4,345
48	Per cent of decrease.....	72.5	33.7	90.7	81.0	77.9	92.3	89.7	91.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
49	Total capital invested in and required for completion of operating enterprises.....dollars..	235,992	267,573	2,069,234	1,857,548	249,787	34,192	99,019	85,020
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	283,506	92,573	2,069,234	1,793,548	249,787	34,192	99,019	77,520
51	Additional capital required to complete these enterprises.....dollars..	2,486	175,000	.....	64,000	.....	.....	3,000	7,500
52	Average cost per acre when completed.....dollars..	20.32	7.29	2.68	27.33	11.77	4.77	2.99	17.82
53	Enterprises constructing open ditches only.....dollars..	105,950	267,573	2,069,234	23,552	217,332	34,192	99,019	.....
54	Average cost per acre when completed.....dollars..	12.10	7.29	2.68	10.87	10.98	4.77	2.99	.....
55	Enterprises constructing tile drains only.....dollars..	28,298	.....	.....	760,448	28,804	.....	.....	34,619
56	Average cost per acre when completed.....dollars..	20.16	.....	.....	32.87	21.85	.....	.....	33.91
57	Enterprises constructing open ditches and tile drains.....dollars..	151,744	.....	.....	1,073,548	3,651	.....	.....	60,401
58	Average cost per acre when completed.....dollars..	38.80	.....	.....	25.16	29.44	.....	.....	13.44
<b>CROPS.</b>									
Improved land in enterprises reporting—									
59	Wheat as principal crop on drained land.....acres..	1,576	2,849	487,137	.....	232	.....	.....	.....
60	Hay as principal crop on drained land.....acres..	27	.....	.....	31	4,525	3,765	12,451	.....
61	Corn as principal crop on drained land.....acres..	6,231	.....	.....	52,821	9,511	.....	4,040	.....
62	Oats as principal crop on drained land.....acres..	.....	15,182	.....	.....	.....	.....	.....	1,670
63	Potatoes as principal crop on drained land.....acres..	.....	.....	.....	499	.....	588	3,871	.....
64	Flax as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....
65	Not reporting principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....

1 Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Murray.	Nicollet.	Nobles.	Norman.	Otter Tail.	Pennington.	Pine.	Pipestone.	Polk.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres..	450,560	283,520	462,080	550,400	1,304,960	388,480	904,320	300,180	1,266,560
2	All land in operating drainage enterprises.....acres..	44,984	28,666	16,734	280,024	50,555	349,624	16,227	14,834	837,261
3	Improved land.....acres..	35,225	16,053	12,069	166,386	25,384	186,319	8,636	14,092	557,509
4	Per cent of all improved land in farms.....	9.2	7.6	3.0	41.5	8.7	95.8	7.1	5.7	66.2
5	Timber and cut-over land.....acres..	337	337	337	337	1,961	22,173	1,075	742	28,336
6	Other unimproved land.....acres..	9,759	12,276	4,665	113,638	23,210	141,132	6,516	742	251,416
7	Swampy or subject to overflow, in enterprises.....acres..	4,928	5,253	3,035	.....	17,147	66,288	812	.....	153,481
8	Suffering a loss of crops from defective drainage.....acres..	4,623	13,911	17	.....	3,201	15,684	791	.....	37,876
9	Assessed acreage.....acres..	44,984	30,746	16,734	280,024	50,555	449,778	16,227	14,834	1,016,453
10	Excess over all land in operating enterprises.....acres..	.....	2,080	.....	.....	100,154	.....	.....	.....	179,192
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....miles..	78.5	142.7	31.0	314.8	241.2	371.2	51.0	5.1	801.7
12	Additional under construction.....miles..	.....	0.5	.....	.....	.....	.....	.....	.....	4.9
13	Maximum completed in any enterprise.....miles..	19.8	14.7	6.2	57.0	14.7	38.6	12.0	5.1	23.6
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	40	20	10	16	20	12	12	10	24
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	9.2	13.0	9.0	24.0	10.0	6.5	5.0	6.0	9.2
16	Mean depth of branch ditches <sup>2</sup> .....feet..	5.8	8.4	5.1	6.0	3.4	8.9	3.0	8.0	4.3
<b>Tile drains:</b>										
17	Completed.....miles..	488.6	36.7	137.6	0.5	23.2	.....	.....	43.2	.....
18	Additional under construction.....miles..	33.6	8.0	10.2	.....	.....	.....	.....	21.6	0.1
19	Maximum completed in any enterprise.....miles..	28.4	10.2	64.5	0.5	8.2	.....	.....	43.2	.....
20	Maximum size of tile <sup>3</sup> .....inches..	36	28	42	15	24	.....	.....	32	24
<b>Accessory levees and dikes:</b>										
21	Completed.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only <sup>4</sup> .....acres..	9,358	23,996	3,713	278,593	41,037	349,624	16,227	.....	833,953
24	Length of these ditches.....miles..	48.5	141.3	19.5	314.3	177.6	371.2	51.0	.....	804.4
25	Average length per acre.....feet..	27.4	31.1	27.7	6.0	22.9	5.6	16.8	.....	5.1
26	Area drained by tile only <sup>4</sup> .....acres..	19,045	8,350	4,173	.....	49	.....	.....	.....	.....
27	Length of these tile.....miles..	827.0	18.4	58.3	.....	1.3	.....	.....	.....	.....
28	Average length per acre.....feet..	90.7	29.0	73.8	.....	140.1	.....	.....	.....	.....
29	Area drained by open ditches and tile <sup>4</sup> .....acres..	16,581	1,320	8,848	1,431	9,469	.....	14,834	.....	2,306
30	Length of these drains.....miles..	225.2	23.2	101.0	1.0	85.5	.....	69.9	.....	2.3
31	Average length per acre.....feet..	71.7	62.8	60.8	3.7	47.7	.....	24.9	.....	8.7
<b>DEVELOPMENT OF LAND.</b>										
32	Improved land in operating enterprises, 1920.....acres..	35,225	16,053	12,069	166,386	25,384	186,319	8,636	14,092	557,509
33	Improved land prior to drainage.....acres..	13,664	9,222	5,819	.....	8,508	85,763	2,811	11,126	233,889
34	Increase since drainage.....acres..	21,561	6,761	6,250	166,386	16,876	99,556	5,825	2,966	323,520
35	Per cent of increase.....	157.8	72.8	107.4	.....	198.4	114.7	207.2	26.7	138.3
36	Per cent increase is of all improved land in farms, 1920.....	5.6	3.2	1.6	41.5	2.5	51.2	4.8	1.2	38.4
37	Timber and cut-over land, 1920.....acres..	.....	337	.....	.....	1,961	22,173	1,075	.....	28,336
38	Timber and cut-over land prior to drainage.....acres..	.....	335	.....	.....	3,325	33,624	1,179	.....	41,630
39	Decrease since drainage.....acres..	.....	18	.....	.....	1,364	11,461	104	.....	13,294
40	Per cent of decrease.....	.....	5.1	.....	.....	41.0	34.1	8.8	.....	31.9
41	Other unimproved land, 1920.....acres..	9,759	12,276	4,665	113,638	23,210	141,132	6,516	742	251,416
42	Other unimproved land prior to drainage.....acres..	31,320	19,019	10,915	280,024	38,724	220,237	12,237	8,708	561,642
43	Decrease since drainage.....acres..	21,561	6,743	6,250	166,386	15,514	88,105	5,721	2,966	310,226
44	Per cent of decrease.....	68.8	35.5	57.3	59.4	40.1	38.4	46.8	80.0	55.2
45	Swampy or subject to overflow, 1920.....acres..	4,928	5,253	3,035	.....	17,147	66,288	812	.....	153,481
46	Swampy or subject to overflow prior to drainage.....acres..	17,052	10,091	8,473	280,024	45,143	132,016	8,000	3,708	307,184
47	Decrease since drainage.....acres..	12,124	4,838	5,438	280,024	27,996	65,728	7,188	3,708	153,703
48	Per cent of decrease.....	71.1	47.9	64.2	100.0	62.0	49.8	89.9	100.0	50.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
49	Total capital invested in and required for completion of operating enterprises.....dollars..	1,448,271	342,445	545,660	670,666	316,154	603,019	89,274	269,175	1,111,537
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	1,343,220	332,762	510,331	670,666	316,154	603,019	89,274	219,175	1,102,337
51	Additional capital required to complete these enterprises.....dollars..	105,051	9,683	35,329	.....	.....	.....	.....	50,000	9,200
52	Average cost per acre when completed.....dollars..	32.20	11.95	32.61	2.40	6.25	1.72	5.50	18.15	1.33
53	Enterprises constructing open ditches only.....dollars..	82,565	205,586	40,329	668,755	188,449	603,019	89,274	.....	1,104,959
54	Average cost per acre when completed.....dollars..	8.82	8.57	10.86	2.40	4.59	1.72	5.50	.....	1.32
55	Enterprises constructing tile drains only.....dollars..	823,622	71,370	130,834	.....	2,159	.....	.....	.....	.....
56	Average cost per acre when completed.....dollars..	43.25	21.30	31.35	.....	44.06	.....	.....	.....	.....
57	Enterprises constructing open ditches and tile drains.....dollars..	642,084	65,489	374,497	1,911	125,646	.....	.....	269,175	6,578
58	Average cost per acre when completed.....dollars..	32.69	49.61	42.33	1.34	13.26	.....	.....	18.15	1.99
<b>CROPS.</b>										
<b>Improved land in enterprises reporting—</b>										
59	Wheat as principal crop on drained land.....acres..	.....	4,256	.....	165,738	228	67,540	.....	.....	237,600
60	Hay as principal crop on drained land.....acres..	.....	11,497	12,069	648	25,156	113,903	8,636	.....	319,909
61	Corn as principal crop on drained land.....acres..	34,425	.....	.....	.....	.....	.....	14,092	.....	.....
62	Oats as principal crop on drained land.....acres..	.....	800	.....	.....	.....	4,876	.....	.....	.....
63	Potatoes as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
64	Flax as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
65	Not reporting principal crop on drained land.....acres..	800	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pope.	Ramsey.	Red Lake.	Redwood.	Renville.	Rice.	Roseau.	St. Louis.	Sherburne.
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	443,520	108,040	276,480	563,840	625,920	316,800	1,068,800	4,161,920	286,720
2	All land in operating drainage enterprises.....	11,402	4,172	146,649	65,146	89,679	4,909	1,036,824	217,689	20,597
3	Improved land.....	7,676	1,866	77,468	40,844	61,816	3,078	210,948	23,134	11,674
4	Per cent of all improved land in farms.....	2.7	5.2	48.5	9.1	12.1	1.4	99.4	24.7	9.1
5	Timber and cut-over land.....	208	231	5,802	20	29		132,944	22,172	1,280
6	Other unimproved land.....	3,518	2,075	63,379	24,282	27,734	1,831	692,932	172,383	7,643
7	Swampy or subject to overflow, in enterprises.....	979	1,654	31,198	9,859	16,021		71,028	61,433	737
8	Suffering a loss of crops from defective drainage.....	1,484	282	5,665	15,738	17,408	1,183	99,739	903	
9	Assessed acreage.....	11,402	4,172	172,553	65,146	93,785	4,909	1,036,824	217,689	20,597
10	Excess over all land in operating enterprises.....			25,904		4,208				
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....	69.4	37.4	158.4	174.4	243.9	43.8	1,091.1	654.8	140.0
12	Additional under construction.....	0.1	5.1		2.7				3.2	
13	Maximum completed in any enterprise.....	11.7	8.1	20.6	34.0	23.6	9.7	212.1	150.0	25.0
14	Maximum width at bottom of ditch.....	20	8	12	24	25	20	60	24	6
15	Maximum of average depths of outlet ditches.....	14.0	6.0	5.5	12.0	12.0	5.5	10.0	10.0	7.0
16	Mean depth of branch ditches.....	3.8	3.5	3.7	4.3	4.0	4.0	5.0	5.5	3.6
Tile drains:										
17	Completed.....	7.1	0.8		479.8	332.4	7.3			5.8
18	Additional under construction.....	0.6			63.8	38.3				1.0
19	Maximum completed in any enterprise.....	6.5	0.4		38.6	76.5	6.0			3.0
20	Maximum size of tile.....	24	24		36	42	16			36
Accessory levees and dikes:										
21	Completed.....									
22	Additional under construction.....									
23	Area drained by open ditches only.....	10,822	3,885	146,649	3,403	47,257	3,237	1,036,824	217,689	16,465
24	Length of these ditches.....	87.9	40.2	158.4	25.7	261.3	33.4	1,091.1	658.0	105.0
25	Average length per acre.....	33.1	54.6	5.7	39.9	29.2	54.5	5.6	16.0	33.7
26	Area drained by tile only.....	403			12,427	4,589				130
27	Length of these tile.....	6.5			154.6	58.4				2.6
28	Average length per acre.....	35.2			65.7	67.2				81.2
29	Area drained by open ditches and tile.....	177	287		49,816	37,733	1,672			4,002
30	Length of these drains.....	2.8	8.1		540.4	396.2	17.7			39.8
31	Average length per acre.....	33.5	57.0		57.9	55.3	55.9			53.5
<b>DEVELOPMENT OF LAND.</b>										
32	Improved land in operating enterprises, 1920.....	7,676	1,866	77,468	40,844	61,816	3,078	210,948	23,134	11,674
33	Improved land prior to drainage.....	4,016	463	34,971	16,997	45,591	1,778	49,075	4,959	2,916
34	Increase since drainage.....	3,660	1,403	42,497	23,847	16,225	1,300	161,873	18,175	8,758
35	Per cent of increase.....	91.1	303.0	121.5	140.3	35.6	73.1	329.8	366.5	300.3
36	Per cent increase is of all improved land in farms, 1920.....	1.3	3.9	26.6	5.3	3.2	0.6	76.3	19.4	6.3
37	Timber and cut-over land, 1920.....	208	231	5,802	20	29		132,944	22,172	1,280
38	Timber and cut-over land prior to drainage.....	726	371	9,629	31	94		132,944	24,227	2,759
39	Decrease since drainage.....	518	140	3,827	11	65			2,055	1,479
40	Per cent of decrease.....	71.3	37.7	29.7	35.5	69.1			8.5	53.6
41	Other unimproved land, 1920.....	3,518	2,075	63,379	24,282	27,734	1,831	692,932	172,383	7,643
42	Other unimproved land prior to drainage.....	6,660	3,338	102,049	48,118	43,894	3,131	854,805	188,503	14,922
43	Decrease since drainage.....	3,142	1,263	38,670	23,836	16,160	1,300	161,873	16,120	7,279
44	Per cent of decrease.....	47.2	37.8	37.9	49.5	36.8	41.5	18.9	8.6	48.8
45	Swampy or subject to overflow, 1920.....	979	1,654	31,198	9,859	16,021		71,028	61,433	737
46	Swampy or subject to overflow prior to drainage.....	5,056	4,059	64,131	24,386	38,561	1,401	829,458	186,209	9,937
47	Decrease since drainage.....	4,076	2,405	22,933	14,527	22,540	1,401	758,430	124,776	9,200
48	Per cent of decrease.....	80.6	59.3	42.4	59.6	58.5	100.0	91.4	67.0	92.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
49	Total capital invested in and required for completion of operating enterprises.....	124,912	86,857	188,572	1,895,940	1,875,171	102,191	1,788,122	1,033,797	176,302
50	Capital invested in these enterprises to Dec. 31, 1919.....	123,112	71,357	188,572	1,597,448	1,774,271	102,191	1,788,122	1,028,797	174,602
51	Additional capital required to complete these enterprises.....	1,800	15,500		298,492	100,900			5,000	1,700
52	Average cost per acre when completed.....	10.96	20.82	1.29	29.10	20.93	20.82	1.71	4.75	8.56
53	Enterprises constructing open ditches only.....	100,064	77,020	188,572	89,372	418,130	52,880	1,788,122	1,033,797	100,083
54	Average cost per acre when completed.....	9.25	19.82	1.29	11.57	8.85	16.34	1.71	4.75	8.08
55	Enterprises constructing tile drains only.....	17,235			344,923	141,681				3,032
56	Average cost per acre when completed.....	42.77			27.76	30.87				23.32
57	Enterprises constructing open ditches and tile drains.....	7,613	9,837		1,511,640	1,315,360	49,311			73,187
58	Average cost per acre when completed.....	43.01	34.28		30.65	34.86	29.49			18.29
<b>CROPS.</b>										
Improved land in enterprises reporting—										
59	Wheat as principal crop on drained land.....	5,950		4,850		60,773		210,948		
60	Hay as principal crop on drained land.....	1,691	1,113	55,570	2,927		602		23,134	11,400
61	Corn as principal crop on drained land.....		26		37,917	1,043	2,476			130
62	Oats as principal crop on drained land.....		513	17,039						
63	Potatoes as principal crop on drained land.....		169							144
64	Flax as principal crop on drained land.....									
65	Not reporting principal crop on drained land.....	85	45							

<sup>1</sup> Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Sibley.	Stearns.	Steele.	Stevens.	Swift.	Todd.	Traverse.	Wabasha.	
<b>LAND AREA.</b>									
1	Approximate land area of the county.....acres..	374,400	871,680	275,840	360,960	474,240	612,480	363,520	346,240
2	All land in operating drainage enterprises.....acres..	21,357	26,283	17,679	44,232	65,840	46,785	171,595	7,527
3	Improved land.....acres..	9,837	21,760	12,373	26,857	50,429	18,394	156,908	4,892
4	Per cent of all improved land in farms.....	3.6	4.4	5.8	9.6	12.9	7.6	52.2	2.2
5	Timber and cut-over land.....acres..	266	441						151
6	Other unimproved land.....acres..	11,254	4,082	5,306	17,375	15,411	28,391	14,689	2,484
7	Swampy or subject to overflow, in enterprises.....acres..	7,421	2,094		4,604	2,369			1,129
8	Suffering a loss of crops from defective drainage.....acres..	2,038	1,215		1,599	3,599		22,441	
9	Assessed acreage.....acres..	21,357	26,283	17,679	44,232	65,840	46,785	171,595	7,527
10	Excess over all land in operating enterprises.....acres..								
<b>DRAINAGE WORKS.</b>									
11	Open ditches:								
12	Completed.....miles..	201.3	197.4	81.0	99.8	100.6	359.2	194.9	2.5
13	Additional under construction.....miles..	2.2			21.4		0.8		
14	Maximum completed in any enterprise.....miles..	14.9	20.0	28.0	19.8	29.7	33.0	21.6	2.5
15	Maximum width at bottom of ditch <sup>1</sup> .....feet..	20	10	20	20	50	20	16	30
16	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	18.0	10.0	7.0	15.0	14.0	9.0	11.0	15.0
17	Mean depth of branch ditches <sup>1</sup> .....feet..	3.7	4.0	3.9	5.0	5.1	3.3	3.4	
18	Tile drains:								
19	Completed.....miles..	9.2	9.5	32.0	89.2	270.7	1.0	3.1	
20	Additional under construction.....miles..	50.8			4.2				
21	Maximum completed in any enterprise.....miles..	3.1	3.0	17.0	18.3	153.0	1.0	1.6	
22	Maximum size of tile <sup>1</sup> .....inches..	24	24	28	48	30	20	14	
23	Accessory levees and dikes:								
24	Completed.....miles..								
25	Additional under construction.....miles..								
26	Area drained by open ditches only <sup>1</sup> .....acres..	17,429	25,164	12,014	9,709	35,062	48,385	170,208	7,527
27	Length of these ditches.....miles..	189.5	196.4	75.0	56.9	60.9	358.0	192.5	2.5
28	Average length per acre.....feet..	54.5	41.2	33.0	30.9	9.2	40.8	6.0	1.8
29	Area drained by tile only <sup>1</sup> .....acres..	474	584	2,172	11,479	4,247		712	
30	Length of these tile.....miles..	6.2	6.5	14.0	45.4	41.0		1.6	
31	Average length per acre.....feet..	69.1	38.8	34.0	20.9	51.0		11.9	
32	Area drained by open ditches and tile <sup>1</sup> .....acres..	3,454	235	3,493	23,044	26,581	400	675	
33	Length of these drains.....miles..	70.8	4.0	24.0	112.3	269.4	3.0	3.9	
34	Average length per acre.....feet..	108.2	89.9	36.3	25.7	53.6	39.6	30.5	
<b>DEVELOPMENT OF LAND.</b>									
35	Improved land in operating enterprises, 1920.....acres..	9,837	21,760	12,373	26,857	50,429	18,394	156,908	4,892
36	Improved land prior to drainage.....acres..	2,162	8,179	1,688	15,060	26,000		153,608	1,505
37	Increase since drainage.....acres..	7,675	13,581	10,685	11,797	24,429	18,394	3,300	3,387
38	Per cent of increase.....	357.1	166.0	633.0	78.3	94.0		2.1	225.0
39	Per cent increase is of all improved land in farms, 1920.....	2.8	2.7	5.0	4.2	6.2	7.6	1.1	1.5
40	Timber and cut-over land, 1920.....acres..	266	441						151
41	Timber and cut-over land prior to drainage.....acres..	603	532			221	1,076		151
42	Decrease since drainage.....acres..	337	91			221	1,076		
43	Per cent of decrease.....	55.9	17.1			100.0	100.0		
44	Other unimproved land, 1920.....acres..	11,254	4,082	5,306	17,375	15,411	28,391	14,689	2,484
45	Other unimproved land prior to drainage.....acres..	18,602	17,572	15,991	29,172	39,619	45,709	17,989	5,871
46	Decrease since drainage.....acres..	7,348	13,490	10,685	11,797	24,208	17,318	3,300	3,387
47	Per cent of decrease.....	39.5	76.8	66.8	40.4	61.1	37.9	18.3	57.7
48	Swampy or subject to overflow, 1920.....acres..	7,421	2,094		4,604	2,369			1,129
49	Swampy or subject to overflow prior to drainage.....acres..	21,302	13,312	13,407	22,069	28,818	44,500		6,022
50	Decrease since drainage.....acres..	13,881	10,218	13,407	17,465	26,449	44,500		4,893
51	Per cent of decrease.....	65.2	83.0	100.0	79.1	91.8	100.0		81.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
52	Total capital invested in and required for completion of operating enterprises.....dollars..	442,006	275,221	312,619	599,836	1,064,494	318,492	297,428	14,694
53	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	207,622	275,221	212,619	564,136	1,064,494	318,492	297,428	14,694
54	Additional capital required to complete these enterprises.....dollars..	235,234			35,700				
55	Average cost per acre when completed.....dollars..	20.74	10.47	12.03	13.56	16.17	6.81	1.73	1.95
56	Enterprises constructing open ditches only.....dollars..	177,863	240,556	107,901	157,652	228,608	313,889	292,907	14,694
57	Average cost per acre when completed.....dollars..	10.21	9.56	8.98	16.24	6.52	6.77	1.72	1.95
58	Enterprises constructing tile drains only.....dollars..	12,357	28,965	38,868	139,189	101,876		3,348	
59	Average cost per acre when completed.....dollars..	26.07	32.77	17.90	12.13	23.99		4.70	
60	Enterprises constructing open ditches and tile drains.....dollars..	252,686	5,700	65,850	302,965	734,010	4,603	1,173	
61	Average cost per acre when completed.....dollars..	73.16	24.26	18.85	13.15	27.67	11.51	1.74	
<b>CROPS.</b>									
62	Improved land in enterprises reporting—								
63	Wheat as principal crop on drained land.....acres..	3,646	10,256		26,857	50,429	156,906		
64	Hay as principal crop on drained land.....acres..								
65	Corn as principal crop on drained land.....acres..	6,191	11,504	7,574			18,394		4,892
66	Oats as principal crop on drained land.....acres..			4,799					
67	Potatoes as principal crop on drained land.....acres..								
68	Flax as principal crop on drained land.....acres..								
69	Not reporting principal crop on drained land.....acres..								

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Barley.



## DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Wadena.	Waseca.	Wash- ington.	Waton- wan.	Wilkin.	Wright.	Yellow Medicine.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres..	344,320	275,840	254,080	277,760	476,800	442,240	479,360	1,267,280
2	All land in operating drainage enterprises.....	acres..	51,937	10,076	8,804	15,158	237,948	13,362	12,775	12,220
3	Improved land.....	acres..	17,109	6,007	4,557	13,906	146,620	7,756	8,495	8,232
4	Per cent of all improved land in farms.....	.....	16.7	3.1	2.9	6.2	37.6	3.0	2.2	1.0
5	Timber and cut-over land.....	acres..	2,707	850	850	4,029	852	516	516	516
6	Other unimproved land.....	acres..	32,121	4,069	3,397	1,252	87,299	4,754	4,280	3,472
7	Swampy or subject to overflow, in enterprises.....	acres..	.....	.....	2,765	.....	36,718	1,652	2,978	3,135
8	Suffering a loss of crops from defective drainage.....	acres..	.....	.....	474	.....	6,231	1,690	1,181	451
9	Assessed acreage.....	.....	51,937	10,076	8,804	15,158	237,199	13,362	12,775	12,220
10	Excess over all land in operating enterprises.....	acres..	.....	.....	.....	.....	49,251	.....	.....	.....
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....	miles..	172.8	59.0	25.5	20.0	283.2	94.2	31.9	74.0
12	Additional under construction.....	miles..	0.2	.....	.....	.....	1.1	.....	0.4	1.0
13	Maximum completed in any enterprise.....	miles..	30.0	12.0	12.5	6.0	40.5	11.0	7.7	19.6
14	Maximum width at bottom of ditch <sup>2</sup> .....	feet..	20	12	10	10	20	20	12	72
15	Maximum of average depths of outlet ditches <sup>2</sup> .....	feet..	6.0	6.0	7.2	7.0	8.0	9.0	8.4	10.8
16	Mean depth of branch ditches <sup>2</sup> .....	feet..	3.4	3.1	4.3	4.9	3.9	3.6	4.3	4.7
<b>Tile drains:</b>										
17	Completed.....	miles..	.....	.....	6.0	182.0	.....	24.0	51.5	18.8
18	Additional under construction.....	miles..	.....	.....	.....	.....	.....	.....	7.9	.....
19	Maximum completed in any enterprise.....	miles..	.....	.....	6.0	40.0	.....	8.0	11.0	10.5
20	Maximum size of tile <sup>2</sup> .....	inches..	.....	.....	18	36	.....	28	30	42
<b>Accessory levees and dikes:</b>										
21	Completed.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....
22	Additional under construction.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only <sup>1</sup> .....	acres..	51,937	10,076	8,110	.....	237,948	11,125	3,986	8,878
24	Length of these ditches.....	miles..	173.0	59.0	23.5	.....	284.3	81.7	24.6	74.3
25	Average length per acre.....	feet..	17.6	30.9	15.3	.....	6.3	38.8	32.6	44.2
26	Area drained by tile only <sup>2</sup> .....	acres..	.....	.....	.....	6,549	.....	158	4,125	.....
27	Length of these tile.....	miles..	.....	.....	.....	57.0	.....	1.0	42.6	.....
28	Average length per acre.....	feet..	.....	.....	.....	70.1	.....	33.4	54.5	.....
29	Area drained by open ditches and tile <sup>1</sup> .....	acres..	.....	.....	894	8,609	.....	2,079	4,664	8,342
30	Length of these drains.....	miles..	.....	.....	8.0	115.0	.....	35.5	24.5	19.5
31	Average length per acre.....	feet..	.....	.....	60.9	70.5	.....	90.2	27.7	30.8
<b>DEVELOPMENT OF LAND.</b>										
32	Improved land in operating enterprises, 1920.....	acres..	17,109	6,007	4,557	13,906	146,620	7,756	8,495	8,232
33	Improved land prior to drainage.....	acres..	.....	574	571	398	104,150	1,540	597	3,487
34	Increase since drainage.....	acres..	17,109	5,433	3,986	13,508	42,470	6,216	7,898	4,745
35	Per cent of increase <sup>2</sup> .....	.....	.....	946.5	698.1	.....	40.8	403.6	.....	136.1
36	Per cent increase is of all improved land in farms, 1920.....	.....	16.7	2.8	2.5	6.0	10.9	2.4	2.0	0.6
37	Timber and cut-over land, 1920.....	acres..	2,707	850	850	4,029	852	516	516	516
38	Timber and cut-over land prior to drainage.....	acres..	3,761	1,409	1,409	4,868	969	673	673	673
39	Decrease since drainage.....	acres..	1,054	559	559	839	117	157	157	157
40	Per cent of decrease.....	.....	28.0	39.7	39.7	.....	17.2	12.1	23.3	23.3
41	Other unimproved land, 1920.....	acres..	32,121	4,069	3,397	1,252	87,299	4,754	4,280	3,472
42	Other unimproved land prior to drainage.....	acres..	48,176	9,502	6,824	14,760	128,930	10,853	12,178	8,060
43	Decrease since drainage.....	acres..	16,055	5,433	3,427	13,508	41,631	6,099	7,898	4,588
44	Per cent of decrease.....	.....	33.3	57.2	50.2	91.5	32.3	56.2	64.9	56.9
45	Swampy or subject to overflow, 1920.....	acres..	.....	.....	2,765	.....	36,718	1,652	2,978	3,135
46	Swampy or subject to overflow prior to drainage.....	acres..	50,607	8,902	8,804	10,600	95,339	7,320	12,346	8,740
47	Decrease since drainage.....	acres..	50,607	8,902	6,039	10,600	58,626	5,668	9,368	5,605
48	Per cent of decrease.....	.....	100.0	100.0	68.6	100.0	61.5	77.4	75.9	64.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
49	Total capital invested in and required for completion of operating enterprises.....	dollars..	164,543	81,715	58,217	450,516	741,575	217,897	227,128	449,285
50	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	164,543	81,715	58,217	450,516	721,575	217,897	212,850	399,285
51	Additional capital required to complete these enterprises.....	dollars..	.....	.....	.....	.....	20,000	.....	14,278	50,000
52	Average cost per acre when completed.....	dollars..	3.17	8.11	6.61	29.72	3.12	16.31	17.78	36.77
53	Enterprises constructing open ditches only.....	dollars..	164,543	81,715	41,490	.....	741,575	138,614	19,474	343,555
54	Average cost per acre when completed.....	dollars..	3.17	8.11	5.12	.....	3.12	12.46	4.89	38.70
55	Enterprises constructing tile drains only.....	dollars..	.....	.....	.....	196,416	.....	3,656	127,098	.....
56	Average cost per acre when completed.....	dollars..	.....	.....	.....	29.99	.....	23.14	30.81	.....
57	Enterprises constructing open ditches and tile drains.....	dollars..	.....	.....	16,727	254,100	.....	75,627	80,556	105,730
58	Average cost per acre when completed.....	dollars..	.....	.....	24.10	29.52	.....	36.38	17.27	31.64
<b>CROPS.</b>										
<b>Improved land in enterprises reporting—</b>										
59	Wheat as principal crop on drained land.....	acres..	.....	.....	.....	.....	89,485	1,045	.....	.....
60	Hay as principal crop on drained land.....	acres..	17,109	6,007	3,812	2,529	57,135	4,757	568	1,265
61	Corn as principal crop on drained land.....	acres..	.....	.....	745	11,377	.....	1,954	7,061	6,436
62	Oats as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	531
63	Potatoes as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....
64	Flax as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....
65	Not reporting principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	866	.....	.....

<sup>1</sup> Includes only Dakota, Houston, Rock, and Scott Counties.<sup>2</sup> When works under construction have been completed.<sup>3</sup> Per cent not shown when more than 1,000.

# MISSISSIPPI.

The following pages present the statistics of drainage for Mississippi collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

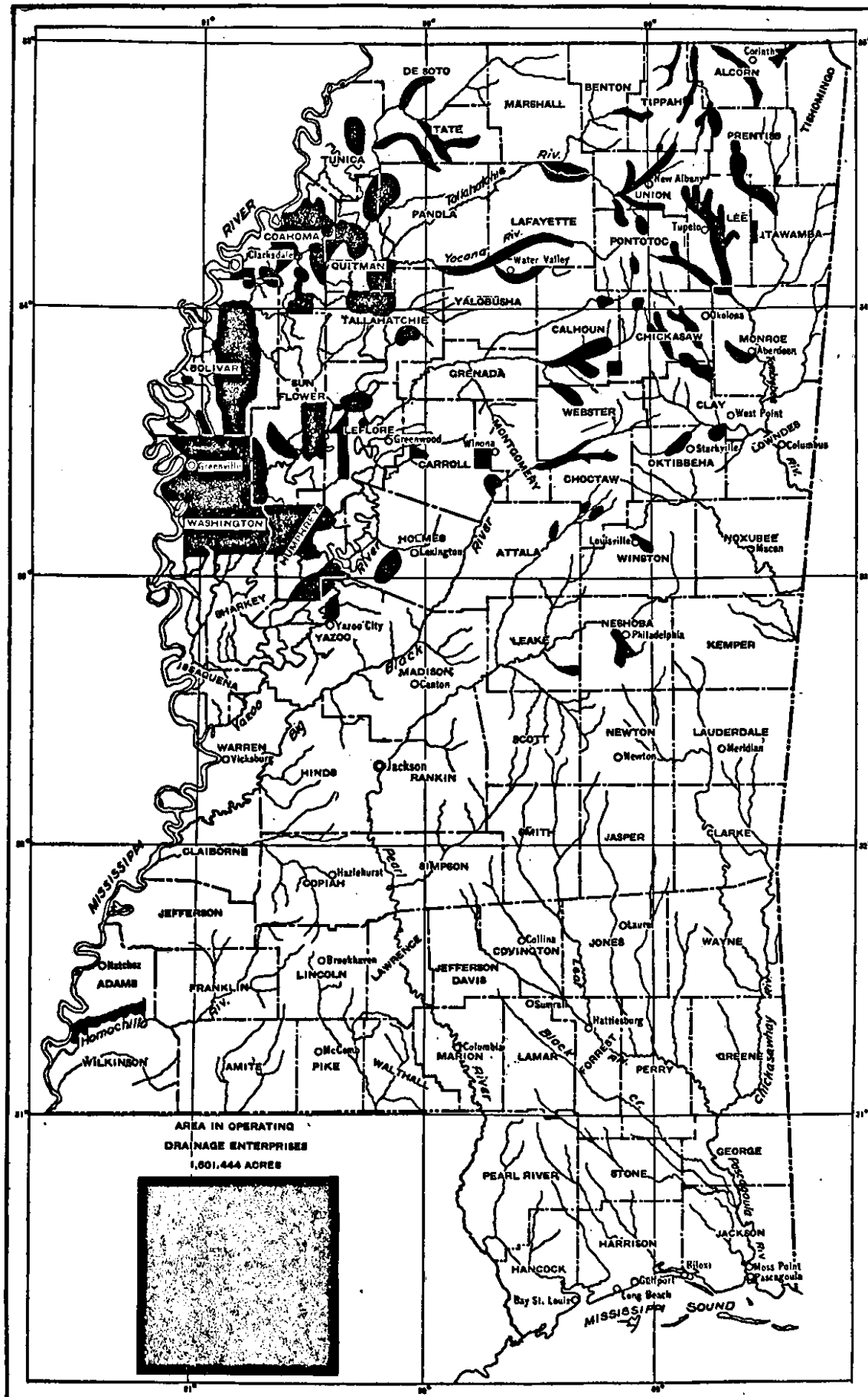
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	272,101	100.0
Farms reporting land having drainage.....	94,926	12.8
Farms reporting land needing drainage.....	29,872	11.0
All land in farms.....acres..	18,196,979	100.0
Improved land in farms.....acres..	9,325,677	51.2
Farm land reported as provided with drainage.....acres..	325,878	4.5
Farm land reported as needing drainage.....acres..	1,455,534	8.0
Needing drainage only.....acres..	151,179	0.8
Needing drainage and clearing.....acres..	1,304,355	7.2
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state.....acres..	29,671,680	100.0
All land in operating drainage enterprises.....acres..	1,601,444	5.4
Improved land.....acres..	941,239	3.2
Per cent of all improved land in farms.....	10.1	.....
Timber and cut-over land.....acres..	631,964	2.1
Other unimproved land.....acres..	28,241	0.1
Swampy, subject to overflow, seeped, or alkali.....acres..	261,126	0.9
Suffering a loss of crops from defective drainage.....acres..	12,207	(1)
Improved land prior to drainage.....acres..	506,828	1.7
Increase since drainage began.....acres..	434,411	1.5
Land in nonoperating enterprises.....acres..	277,557	0.9
Open ditches in operating enterprises.....miles..	2,038.7	100.0
Completed.....miles..	1,815.1	89.0
Additional under construction.....miles..	223.6	11.0
Tile drains in operating enterprises.....miles..	293.0	100.0
Completed.....miles..	238.8	81.5
Additional under construction.....miles..	54.2	18.5
Total capital invested in and required for completion of operating enterprises..	\$8,561,264	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	7,076,164	82.7
Additional capital required to complete these enterprises.....	1,485,100	17.3
Average cost per acre when completed.....	5.35	.....

(1) Less than one-tenth of 1 per cent.

# MISSISSIPPI

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts for which the order of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	1,879,001	100.0	\$7,192,907	100.0	\$4,060,333
Operating enterprises.....	1,601,444	85.2	7,076,164	98.4	1,485,100
With works completed.....	1,175,776	62.6	5,522,944	76.8	.....
With works under construction.....	425,668	22.7	1,553,220	21.6	1,485,100
Nonoperating enterprises.....	277,557	14.8	116,743	1.6	2,575,233

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Practically all of the drainage enterprises are in the northern half of the state, and about three-fourths of the land in such enterprises is situated in 10 counties near Mississippi River.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	1,879,001	100.0	\$7,192,907	100.0	\$4,060,333
Operating enterprises.....	1,601,444	85.2	7,076,164	98.4	1,485,100
Pearl River.....	24,027	1.3	192,300	2.7	85,000
Tombigbee River.....	131,554	7.0	837,034	11.6	.....
Yazoo River.....	1,355,499	72.1	5,687,607	79.1	1,397,100
Tennessee River.....	3,900	0.2	34,000	0.5	.....
Mississippi River.....	86,464	4.6	325,223	4.5	3,000
Nonoperating enterprises.....	277,557	14.8	116,743	1.6	2,575,233
Pearl River.....	6,102	0.3	6,081	0.1	90,959
Pascagoula River.....	4,583	0.2	4,700	0.1	81,300
Tombigbee River.....	11,828	0.6	6,750	0.1	105,500
Yazoo River.....	235,447	12.5	87,212	1.2	2,201,883
Mississippi River.....	7,463	0.4	10,800	0.2	48,800
Gulf of Mexico.....	12,185	0.6	1,200	( <sup>c</sup> )	46,791

<sup>c</sup> Less than one-tenth of 1 per cent.

For both operating and nonoperating enterprises, approximately 85 per cent of the acreage is drained into Yazoo River.

Condition of land in enterprises.—The drainage enterprises in the region between Yazoo and Mississippi Rivers are principally for the reclamation of level swamp areas. This region is of alluvial formation, and was subject to inundation by overflow from the Mississippi until construction of the extensive system of levees along that stream. Storm run-off from the higher rolling land on the east also overflowed parts of the delta land. The characteristic high banks of the natural watercourses greatly interfere with drainage of the surface water into the channels that exist. In the counties east of Yazoo River, the drainage problem generally is one of relieving the bottom land along the streams from overflow by floods of short duration.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	1,601,444	100.0	1,175,776	425,668	277,557
Improved land.....	941,239	58.8	768,105	173,134	107,852
Timber and cut-over land.....	631,964	39.5	383,633	248,331	137,496
Other unimproved land.....	28,241	1.8	24,038	4,203	32,209
Swampy or subject to overflow..	261,126	16.3	210,422	50,704	108,211
Suffering a loss of crops.....	12,207	0.8	7,167	5,040	948

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way, 167 operating drainage enterprises are counted in Mississippi, with an average area of 9,608 acres assessed. The assessed acreage exceeds the land in enterprises by 3,040 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	1,601,444	1,604,484	100.0
200 to 499 acres.....	1,894	1,894	0.1
500 to 999 acres.....	8,989	9,789	0.6
1,000 to 4,999 acres.....	199,000	201,240	12.5
5,000 to 9,999 acres.....	157,416	157,416	9.8
10,000 to 49,999 acres.....	664,285	664,285	41.4
50,000 to 99,999 acres.....	320,400	320,400	20.0
100,000 to 499,999 acres.....	249,460	249,460	15.5

Character of enterprises.—The drainage enterprises in Mississippi are swamp land districts and drainage districts established by the county boards of supervisors, by the chancery courts, or by county boards of drainage commissioners in accordance with the general drainage laws of the state, and private undertakings by individual landowners.

Swamp land districts for the reclamation of wet, swamp, or overflowed land are formed in accordance with an act of February 19, 1902 (ch. 70), which now forms sections 371 to 391 (ch. 17) of the Mississippi Code of 1906 of the public statute laws. A petition for establishment, signed by a majority of the resident landowners owning at least one-third of the land to be drained, is filed with the board of supervisors of the county where the proposed district is situated. Three commissioners named in the petition determine what land will be drained by the same system of connecting channels, and the county supervisors may decree the district established. A special tax upon the district is levied by the supervisors, not exceeding 50 cents per acre in any year, and when a sufficient amount has been collected the commissioners let contracts for constructing the drains. Right of way may be obtained by condemnation. Upon petition from one-third of the landowners, the county supervisors may issue bonds in anticipation of the full amount of taxes authorized to be levied for not exceeding 30 years.

Drainage districts may be established by the county boards of supervisors under a law of March 1, 1912 (ch. 195), or under one of March 16, 1912 (ch. 198). The former act, as amended, requires that a petition for establishment be signed by 10 per cent of the landowners in the proposed district. The supervisors appoint an engineer, and may appoint three temporary commissioners also, to make a report as to the land that will be benefited and the probable cost of the drainage improvements. Hearings are held upon the petition and upon the engineer's report, before the supervisors decree the district established. The executive officers of the enterprise are three commissioners appointed by the board of supervisors, though the selection may be determined by petition signed by a majority of the landowners. The plan of drainage

works and the assessments of damages and benefits are made by the commissioners, the assessments being subject to confirmation by the board of supervisors and to appeal to the chancery court. The assessments for cost are made by the county supervisors against the real property in the district, in proportion to the benefits. Bonds may be issued by the commissioners to run not more than 30 years. For a district in more than one county, proceedings are before the chancery court instead of the county supervisors. Subdistricts may be formed in accordance with an act of February 26, 1914 (ch. 269), wholly or partly within a drainage district organized under the act of March 1, 1912 (ch. 195). The manner of establishment is similar to that for an original district, but the petition must be signed by one-third of the landowners owning a majority of the acreage or by a majority of the owners owning a third of the acreage or real property. The commissioners of the main district serve also for the subdistrict. An independent district may be formed wholly or partly within another district, under the statute of 1914, upon petition similar to that required for a subdistrict.

The establishment of a drainage district under the act of March 16, 1912 (ch. 198), requires a petition to the county supervisors from a majority of the resident landowners who shall own one-third of the land. Three commissioners named in the petition are the officers of the district to determine the plan of drainage and to assess damages if any are claimed. The cost of construction has been paid by a uniform tax upon the land benefited. However, three-fourths of the owners holding half or more of the land may petition for assessments according to benefits, and then the commissioners must divide the land into five classes to be assessed, per acre, in the ratio 5:4:3:2:1. Public hearings are held upon the petition and upon the commissioners' plan of improvement, and appeals regarding classification of the land may be taken to the chancery court. Rights of way may be condemned. Bonds may be issued upon petition from a majority of the landowners owning a majority of the acreage, to be paid by special tax levies not exceeding \$1 per acre in any year.

Drainage districts under the chancery courts, except intercounty districts formed under the act of March 1, 1912, are established in accordance with a law of April 12, 1906 (ch. 132), which is now chapter 39 of the Mississippi Code of 1906. This statute as amended provides for a board of three drainage commissioners for the county, to be elected by the drainage taxpayers of the county, if 20 per cent of the owners of real property affected by constructed or proposed drainage works petition for such commissioners. Before 1916, this board was elected by the county supervisors when petition for the first drainage district had been approved by the chancery court. Petition for a district

under this law must be filed with the chancery court of the county containing the greatest part of the proposed district, signed by a majority of the landowners owning at least one-third of the land to be affected or by one-third of the owners holding a majority of the acreage. The drainage commissioners investigate regarding the practicability of the project, and after public hearing upon their report the chancery court may decree the district established. The commissioners determine the plan of drainage, and assess damages and benefits subject to confirmation by the court after public hearing. Rights of way may be secured as in eminent domain cases. Bonds may be issued by the commissioners, payable in 1 to 20 years.

An act of March 13, 1912 (ch. 197), also provides for a county board of three drainage commissioners for each county embracing all or a part of one or more drainage districts, to have jurisdiction over all such districts within the county organized under this act. These commissioners are appointed by the chancellors of the chancery districts. Petition for establishment of the drainage district must be signed by 10 per cent of the landowners of the proposed district, in number, acreage, or value, and be filed with the clerk of the chancery court of the county containing the greater part of that district. If the petition is sufficient, the county drainage commissioners refer it to three district drainage commissioners whom they appoint to investigate regarding the feasibility and utility of the project. The district is established by the county drainage commissioners after public hearing upon the district commissioners' report, if the proposed work will be beneficial to the landowners. The county drainage commissioners are the corporate authority of the district. The cost of the enterprise is apportioned against the tracts of land in proportion to benefits. Damages and benefits are assessed by the district commissioners and confirmed by the county drainage commissioners, subject to appeal to the chancery court. Rights of way may be obtained by proceedings before the courts of eminent domain. Bonds may be issued by the county commissioners for not exceeding 30 years.

A private drain may be constructed across land of an objecting owner, if necessary, by petition to the county supervisors and payment of damages assessed, under an act of March 15, 1918 (ch. 206).

The first drainage law of Mississippi was passed in 1886, applicable only in Lee County, authorizing the county supervisors to drain swamp and overflowed land upon petition from the owners of a majority of the acreage. A law of February 11, 1898 (ch. 39), authorized the issue of bonds for reclamation work upon petition from landowners, by counties having authority to levy taxes on swamp and overflowed land. An act of March 6, 1900, applicable in all counties, was similar to the swamp land district act of 1902,

which repealed both the act of 1900 and that of 1898. A few counties were excepted from the provisions of chapter 39 of the Code of 1906 until 1912. Of the many amendments to the drainage laws of the state, the few that affect the character of the enterprises have been incorporated in the foregoing statement.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.	1,879,001	100.0	\$7,192,007	100.0	\$4,060,333
Operating enterprises.....	1,601,444	85.2	7,078,164	98.4	1,485,100
Swamp land districts:					
Code of 1906, ch. 17.....	305,018	16.2	1,221,609	17.0	3,000
Drainage districts:					
Code of 1906, ch. 39.....	540,587	28.8	2,652,781	36.9	68,000
Laws of 1912, ch. 195.....	652,202	34.7	2,330,078	32.4	1,056,500
Laws of 1912, ch. 197.....	41,498	2.2	291,216	4.0	95,600
Laws of 1912, ch. 198.....	5,409	0.3	49,500	0.7	.....
Individual ownerships.....	56,750	3.0	531,000	7.4	262,000
Nonoperating enterprises.....	277,557	14.8	118,743	1.6	2,575,233
Drainage districts:					
Code of 1906, ch. 39.....	31,062	1.7	19,800	0.3	254,800
Laws of 1912, ch. 195.....	240,753	12.8	92,481	1.3	2,244,885
Laws of 1912, ch. 197.....	5,742	0.3	4,462	0.1	75,538

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 1,815.1 miles of open ditches, 238.8 miles of tile drains, and 6.7 miles of accessory levees; the additional lengths under construction were 223.6 miles of ditches, 54.2 miles of tile drains, and 36.8 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one pumping district for land drainage among the enterprises under construction in Mississippi. Part of the drainage water from 44,000 acres is to be removed by two centrifugal pumps of 78,000 gallons per minute capacity, operated by internal-combustion engines capable of developing 250 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	1,601,444	100.0	\$7,078,164	100.0	\$1,485,100
Open ditches only.....	1,274,464	79.6	5,848,352	82.6	974,800
Open ditches and levees.....	279,230	17.4	768,812	10.9	368,500
Open ditches and tile drains <sup>1</sup> .....	47,750	3.0	461,000	6.5	142,000

<sup>1</sup> Includes 8,300 acres drained by tile only.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	1,601,444	100.0	\$7,076,164	100.0	\$1,485,106
Gravity drainage only.....	1,504,044	93.9	6,691,064	94.6	1,160,100
Part gravity and part pumping.	97,400	6.1	385,100	5.4	325,000
Total area served by pumps....	44,000	2.7	.....	.....	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted as it seemed they do not represent so well the average depths of outlet provided for all the farms in those districts; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 6.9 instead of 6.8 feet.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	1,601,444	100.0
Less than 3 feet.....	2,000	0.1
3.0 to 3.9 feet.....	30,600	1.9
4.0 to 4.9 feet.....	41,758	2.6
5.0 to 5.9 feet.....	43,248	2.7
6.0 to 6.9 feet.....	413,980	25.9
7.0 to 7.9 feet.....	127,365	8.0
8.0 to 8.9 feet.....	471,362	29.4
9.0 to 9.9 feet.....	.....	.....
10 feet and more.....	65,000	4.1
Not reporting branches.....	406,131	25.4

**Maintenance of works.**—The statutes provide for maintenance of the improvement works of all the public drainage enterprises in Mississippi. The county supervisors are charged with protecting and keeping in repair the drainage works of swamp land districts organized under chapter 17 of the Code of 1906, and

are authorized to levy assessments against the districts to pay for that work. The commissioners of drainage districts established under chapters 195 and 198 of the laws of 1912 are authorized to borrow money to pay for maintenance of the drainage works, payment to be made from taxes levied against the districts by county supervisors. In districts under chapter 195, notice and hearing must be given before any levy is made; in those under chapter 198, the levy must not exceed 25 cents per acre in any year. Chapter 39 of the Code of 1906 provides that the boards of drainage commissioners may do any and all acts necessary in repairing and maintaining any drain or other work for which they have been appointed, and may make additional assessments to pay the cost involved. For districts formed in accordance with chapter 197 of the laws of 1912, the district drainage commissioners may, with the approval of the county board of drainage commissioners, do anything necessary for repairing and maintaining the works of the district, and the county supervisors shall levy taxes against the districts each year, if requested by the drainage commissioners, to pay for the maintenance work. The county board of drainage commissioners supervises the maintenance of the districts in case there are no district drainage commissioners.

TABLE 10.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises..	1,601,444	100.0	\$7,076,164	100.0	\$1,485,106
By district forces.....	778,767	48.6	3,295,081	46.6	1,009,600
By contract.....	460,185	28.7	2,151,353	30.4	20,000
By landowners.....	45,920	2.9	481,000	6.8	242,000
No maintenance provided.....	316,672	19.8	1,148,730	16.2	213,500

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts or by the county supervisors or drainage commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

DRAINAGE—MISSISSIPPI.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acres.	Per cent of total.	Acres.	Per cent of total.
All operating enterprises.....	1,601,444	100.0	1,604,484	100.0
1890 to 1899.....	3,950	0.2	3,950	0.2
1900 to 1904.....	11,929	0.7	11,929	0.7
1905 to 1909.....	244,013	15.2	245,053	15.3
1910 to 1914.....	907,062	56.6	907,062	56.5
1915 to 1919.....	434,490	27.1	435,490	27.1

TABLE 12.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$7,076,164	100.0	\$1,485,100
1890 to 1899.....	96,000	1.4	56,000
1900 to 1904.....	208,000	2.9	50,000
1905 to 1909.....	878,090	12.4	26,000
1910 to 1914.....	4,211,398	59.5	180,000
1915 to 1919.....	1,682,676	23.8	1,173,100

TABLE 13.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	2,038.7	100.0	293.0	100.0	43.5	100.0
1890 to 1899.....	20.0	1.0	32.0	10.9	.....	.....
1900 to 1904.....	52.0	2.6	52.0	17.7	.....	.....
1905 to 1909.....	234.5	11.5	93.0	31.7	.....	.....
1910 to 1914.....	1,143.3	56.1	84.0	28.7	6.5	14.9
1915 to 1919.....	588.9	28.9	32.0	10.9	37.0	85.1

Crops.—The principal crops grown upon the drained land in the drainage enterprises are cotton and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Alcorn.	Amite.	Attala.	Benton.	Bolivar.	Calhoun.	Carroll.	Chick-		
		assaw.									
1 Number of all farms in the state or county.....	272,101	2,901	3,148	4,024	1,904	12,808	3,266	3,963	3,055		
2 Farms reporting land having drainage.....	34,926	1,090	259	242	260	2,265	424	273	593		
3 Farms reporting land needing drainage.....	29,872	927	657	1,052	268	166	695	153	335		
4 Farms in drainage and levee districts.....	18,496	335	1	26	62	1,673	343	66	165		
<b>LAND AND FARM AREA.</b>											
5 Approximate land area of the state or county..... acres..	29,671,680	247,040	455,960	457,600	253,440	562,560	370,560	399,360	320,640		
6 All land in farms..... acres..	18,195,979	198,752	287,305	385,388	201,077	326,311	281,401	341,306	241,907		
7 Improved land in farms..... acres..	9,325,677	91,553	126,201	184,716	70,215	291,324	112,329	168,718	140,597		
8 Woodland in farms..... acres..	7,014,898	92,553	145,169	141,721	89,348	29,041	126,478	116,222	63,651		
9 Other unimproved land in farms..... acres..	1,856,404	14,646	15,935	58,951	41,516	5,946	42,594	56,366	37,659		
10 Farm land reported as provided with drainage..... acres..	825,878	32,972	9,785	6,004	4,435	47,668	14,239	18,090	17,466		
11 Farm land reported as needing drainage..... acres..	1,455,534	37,618	46,279	49,440	12,616	2,348	41,538	14,578	13,565		
12 Drainage only..... acres..	151,179	3,349	1,988	5,368	1,360	1,385	1,406	6,979	1,905		
13 Drainage and clearing..... acres..	1,304,355	34,269	44,291	44,072	11,255	963	40,132	7,590	11,660		
	Choctaw.	Clab-	Clay.	Co-	Copiah.	Coving-	De Soto.	Harris-	Hinds.	Holmes.	Hum-
		borne.	phreys.								
1 Number of all farms in the county.....	2,188	2,154	2,793	8,628	4,349	2,151	4,858	720	5,951	6,240	3,695
2 Farms reporting land having drainage.....	335	144	254	888	101	51	128	36	555	1,176	379
3 Farms reporting land needing drainage.....	702	321	63	57	200	215	210	55	812	244	33
4 Farms in drainage and levee districts.....	126	7	4	701	1	.....	32	4	.....	13	372
<b>LAND AND FARM AREA.</b>											
5 Approximate land area of the county..... acres..	264,960	312,960	261,120	339,200	492,180	262,400	304,000	364,800	549,120	480,640	261,120
6 All land in farms..... acres..	228,010	244,556	180,737	212,023	377,399	179,288	229,480	55,746	391,016	353,399	122,445
7 Improved land in farms..... acres..	75,416	113,488	127,641	185,614	210,712	68,127	173,794	11,578	269,818	212,052	97,452
8 Woodland in farms..... acres..	124,750	102,384	45,431	25,767	148,031	107,783	37,383	87,032	73,565	98,951	21,870
9 Other unimproved land in farms..... acres..	27,844	28,684	4,665	642	20,656	3,378	18,303	7,136	47,635	42,396	3,123
10 Farm land reported as provided with drainage..... acres..	9,496	2,288	7,345	15,662	1,930	539	2,757	648	7,766	18,265	8,874
11 Farm land reported as needing drainage..... acres..	82,790	13,692	5,224	3,923	12,226	9,054	6,117	1,797	30,341	10,805	5,292
12 Drainage only..... acres..	3,384	2,631	860	561	996	350	104	345	2,401	1,744	26
13 Drainage and clearing..... acres..	49,406	11,061	4,364	3,362	11,230	8,704	6,013	1,452	27,940	9,061	5,266



DRAINAGE—MISSISSIPPI.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Issaquena.	Itawamba.	Jackson.	Jasper.	Jones.	Lafayette.	Lauderdale.	Leake.	Lee.	LeFlore.	Lowndes
1	Number of all farms in the county.....	1,914	3,064	688	2,780	2,666	3,288	3,076	3,492	4,768	5,967	3,020
2	Farms reporting land having drainage.....	800	991	23	137	295	38	163	206	1,322	961	198
3	Farms reporting land needing drainage.....	396	1,463	49	326	1,191	292	159	893	450	200	317
4	Farms in drainage and levee districts.....	787	186	.....	1	5	41	.....	34	597	502	3
<b>LAND AND FARM AREA.</b>												
5	Approximate land area of the county.....acres	259,840	338,560	454,400	428,880	445,440	424,980	448,000	368,040	286,720	366,080	319,360
6	All land in farms.....acres	96,379	261,029	97,078	274,615	229,259	310,373	271,573	264,502	238,358	209,976	246,637
7	Improved land in farms.....acres	54,697	90,701	14,566	100,211	76,400	129,967	109,730	108,461	149,002	166,733	159,947
8	Woodland in farms.....acres	38,388	137,392	55,662	150,194	131,876	127,563	131,614	108,097	49,464	37,168	69,080
9	Other unimproved land in farms.....acres	3,294	32,936	26,850	24,210	20,983	52,843	30,229	47,944	39,892	6,075	16,910
10	Farm land reported as provided with drainage.....acres	16,805	12,935	517	1,078	1,621	1,377	1,794	2,675	27,385	24,092	6,795
11	Farm land reported as needing drainage.....acres	15,835	51,606	4,198	14,812	62,466	13,645	6,473	42,730	13,366	18,807	21,402
12	Drainage only.....acres	7,650	1,116	18	1,558	865	1,497	1,975	4,144	4,459	3,878	5,795
13	Drainage and clearing.....acres	8,185	50,490	4,180	13,254	61,601	12,148	4,498	38,586	12,907	14,929	16,606
		Madison.	Monroe.	Montgomery.	No-shoba.	Newton.	Noxubee.	Oktobeha.	Panola.	Perry.	Pike.	Pontotoc.
1	Number of all farms in the county.....	5,260	5,026	1,988	3,054	3,237	4,242	2,816	4,900	834	2,689	3,934
2	Farms reporting land having drainage.....	36	436	239	831	561	375	224	211	48	558	1,697
3	Farms reporting land needing drainage.....	279	594	268	805	966	199	384	494	111	794	967
4	Farms in drainage and levee districts.....	.....	8	31	87	3	.....	20	186	.....	133	685
<b>LAND AND FARM AREA.</b>												
5	Approximate land area of the county.....acres	464,000	492,800	254,720	359,040	363,520	436,480	292,480	445,440	412,160	280,480	316,160
6	All land in farms.....acres	347,366	395,013	197,696	240,694	283,054	303,740	217,188	320,654	90,774	207,995	274,007
7	Improved land in farms.....acres	249,767	205,431	88,830	103,552	128,963	210,944	128,028	202,567	22,306	85,912	139,805
8	Woodland in farms.....acres	62,207	168,416	73,321	117,027	140,024	75,016	73,584	81,513	61,056	118,239	87,540
9	Other unimproved land in farms.....acres	35,392	21,166	35,545	20,115	14,067	17,880	15,576	36,574	17,412	3,844	40,662
10	Farm land reported as provided with drainage.....acres	2,453	13,429	11,453	14,784	8,772	13,487	7,402	4,946	515	13,824	37,475
11	Farm land reported as needing drainage.....acres	9,070	34,741	16,306	25,148	44,862	15,694	22,771	22,934	4,526	20,815	37,609
12	Drainage only.....acres	4,527	6,761	4,713	2,952	5,276	4,109	2,564	2,466	50	635	5,421
13	Drainage and clearing.....acres	4,543	27,960	10,693	22,196	39,586	11,525	20,207	20,468	4,476	20,180	32,038
		Prentiss.	Quitman.	Rankin.	Scott.	Sharkey.	Simpson.	Smith.	Sunflower.	Tallahatchie.	Tate.	Tippah.
1	Number of all farms in the county.....	3,144	4,315	3,231	2,243	3,142	2,522	2,695	9,668	6,495	3,955	2,702
2	Farms reporting land having drainage.....	1,431	139	109	67	807	658	561	3,116	549	170	497
3	Farms reporting land needing drainage.....	993	204	520	383	77	776	146	736	837	168	300
4	Farms in drainage and levee districts.....	410	92	2	8	828	1	.....	836	2	89	249
<b>LAND AND FARM AREA.</b>												
5	Approximate land area of the county.....acres	261,760	252,800	506,240	382,080	270,080	368,000	400,640	431,360	402,560	256,000	285,440
6	All land in farms.....acres	219,708	123,580	296,465	207,357	78,936	187,350	227,734	261,519	261,748	194,587	256,480
7	Improved land in farms.....acres	100,678	102,128	134,233	92,220	68,724	82,927	91,206	220,497	174,478	138,753	107,222
8	Woodland in farms.....acres	89,213	19,768	133,436	98,449	9,766	94,801	116,525	38,074	58,849	33,701	110,354
9	Other unimproved land in farms.....acres	29,812	1,694	28,781	16,688	416	9,623	20,003	2,948	48,416	22,133	39,904
10	Farm land reported as provided with drainage.....acres	26,816	1,537	4,210	852	16,681	16,166	9,488	67,029	12,815	6,253	10,838
11	Farm land reported as needing drainage.....acres	23,392	9,179	43,204	17,657	4,665	42,072	30,423	6,996	7,446	4,497	9,008
12	Drainage only.....acres	2,131	605	7,317	2,506	368	1,161	3,220	1,322	595	400	655
13	Drainage and clearing.....acres	21,261	8,574	35,887	15,151	4,297	40,911	27,203	5,674	6,850	4,097	8,343
		Tishomingo.	Tunica.	Union.	Washington.	Wayne.	Webster.	Wilkinson.	Winston.	Yalobusha.	Yazoo.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,250	4,036	3,519	9,281	1,828	2,221	2,436	2,814	2,594	6,663	37,833
2	Farms reporting land having drainage.....	412	805	1,350	2,883	147	453	118	117	504	97	106
3	Farms reporting land needing drainage.....	559	154	1,225	145	225	377	244	823	828	19	1,870
4	Farms in drainage and levee districts.....	.....	859	483	2,392	2	83	.....	14	63	.....	43
<b>LAND AND FARM AREA.</b>												
5	Approximate land area of the county.....acres	273,920	267,520	263,680	462,720	519,680	266,240	426,880	382,080	313,000	579,200	6,902,400
6	All land in farms.....acres	189,089	164,449	224,685	316,932	196,884	215,809	234,868	259,745	238,755	409,532	3,195,866
7	Improved land in farms.....acres	65,158	117,239	109,132	230,317	57,017	86,259	107,760	101,325	102,813	243,581	1,334,242
8	Woodland in farms.....acres	113,671	33,632	69,642	69,319	132,996	105,006	98,309	131,906	92,716	132,913	1,515,678
9	Other unimproved land in farms.....acres	10,260	13,578	46,911	17,206	6,371	24,544	28,799	26,514	43,226	33,038	342,946
10	Farm land reported as provided with drainage.....acres	7,313	21,585	34,210	86,118	3,316	12,997	8,934	2,452	23,429	3,794	1,377
11	Farm land reported as needing drainage.....acres	24,517	19,022	25,461	24,373	15,071	30,169	17,509	58,336	47,675	848	106,012
12	Drainage only.....acres	2,107	4,647	1,245	4,753	399	1,689	503	1,706	4,274	405	3,454
13	Drainage and clearing.....acres	22,410	14,375	24,216	19,585	14,672	23,480	17,006	56,630	43,401	443	102,558

<sup>1</sup> No drainage on farms reported in Adams, Clarke, Greene, Jefferson Davis, Marion, Pearl River, Walthall, and Warren Counties.

DRAINAGE—MISSISSIPPI.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE	Adams.	Alcorn.	Attala.	Benton.	Bolivar.	Calhoun.	Carroll.	Chick- asaw.	
<b>LAND AREA.</b>										
1	Approximate land area of the state or county.....acres..	29,671,680	272,640	247,040	457,600	253,440	562,560	370,560	399,300	320,640
2	All land in operating drainage enterprises.....acres..	1,801,444	29,183	26,883	4,788	4,000	184,896	29,352	8,200	22,218
3	Improved land.....acres..	941,239	5,253	13,102	1,919	1,600	125,386	12,972	6,900	19,052
4	Per cent of all improved land in farms.....	10.1	6.4	14.8	1.0	2.3	43.0	11.5	4.1	13.6
5	Timber and cut-over land.....acres..	631,964	23,930	13,781	2,379	2,400	44,426	16,880	1,240	3,166
6	Other unimproved land.....acres..	28,241					15,084			
7	Swampy or subject to overflow, in enterprises.....acres..	261,126	29,183	26,600	2,880		19,950			170
8	Suffering a loss of crops from defective drainage.....acres..	12,207					5,040			
9	Assessed acreage.....	1,604,484	29,183	26,883	4,788	4,000	184,896	29,352	8,200	22,218
10	Excess over all land in operating enterprises.....acres..	3,040								
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....miles..	1,815.1	3.8	66.2	10.0	8.5	189.7	31.0	9.8	54.5
12	Additional under construction.....miles..	223.6	1.2				16.8			
13	Maximum completed in any enterprise.....miles..	121.0	3.8	38.0	10.0	8.5	50.0	12.0	7.5	15.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	120	8	20	21	8	60	30	30	30
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	20.0	19.0	9.0	15.0	8.0	11.0	10.0	15.0	8.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	6.8		6.0			5.7	7.0		6.3
Tile drains:										
17	Completed.....miles..	238.8					80.0			
18	Additional under construction.....miles..	54.2					3.5			
19	Maximum completed in any enterprise.....miles..	60.0					80.0			
20	Maximum size of tile <sup>1</sup> .....inches..	36					36			
Accessory levees and dikes:										
21	Completed.....miles..	6.7								
22	Additional under construction.....miles..	36.8								
Pumping plants:										
23	Engine capacity.....horsepower..	250								
24	Pump capacity.....gallons per minute..	78,000								
25	Area served by pumps.....acres..	44,000								
26	Area drained by open ditches only <sup>1</sup> .....acres..	1,274,464	29,183	26,883	4,798	4,000	171,596	29,852	8,200	22,218
27	Length of these ditches.....miles..	1,685.1	5.0	66.2	10.0	8.5	114.5	31.0	9.8	54.5
28	Average length per acre.....feet..	7.0	0.9	13.0	11.0	11.2	3.5	5.5	6.3	13.0
29	Area having open ditches and levees <sup>1</sup> .....acres..	279,230								
30	Length of these ditches.....miles..	259.1								
31	Average length per acre.....feet..	4.9								
32	Length of the accessory levees.....miles..	43.6								
33	Area drained by open ditches and tile <sup>1</sup> .....acres..	*47,750					13,800			
34	Length of these drains.....miles..	387.6					125.5			
35	Average length per acre.....feet..	42.8					49.8			
<b>DEVELOPMENT OF LAND.</b>										
36	Improved land in operating enterprises, 1920.....acres..	941,239	5,253	13,102	1,919	1,600	125,386	12,972	6,900	19,052
37	Improved land prior to drainage.....acres..	506,628	5,253	4,542	960	800	74,568	3,963	3,100	13,142
38	Increase since drainage.....acres..	434,411		8,560	959	800	50,818	9,009	3,800	5,910
39	Per cent of increase.....	85.7		188.5	99.9	100.0	68.1	227.3	124.5	45.0
40	Per cent increase is of all improved land in farms, 1920.....	4.7		9.8	0.5	1.1	17.4	8.0	2.3	4.2
41	Timber and cut-over land, 1920.....acres..	631,964	23,930	13,781	2,379	2,400	44,426	16,880	1,240	3,166
42	Timber and cut-over land prior to drainage.....acres..	1,012,215	23,930	22,341	3,838	3,200	62,159	25,889	2,580	8,348
43	Decrease since drainage.....acres..	380,251		8,560	959	800	7,733	9,009	1,340	5,182
44	Per cent of decrease.....	37.6		38.8	25.0	25.0	14.8	34.8	51.9	62.1
45	Other unimproved land, 1920.....acres..	28,241					15,084			
46	Other unimproved land prior to drainage.....acres..	82,401					58,169		2,520	728
47	Decrease since drainage.....acres..	54,160					43,085		2,520	728
48	Per cent of decrease.....	65.7					74.1		100.0	100.0
49	Swampy or subject to overflow, 1920.....acres..	261,126	29,183	26,600	2,880		19,950			170
50	Swampy or subject to overflow, prior to drainage.....acres..	627,415	29,183	26,883	4,798	4,000	68,925		810	1,492
51	Decrease since drainage.....acres..	366,289		283	1,918	4,000	48,975		840	1,322
52	Per cent of decrease.....	58.4		1.1	40.0	100.0	71.1		100.0	88.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
53	Total capital invested in and required for completion of operating enterprises.....dollars..	8,561,264	20,850	131,220	30,000	23,500	1,022,473	148,000	32,000	214,500
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	7,076,164	17,650	131,220	30,000	23,500	843,473	148,000	32,000	214,500
55	Additional capital required to complete these enterprises.....dollars..	1,485,100	3,000				179,000			
56	Average cost per acre when completed.....dollars..	5.35	0.71	4.88	6.25	5.88	5.53	4.96	3.90	9.65
57	Enterprises constructing open ditches only.....dollars..	6,820,982	20,850	181,220	30,000	23,500	778,473	148,000	32,000	214,500
58	Average cost per acre when completed.....dollars..	5.35	0.71	4.88	6.25	5.88	4.54	4.96	3.90	9.65
59	Enterprises constructing open ditches and levees.....dollars..	1,137,312								
60	Average cost per acre when completed.....dollars..	4.07								
61	Enterprises constructing open ditches and tile drains.....dollars..	* 803,000					244,000			
62	Average cost per acre when completed.....dollars..	12.63					18.35			
<b>CROPS.</b>										
63	Improved land in enterprises reporting--									
64	Cotton as principal crop on drained land.....acres..	804,391	5,253	1,920	1,919		124,528	6,000	3,600	19,052
65	Corn as principal crop on drained land.....acres..	136,848		11,182		1,600	858	6,972	3,360	

<sup>1</sup> When works under construction have been completed. \* Includes 8,300 acres drained by tile only. \* Includes cost of 2 enterprises constructing 112 miles of tile only.

DRAINAGE—MISSISSIPPI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Choctaw.	Clay.	Cochos.	De Soto.	Holmes.	Humphreys.	Itawamba.	Lafayette.	Lee.	Leflore.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	264,960	261,120	339,200	304,000	480,640	261,120	338,560	424,960	286,720	366,080
2	All land in operating drainage enterprises.....	14,975	12,293	172,000	5,500	25,000	158,500	9,097	18,839	49,234	34,007
3	Improved land.....	6,433	7,236	138,171	1,650	17,500	81,550	5,708	10,205	44,989	24,383
4	Per cent of all improved land in farms.....	8.5	5.7	74.4	0.9	8.3	53.7	6.3	7.9	30.2	14.6
5	Timber and cut-over land.....	6,274	5,057	33,829	3,850	7,500	76,950	3,389	8,634	4,245	9,624
6	Other unimproved land.....	2,268									
7	Swampy or subject to overflow, in enterprises.....			9,798				9,097		49,234	
8	Suffering a loss of crops from defective drainage.....			6,259							
9	Assessed acreage.....	14,975	12,293	175,040	5,500	25,000	158,500	9,097	18,839	49,234	34,007
10	Excess over all land in operating enterprises.....			3,040							
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....	40.6	20.5	213.8	14.0	8.0	130.6	18.0	19.0	92.6	43.0
12	Additional under construction.....			1.2		8.0					
13	Maximum completed in any enterprise.....	15.0	14.0	36.0	14.0	8.0	117.0	9.0	11.0	11.0	11.5
14	Maximum width at bottom of ditch <sup>1</sup> .....	15	25	30	8	30	20	10	20	40	25
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	10.0	6.0	20.0	3.0	10.0	12.0	10.0	14.0	15.0	10.0
16	Mean depth of branch ditches <sup>1</sup> .....			6.5			8.0			8.0	4.6
Tile drains:											
17	Completed.....			150.2							
18	Additional under construction.....			47.3							
19	Maximum completed in any enterprise.....			50.0							
20	Maximum size of tile <sup>1</sup> .....			36							
Accessory levees and dikes:											
21	Completed.....						3.6				
22	Additional under construction.....										
Pumping plants:											
23	Engins capacity.....										
24	Pump capacity.....										
25	Area served by pumps.....										
26	Area drained by open ditches only <sup>1</sup> .....	14,975	12,293	144,850	5,500	25,000		9,097	18,839	49,234	34,007
27	Length of these ditches.....	40.6	20.5	169.5	14.0	16.0		18.0	19.0	92.6	43.0
28	Average length per acre.....	14.3	8.8	6.2	13.4	3.4		10.4	5.8	9.9	6.7
29	Area having open ditches and levees <sup>1</sup> .....						158,500				
30	Length of these ditches.....						130.6				
31	Average length per acre.....						4.4				
32	Length of the accessory levees.....						3.6				
33	Area drained by open ditches and tile <sup>1</sup> .....			27,150							
34	Length of these drains.....			243.0							
35	Average length per acre.....			47.3							
<b>DEVELOPMENT OF LAND.</b>											
36	Improved land in operating enterprises, 1920.....	6,433	7,236	138,171	1,650	17,500	81,550	5,708	10,205	44,989	24,383
37	Improved land prior to drainage.....	1,497	6,006	69,089	1,100	12,500	38,535	633	6,876	28,036	4,101
38	Increase since drainage.....	4,936	1,230	69,082	550	6,000	43,015	5,075	3,329	16,953	20,282
39	Per cent of increase.....	329.7	20.5	100.0	50.0	40.0	111.6	801.7	48.4	60.5	494.6
40	Per cent increase is of all improved land in farms, 1920.....	6.5	1.0	37.2	0.3	2.4	44.1	5.6	2.6	11.4	12.2
41	Timber and cut-over land, 1920.....	6,274	5,057	33,829	3,850	7,500	76,950	3,389	8,634	4,245	9,624
42	Timber and cut-over land prior to drainage.....	9,138	6,287	102,521	4,400	12,500	119,965	8,464	11,963	21,198	29,906
43	Decrease since drainage.....	2,864	1,230	68,692	550	5,000	43,015	5,075	3,329	16,953	20,282
44	Per cent of decrease.....	31.3	19.6	67.0	12.5	40.0	35.9	60.0	27.8	80.0	67.8
45	Other unimproved land, 1920.....	2,268									
46	Other unimproved land prior to drainage.....	4,340		390							
47	Decrease since drainage.....	2,072		390							
48	Per cent of decrease.....	47.7		100.0							
49	Swampy or subject to overflow, 1920.....			9,798				9,097		49,234	
50	Swampy or subject to overflow prior to drainage.....			48,836				9,097		49,234	23,039
51	Decrease since drainage.....			37,038							23,039
52	Per cent of decrease.....			79.1							100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
53	Total capital invested in and required for completion of operating enterprises.....	100,209	62,500	985,822	12,000	110,000	528,000	68,732	176,076	276,644	139,380
54	Capital invested in these enterprises to Dec. 31, 1919.....	100,209	62,500	899,822	12,000	50,000	528,000	68,732	162,676	276,644	139,380
55	Additional capital required to complete these enterprises.....			86,000		60,000			13,400		
56	Average cost per acre when completed.....	6.69	5.08	6.78	2.18	4.40	3.33	7.56	6.35	5.62	4.10
57	Enterprises constructing open ditches only.....	100,209	62,500	665,822	12,000	110,000		68,732	176,076	276,644	139,380
58	Average cost per acre when completed.....	6.69	5.08	4.60	2.18	4.40		7.56	6.35	5.62	4.10
59	Enterprises constructing open ditches and levees.....						528,000				
60	Average cost per acre when completed.....						3.33				
61	Enterprises constructing open ditches and tile drains.....			320,000							
62	Average cost per acre when completed.....			11.79							
<b>CROPS.</b>											
63	Improved land in enterprises reporting— Cotton as principal crop on drained land.....	6,433	7,236	136,809	1,650	17,500	81,560	5,708	8,270	36,689	24,383
64	Corn as principal crop on drained land.....			1,362					1,935	8,300	

<sup>1</sup> When works under construction have been completed.

DRAINAGE—MISSISSIPPI.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Marshall.	Monroe.	No-shoba.	Oktib-beha.	Panola.	Pon-totoc.	Pren-tiss.	Quitman.	Sun-flower.	Talla-hatchie.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....acres	440,960	492,800	359,040	292,480	445,440	316,160	261,780	252,900	481,300	402,560
2	All land in operating drainage enterprises.....acres	8,740	6,262	11,418	12,150	19,934	17,109	18,844	72,647	90,460	26,300
3	Improved land.....acres	2,185	5,572	400	5,798	11,820	13,576	10,144	30,284	55,449	11,700
4	Per cent of all improved land in farms.....	1.3	2.7	0.4	4.5	5.8	9.7	10.1	29.7	26.1	6.7
5	Timber and cut-over land.....acres	6,555	690	11,018	4,282	8,114	3,533	8,700	41,790	35,011	9,600
6	Other unimproved land.....acres				2,070				6,773		5,000
7	Swampy or subject to overflow, in enterprises.....acres		6,262	5,709	4,009	1,000		6,878	1,023	35,011	2,500
8	Suffering a loss of crops from defective drainage.....acres							300			
9	Assessed acreage.....	8,740	6,262	11,418	12,150	19,934	17,109	18,844	72,647	90,460	26,300
10	Excess over all land in operating enterprises.....acres										
<b>DRAINAGE WORKS.</b>											
Open ditches:											
11	Completed.....miles	9.5	17.0	9.9	23.0	23.0	45.5	52.5	61.7	110.0	4.9
12	Additional under construction.....miles	3.2		8.1		11.2		3.4	38.9		5.1
13	Maximum completed in any enterprise.....miles	9.5	10.0	9.9	17.0	22.2	12.5	8.1	44.4	82.0	4.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	24	26	40	20	35	20	18	35	120	100
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	18.0	12.0	10.0	9.0	8.0	9.0	10.0	11.0	14.0	12.0
16	Mean depth of branch ditches <sup>1</sup> .....feet			8.0	4.7	6.9	8.0	7.0	6.7	6.8	7.0
Tile drains:											
17	Completed.....miles								2.0		6.6
18	Additional under construction.....miles										3.4
19	Maximum completed in any enterprise.....miles								2.0		6.6
20	Maximum size of tile <sup>1</sup> .....inches								20		30
Accessory levees and dikes:											
21	Completed.....miles										
22	Additional under construction.....miles					5.0			25.5		2.5
Pumping plants:											
23	Engine capacity.....horsepower										
24	Pump capacity.....gallons per minute										
25	Area served by pumps.....acres										
26	Area drained by open ditches only <sup>1</sup> .....acres	8,740	6,262	11,418	12,150	1,600	17,109	18,844	10,711	90,460	10,000
27	Length of these ditches.....miles	12.7	17.0	18.0	23.0	2.2	45.5	55.9	15.1	110.0	4.0
28	Average length per acre.....feet	7.7	14.8	8.3	10.0	7.3	14.0	15.7	7.4	6.4	2.1
29	Area having open ditches and levees <sup>1</sup> .....acres					18,334			58,836		12,000
30	Length of these ditches.....miles					32.0			78.5		8.0
31	Average length per acre.....feet					9.2			7.0		2.6
32	Length of the accessory levees.....miles					5.0			25.5		2.5
33	Area drained by open ditches and tile <sup>1</sup> .....acres								3,000		4,300
34	Length of these drains.....miles								9.0		10.0
35	Average length per acre.....feet								15.8		12.3
<b>DEVELOPMENT OF LAND.</b>											
36	Improved land in operating enterprises, 1920.....acres	2,185	5,572	400	5,798	11,820	13,576	10,144	30,284	55,449	11,700
37	Improved land prior to drainage.....acres	2,185	5,395	400	3,893	7,782	7,656	7,258	21,252	24,438	11,220
38	Increase since drainage.....acres		207		1,905	4,038	5,920	2,886	9,032	31,011	480
39	Per cent of increase.....		3.9		48.9	51.9	77.3	39.8	42.5	128.9	4.3
40	Per cent increase is of all improved land in farms, 1920.....		0.1		1.5	2.0	4.2	2.9	8.8	14.1	0.3
41	Timber and cut-over land, 1920.....acres	6,555	690	11,018	4,282	8,114	3,533	8,700	41,790	35,011	9,600
42	Timber and cut-over land prior to drainage.....acres	6,555	897	11,018	5,497	10,277	9,453	11,586	48,187	66,022	10,080
43	Decrease since drainage.....acres		207		1,215	2,163	5,920	2,886	6,347	31,011	480
44	Per cent of decrease.....		22.1		22.1	21.0	52.6	24.9	13.2	47.0	4.8
45	Other unimproved land, 1920.....acres				2,070				573		5,000
46	Other unimproved land prior to drainage.....acres				2,760	1,875			3,258		5,000
47	Decrease since drainage.....acres				690	1,875			2,685		
48	Per cent of decrease.....				25.0	100.0			82.4		
49	Swampy or subject to overflow, 1920.....acres		6,262	5,709	4,009	1,000		6,878	1,023	35,011	2,500
50	Swampy or subject to overflow, prior to drainage.....acres		6,262	11,418	12,150	2,375		18,844	38,610	66,022	19,380
51	Decrease since drainage.....acres			5,709	8,141	1,875		11,966	37,587	31,011	16,880
52	Per cent of decrease.....			50.0	67.0	65.2		63.5	97.4	47.0	87.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
53	Total capital invested in and required for completion of operating enterprises.....dollars	76,240	43,500	180,000	60,000	130,375	122,582	134,919	380,012	490,056	94,300
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars	61,040	43,500	95,000	60,000	73,375	122,582	134,919	150,012	490,056	45,300
55	Additional capital required to complete these enterprises.....dollars	15,200		85,000		57,000			230,000		49,000
56	Average cost per acre when completed.....dollars	8.72	6.95	15.76	4.94	6.54	7.16	7.16	5.23	5.42	3.59
57	Enterprises constructing open ditches only.....dollars	76,240	43,500	180,000	60,000	20,375	122,582	134,919	57,312	490,056	30,000
58	Average cost per acre when completed.....dollars	8.72	6.95	15.76	4.94	12.73	7.16	7.16	5.35	5.42	3.00
59	Enterprises constructing open ditches and levees.....dollars					110,000			268,700		49,300
60	Average cost per acre when completed.....dollars					6.00			5.07		4.11
61	Enterprises constructing open ditches and tile drains.....dollars								24,000		15,000
62	Average cost per acre when completed.....dollars								8.00		3.49
<b>CROPS.</b>											
Improved land in enterprises reporting—											
63	Cotton as principal crop on drained land.....acres		5,572	400	5,798	11,820	5,686		11,857	55,449	11,700
64	Corn as principal crop on drained land.....acres	2,185					7,890	10,144	18,427		

<sup>1</sup> When works under construction have been completed.

## DRAINAGE—MISSISSIPPI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Tate.	Tippah.	Tunica.	Union.	Wash- ington.	Webster.	Yalo- busha.	Yazoo.	Other counties. <sup>1</sup>
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	256,000	285,440	287,520	263,680	462,720	266,240	313,600	579,200	1,279,360
2	All land in operating drainage enterprises.....	34,030	12,537	18,960	29,919	358,140	4,950	14,900	25,500	9,169
3	Improved land.....	15,721	9,036	3,161	15,805	198,909	2,618	6,720	14,100	4,172
4	Per cent of all improved land in farms.....	11.3	8.4	2.7	14.5	86.4	3.0	6.5	5.8	1.1
5	Timber and cut-over land.....	15,063	3,501	15,799	14,114	159,231	2,332	8,180	11,400	4,997
6	Other unimproved land.....	3,246								
7	Swampy or subject to overflow, in enterprises.....	4,006	700	65	890	44,961				1,200
8	Suffering a loss of crops from defective drainage.....	608								
9	Assessed acreage.....	34,030	12,537	18,960	29,919	358,140	4,950	14,900	25,500	9,169
10	Excess over all land in operating enterprises.....									
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....	47.2	57.0	6.6	72.6	292.7	10.0	14.6	5.4	28.4
12	Additional under construction.....	3.8		2.0		112.3		8.4		
13	Maximum completed in any enterprise.....	18.0	15.0	3.3	26.0	121.0	6.0	8.5	3.4	8.4
14	Maximum width at bottom of ditch <sup>2</sup> .....	60	24	35	30	120	15	35	16	20
15	Maximum of average depths of outlet ditches <sup>2</sup> .....	10.0	9.0	9.0	10.0	10.0	10.0	8.0	10.0	9.0
16	Mean depth of branch ditches <sup>2</sup> .....		5.0	7.6		7.0		5.0	8.0	
Tile drains:										
17	Completed.....									
18	Additional under construction.....									
19	Maximum completed in any enterprise.....									
20	Maximum size of tile <sup>2</sup> .....									
Accessory levees and dikes:										
21	Completed.....			2.7					0.4	
22	Additional under construction.....			3.8						
Pumping plants:										
23	Engine capacity.....					250				
24	Pump capacity.....					78,000				
25	Area served by pumps.....					44,000				
26	Area drained by open ditches only <sup>2</sup> .....	34,030	12,537		29,919	358,140	4,950	14,900	13,000	9,169
27	Length of these ditches.....	51.0	57.0		72.6	405.0	10.0	23.0	2.0	28.4
28	Average length per acre.....	7.9	24.0		12.8	6.0	10.7	8.2	0.8	18.4
29	Area having open ditches and levees <sup>2</sup> .....			18,960					12,500	
30	Length of these ditches.....			8.6					8.4	
31	Average length per acre.....			2.4					1.4	
32	Length of the accessory levees.....			6.5					0.4	
33	Area drained by open ditches and tile <sup>2</sup> .....									
34	Length of these drains.....									
35	Average length per acre.....									
<b>DEVELOPMENT OF LAND.</b>										
36	Improved land in operating enterprises, 1920.....	15,721	9,036	3,161	15,805	198,909	2,618	6,720	14,100	4,172
37	Improved land prior to drainage.....	6,046	3,947	2,291	6,080	97,248	2,419	6,720	13,475	2,452
38	Increase since drainage.....	9,675	5,089	870	9,725	101,661	199		625	1,720
39	Per cent of increase.....	160.0	128.9	38.0	160.0	104.5	8.2		4.6	70.1
40	Per cent increase is of all improved land in farms, 1920.....	7.0	4.7	0.7	8.9	44.1	0.2		0.3	0.5
41	Timber and cut-over land, 1920.....	15,063	3,501	15,799	14,114	159,231	2,332	8,180	11,400	4,997
42	Timber and cut-over land prior to drainage.....	24,738	8,507	16,637	23,839	260,892	2,531	8,180	12,025	6,717
43	Decrease since drainage.....	9,675	5,006	838	9,725	101,661	199		625	1,720
44	Per cent of decrease.....	39.1	58.8	5.0	40.8	39.0	7.9		5.2	25.6
45	Other unimproved land, 1920.....	3,246								
46	Other unimproved land prior to drainage.....	3,246	83	32						
47	Decrease since drainage.....		83	32						
48	Per cent of decrease.....		100.0	100.0						
49	Swampy or subject to overflow, 1920.....	4,006	700	65	890	44,961				1,200
50	Swampy or subject to overflow, prior to drainage.....	20,030	1,010	903	1,616	158,618				5,350
51	Decrease since drainage.....	16,024	310	838	726	113,657				4,150
52	Per cent of decrease.....	80.0	30.7	92.8	44.9	71.7				77.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
53	Total capital invested in and required for completion of operating enterprises.....	184,000	99,476	124,312	202,200	1,921,229	22,919	114,000	31,000	58,438
54	Capital invested in these enterprises to Dec. 31, 1919.....	169,000	99,476	54,812	202,200	1,368,229	22,919	54,000	31,000	58,438
55	Additional capital required to complete these enterprises.....	15,000		79,500		553,000		60,000		
56	Average cost per acre when completed.....	5.41	7.93	7.08	6.76	5.36	4.63	7.66	1.22	6.37
57	Enterprises constructing open ditches only.....	184,000	99,476		202,200	1,921,229	22,919	114,000	14,000	58,438
58	Average cost per acre when completed.....	5.41	7.93		6.76	5.36	4.63	7.66	1.08	6.37
59	Enterprises constructing open ditches and levees.....			134,312					17,000	
60	Average cost per acre when completed.....			7.08					1.36	
61	Enterprises constructing open ditches and tile drains.....									
62	Average cost per acre when completed.....									
<b>CROPS.</b>										
63	Improved land in enterprises reporting— Cotton as principal crop on drained land.....	15,721		3,161		161,897	2,618	6,720	14,100	3,392
64	Corn as principal crop on drained land.....		9,036		15,805	37,012				780

<sup>1</sup> Includes only Leake, Montgomery, Tishomingo, and Winston Counties.<sup>2</sup> When works under construction have been completed.

# MISSOURI.

The following pages present the statistics of drainage for Missouri collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture; while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state .....	263,004	100.0
Farms reporting land having drainage .....	11,917	4.5
Farms reporting land needing drainage .....	19,572	7.4
All land in farms.....acres..	34,774,679	100.0
Improved land in farms.....acres..	24,832,966	71.4
Farm land reported as provided with drainage.....acres..	859,663	2.5
Farm land reported as needing drainage.....acres..	830,693	2.4
Needing drainage only.....acres..	163,178	0.5
Needing drainage and clearing.....acres..	667,515	1.9
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state.....acres..	43,985,280	100.0
All land in operating drainage enterprises.....acres..	2,596,204	5.9
Improved land.....acres..	1,474,302	5.9
Per cent of all improved land in farms.....		5.9
Timber and cut-over land.....acres..	1,074,860	2.4
Other unimproved land.....acres..	47,042	0.1
Swampy, subject to overflow, seeped, or alkali.....acres..	454,360	1.0
Suffering a loss of crops from defective drainage.....acres..	242,258	0.6
Improved land prior to drainage.....acres..	760,796	1.7
Increase since drainage began.....acres..	713,506	1.6
Land in nonoperating enterprises.....acres..	384,061	0.9
Open ditches in operating enterprises.....miles..	3,899.1	100.0
Completed.....miles..	3,438.7	88.2
Additional under construction.....miles..	460.4	11.8
Tile drains in operating enterprises.....miles..	44.7	100.0
Completed.....miles..	38.8	86.8
Additional under construction.....miles..	5.9	13.2
Total capital invested in and required for completion of operating enterprises..	\$24,749,735	100.0
Capital invested in these enterprises to Dec. 31, 1919 .....	20,723,128	83.7
Additional capital required to complete these enterprises .....	4,026,607	16.3
Average cost per acre when completed.....	9.53	



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	2,980,265	100.0	\$20,889,328	100.0	\$10,178,401
Operating enterprises.....	2,596,204	87.1	20,723,128	99.2	4,026,607
With works completed.....	1,858,945	62.4	13,294,035	63.6	—
With works under construction.....	737,259	24.7	7,429,093	35.6	4,026,607
Nonoperating enterprises.....	384,061	12.9	166,200	0.8	6,151,794

<sup>1</sup>The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Two-thirds of the area in drainage enterprises in Missouri is in the southeast corner of the state. Southeast of a line passing about 6 miles west of Cape Girardeau and Poplar Bluff, approximately 70 per cent of all the land is in drainage enterprises. This region, except Mississippi and Scott Counties and the east corner of New Madrid County, is drained southwesterly through Arkansas.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	2,980,265	100.0	\$20,889,328	100.0	\$10,178,401
Operating enterprises.....	2,596,204	87.1	20,723,128	99.2	4,026,607
Mississippi River.....	702,824	23.6	6,317,435	30.2	300,250
Black River.....	262,376	8.8	1,354,932	6.5	1,000,000
St. Francis River.....	1,173,030	39.4	9,313,035	44.6	2,639,317
Missouri River.....	367,151	12.3	2,550,495	12.2	373,865
Osage River.....	90,823	3.0	1,187,231	5.7	263,175
Nonoperating enterprises.....	384,061	12.9	166,200	0.8	6,151,794
Mississippi River.....	45,714	1.5	9,600	( <sup>1</sup> )	316,670
St. Francis River.....	48,835	1.6	8,600	( <sup>1</sup> )	428,369
Missouri River.....	289,512	9.7	148,000	0.7	5,406,755

<sup>1</sup>Less than one-tenth of 1 per cent.

Almost all the other land in drainage enterprises is situated in the northwestern part of the state, some along Mississippi River and its smaller tributaries but more on the streams flowing into the Missouri.

Condition of land in enterprises.—In the southeastern part of Missouri, except as artificial drainage has been accomplished, the area in drainage enterprises is mostly typical southern swamp land which in its virgin state was covered generally with timber. Considerable protection against overflow from the Mississippi is afforded by levees along that river, but the natural drainage channels are extremely crooked and obstructed, and have high banks from which the land slopes away to wide swampy tracts.

In the northern and western parts of the state, the area in drainage enterprises is generally the bottom land between the hills, subject to inundation by stream floods. A considerably greater part was under some degree of cultivation before the drainage enterprises were organized than was the case in the southeastern counties.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	2,596,204	100.0	1,858,945	737,259	384,061
Improved land.....	1,474,302	56.8	1,207,730	268,572	265,063
Timber and cut-over land.....	1,074,880	41.4	810,298	464,564	77,268
Other unimproved land.....	47,042	1.8	40,919	6,123	41,730
Swampy or subject to overflow....	454,360	17.5	300,972	253,388	270,392
Suffering a loss of crops.....	242,258	9.3	123,210	119,048	17,917

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 238 operating drainage enterprises are counted in Missouri, with an average area of 13,046 acres assessed. The assessed acreage exceeds the land in enterprises by 508,685 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.



TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	2, 596, 204	8, 104, 889	100. 0
Less than 200 acres.....	177	177	(1)
200 to 499 acres.....	1, 058	1, 058	(1)
500 to 999 acres.....	10, 901	13, 154	0. 4
1,000 to 4,999 acres.....	217, 559	239, 414	7. 7
5,000 to 9,999 acres.....	302, 068	341, 834	11. 0
10,000 to 49,999 acres.....	1, 306, 271	1, 557, 927	50. 2
50,000 to 99,999 acres.....	503, 793	546, 213	17. 6
100,000 to 499,999 acres.....	254, 377	405, 062	13. 0

<sup>1</sup> Less than one-tenth of 1 per cent.

**Character of enterprises.**—The drainage enterprises in Missouri are nearly all drainage districts established by the circuit courts and the county courts, in accordance with the general drainage laws of the state. The few other drainage enterprises include levee districts, county drains, and enterprises under individual ownership, including some in which two or more farm owners cooperated without organizing under any law. The statutes relating to the establishment of drains and levees have been amended many times, and now form chapter 41 of the Revised Statutes of Missouri, 1909.

Drainage districts may be established by the circuit courts for the reclamation of swamp, wet, or overflowed land for agricultural or sanitary purposes, under the provisions of Article I, of chapter 41 of the Revised Statutes. Levee districts may be established by the circuit courts for the reclamation and protection of land from overflow and other water, for agricultural or sanitary purposes, under Article IX of that chapter. Both of these articles were newly written and reenacted in 1913, Article I on March 24 and Article IX on April 7.

The circuit court drainage districts are formed, according to the existing statute, by the owners of a majority of the acreage signing and filing with the clerk of the circuit court articles of association containing a petition for the establishment of the district described therein. The district is declared a public corporation if the court, after public hearing, approves the petition. The officers of the district are five supervisors elected by the landowners voting in proportion to their acreages. The plan of reclamation works is determined by the supervisors. Damages and benefits are assessed by three commissioners appointed by the court. After public hearing upon the commissioners' report, the court may amend the assessments, subject to appeal, and must confirm the report or dissolve the district according to whether the benefits will be greater or less than the cost of reclamation. The supervisors construct the reclamation works of the district, by letting contracts or otherwise. They may issue bonds of the district for not exceeding 90 per cent of the taxes levied to pay the cost of the

enterprise, which is apportioned according to the benefits. For a district located in two or more counties, the articles of association are filed in the circuit court of the county containing the greater part of the district. The period of incorporation may be extended upon petition from the landowners.

Circuit court levee districts are organized in a manner similar to circuit court drainage districts. The duties and powers of the supervisors are like those of the supervisors of the drainage districts, but the provisions regarding levy of taxes and amount of bond issue are not identical.

The drainage districts established by the county courts now are governed by Articles III and IV of chapter 41, Revised Statutes of 1909, as amended. Article IV was entirely rewritten by an act of May 29, 1919. Levee districts may be established by the county courts in accordance with Article X of the same chapter.

Each drainage district organized under Article III is established by the county court of the county containing the greater part of the land in the proposed district, after receipt of a petition from the owners of a major part of the land or from a majority of the owners representing one-third or more of the land to be drained. The enterprise is administered by three commissioners appointed by the court, who investigate the practicability of the project and, if the benefits will exceed the cost, prepare plans for the improvement works. The commissioners assess damages, and apportion the cost against the tracts of land in proportion to the benefits that will accrue. The court holds hearings upon the petition and upon the commissioners' report, and may change the boundaries of the district, the awards of damages, and the assessments of benefits before confirming the report. The commissioners may issue notes or bonds of the district to secure funds for financing the undertaking.

The present form of Article IV provides that drainage districts may be established by the county courts upon petition from one or more interested landowners, whenever the proposed drainage will be of public benefit. The court appoints three viewers and an engineer to report upon the practicability and utility of the proposed undertaking, and may establish the district after public hearing upon this report. Then three viewers and an engineer again are appointed to prepare the complete plan of drainage and to assess damages and benefits against the land to be affected. These assessments are confirmed by the court, after public hearing, with such amendments as are deemed equitable. Appeals regarding damages awarded may be taken to the circuit court. The assessments of cost, apportioned like the assessments of benefits, are payable in such installments as the court may determine, and bonds may be issued by the court in an amount not exceeding the assessments of cost.

County drains may be established, under Article V of the chapter on drains and levees, without being incorporated as districts, by petition to the county court from a majority in interest of the resident owners of any body of swamp or overflowed land. If the court approves the petition, two commissioners are appointed to act with the county surveyor in examining the land to be drained, in preparing a plan of improvement, and in assessing the amounts of damages and of benefits. After confirmation of the commissioners' report, the court acts as the executive officer of the enterprise.

Levee districts may be organized by the county courts, according to Article X, to protect land subject to overflow by rivers, after notice published by the court or by any interested landholder. A board of three directors is appointed by the court to prepare plans for the necessary protection works, and to construct and maintain the works if the landowners vote to complete the undertaking. The cost of construction is apportioned according to benefits determined by the county assessor, subject to appeal to the county board of equalization. Right of way is secured by agreement with the owners of the land taken or by condemnation proceedings. The directors may issue notes or bonds of the district for money borrowed for district purposes. Extension of the district to include all land benefited may be made by the court upon petition from the directors and after public hearing.

No enterprises are reported as organized under Article II, VI, VII, or VIII. Article II provides for organizing into a drainage district any county owning swamp or overflowed land donated by the state for reclamation purposes. Upon petition from a majority of the taxpaying citizens, the county court shall declare the county established as a drainage district according to Article I, and shall perform the duties therein prescribed for the supervisors of the district. Construction work is to be put under contract, payable in the swamp and overflowed land of the county at not less than \$1.25 per acre. Articles VI and VII were repealed by an act of March 27, 1913, which provides for the drainage of wet or overflowed land by individuals without forming drainage districts. Owners of land that must be drained across the property of other owners may petition either the county court or the circuit court to appoint commissioners to consider the location of the necessary drain and to assess damages and benefits. After public hearing and confirmation of the commissioners' report, and after payment of damages has been made or offered, the court may let contract for construction of the drain or levee and charge the cost to the landowners in proportion to the benefits assessed. Article VIII provides for the organization of sanitary drainage districts lying partly within a city of 300,000 inhabitants or more, under the circuit courts.

When Congress, in 1850, had given the swamp and overflowed land to the states in which it was located, Missouri undertook to encourage the development of that land. In 1851 laws were enacted to provide for the reclamation and sale of the swamp land in 10 southeastern counties of the state, by commissioners designated by the legislature, and to grant the swamp and overflowed land elsewhere to the counties in which it was situated. In 1853 the swamp land in the southeastern counties was given to those counties for reclamation. A number of statutes were enacted to encourage the counties in developing the land that had been given to them. A department of land reclamation was created by an act of March 25, 1913, in charge of a land reclamation commissioner appointed by the governor of the state. The commissioner's duties include diffusing information regarding the benefits to be derived from drainage and giving assistance in formulating plans for drainage work.

An act of March 13, 1867, authorized the county courts to condemn land for drainage purposes, and provided that commissioners should be appointed to assess damages and benefits. This seems to have been the first drainage law of Missouri to apportion the cost according to benefits. The drainage of land upon petition from the landowners apparently first was provided by an act of March 3, 1869. The first law authorizing the establishment of drainage districts with corporate powers was that of April 26, 1879, providing for articles of association to be filed with the circuit court and for proceedings not unlike those under the present circuit court drainage act (Art. I, ch. 41, Rev. Stat. 1909). The incorporation of drainage districts by county courts was first authorized by an act of April 1, 1893.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	2,380,265	100.0	\$20,889,328	100.0	\$10,178,401
Operating enterprises.....	2,596,204	87.1	20,728,128	99.2	4,026,807
Circuit court districts.....	1,070,738	35.9	13,362,764	64.0	2,538,040
Art. I, ch. 41, Rev. Stat. 1909.	1,001,996	33.6	12,170,764	58.3	2,234,040
Art. IX, ch. 41, Rev. Stat. 1909.	68,742	2.3	1,192,000	5.7	304,000
County court districts.....	1,514,530	50.8	7,290,164	34.9	1,487,567
Art. III, ch. 41, Rev. Stat. 1909.	200,217	6.7	534,673	2.6	8,625
Art. IV, ch. 41, Rev. Stat. 1909.	1,312,265	44.0	6,751,491	32.3	1,483,942
Art. X, ch. 41, Rev. Stat. 1909.	2,048	0.1	4,000	( <sup>1</sup> )	5,000
County drains.....	1,040	( <sup>1</sup> )	1,500	( <sup>1</sup> )	.....
Art. V, ch. 41, Rev. Stat. 1909.	1,040	( <sup>1</sup> )	1,500	( <sup>1</sup> )	.....
Individual ownerships.....	9,896	0.3	63,700	0.3	21,000
Nonoperating enterprises.....	334,061	12.9	166,200	0.8	6,151,794
Circuit court districts.....	318,478	10.7	161,000	0.8	5,752,884
Art. I, ch. 41, Rev. Stat. 1909.	318,478	10.7	161,000	0.8	5,752,884
County court districts.....	62,085	2.1	3,200	( <sup>1</sup> )	385,410
Art. IV, ch. 41, Rev. Stat. 1909.	62,085	2.1	3,200	( <sup>1</sup> )	385,410
Individual ownerships.....	3,500	0.1	2,000	( <sup>1</sup> )	33,500

<sup>1</sup> Less than one-tenth of 1 per cent.

**Drainage works.**—The total works completed by the drainage enterprises to December 31, 1919, comprised 3,438.7 miles of open ditches, 38.8 miles of tile drains, and 456.9 miles of accessory levees; the additional lengths under construction were 460.4 miles of open ditches, 5.9 miles of tile drains, and 74.9 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains.

There are 11 pumping districts among the operating drainage enterprises in Missouri, and 4 among the non-operating enterprises.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	2,596,204	100.0	\$20,723,128	100.0	\$4,026,607
Open ditches only.....	1,612,085	62.1	11,468,524	55.3	1,974,142
Open ditches and levees.....	863,432	34.0	7,278,025	35.1	1,939,040
Tile drains only.....	760	( <sup>1</sup> )	11,250	0.1	6,250
Open ditches and tile drains.....	45,240	1.8	466,230	2.2	19,000
Tile drains and levees.....	7,000	0.3	14,000	0.1	.....
Open ditches, tile drains, and levees.....	45,687	1.8	1,487,099	7.2	88,175

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,596,204	100.0	\$20,723,128	100.0	\$4,026,607
Gravity drainage only.....	2,518,898	97.0	18,462,288	89.1	4,006,607
All drainage by pumping.....	77,306	3.0	2,260,830	10.9	20,000
Part gravity and part pumping.....	77,306	3.0	2,260,830	10.9	20,000
Total area served by pumps.....	70,308	2.7	.....	.....	.....

TABLE 9.—DRAINAGE PUMPING PLANTS IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horse-power.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All enterprises.....	2,785	100.0	552,000	100.0	70,308	100.0
Steam.....	1,910	68.6	407,000	73.7	57,298	81.5
Electric.....	500	18.0	75,000	13.6	4,010	5.7
Internal-combustion.....	375	13.5	70,000	12.7	9,000	12.8

TABLE 10.—DRAINAGE PUMPING PLANTS IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF PUMPS: 1920.

KIND OF PUMP.	PUMPS.			ENGINE CAPACITY.		AREA SERVED.	
	Number.	Capacity.		Horse-power.	Per cent of total.	Acreage.	Per cent of total.
		Gallons per minute.	Per cent of total.				
All enterprises.....	14	552,000	100.0	2,785	100.0	70,308	100.0
Centrifugal.....	13	545,000	98.7	2,725	97.8	69,308	98.6
Rotary.....	1	7,000	1.3	60	2.2	1,000	1.4

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and more were omitted, because it seemed they did not represent so well the average depth of outlet provided for all the farms in those districts; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 7.2 instead of 7.0 feet.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	2,596,204	100.0
Less than 3 feet.....	29,617	1.1
3.0 to 3.9 feet.....	40,432	1.6
4.0 to 4.9 feet.....	111,658	4.3
5.0 to 5.9 feet.....	150,483	5.8
6.0 to 6.9 feet.....	163,836	6.3
7.0 to 7.9 feet.....	544,976	21.0
8.0 to 8.9 feet.....	827,407	31.9
9.0 to 9.9 feet.....	68,121	2.6
10 feet and more.....	203,195	7.8
Not reporting branches.....	456,431	17.6

**Maintenance of works.**—The circuit court drainage act (Art. I, ch. 41, Rev. Stat. 1909) and the circuit court levee act (Art. IX) authorize the boards of supervisors of the districts to maintain the improvement works of their respective districts in good condition, and to appoint ditch overseers or inspectors to

have charge of that work. Each board is authorized also to levy annually a tax for maintenance purposes, to be apportioned like and not to exceed 10 per cent of the net assessments of benefits for construction. The commissioners of drainage districts organized under Article III of the statutes relating to drains and levees are authorized to make repairs to the improvement works and to levy assessments therefor. However, if the cost will exceed the equivalent of 30 cents per acre on all the land benefited, the commissioners must file petition and the county court, after public hearing, determines what work shall be done and the amount of benefits to be assessed against each tract of land. Article IV directs that the county court appoint annually a ditch overseer to inspect and to keep in repair all ditches in the county established under this article. For the cost of maintenance the court may levy annually a tax not exceeding 10 per cent of the cost of construction, to be apportioned like the assessments of benefits for construction. Drains established under Article V are to be kept in repair by the county court, the cost to be paid by the land benefited in such proportion and in such manner as the court may prescribe.

TABLE 12.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,596,204	100.0	\$20,723,128	100.0	\$4,026,607
By district forces.....	1,185,656	44.5	9,556,820	46.1	163,500
By contract.....	383,522	14.8	3,791,283	18.3	192,500
By landowners.....	254,439	9.8	1,692,915	8.2	40,000
By method not specified.....	142,331	5.5	1,425,256	6.9	57,625
No maintenance provided.....	165,884	6.4	872,304	3.9	594,150
Not reported.....	494,072	19.0	3,454,990	16.7	2,988,833

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 13.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	2,596,204	100.0	3,104,889	100.0
1880 to 1889.....	1,040	( <sup>1</sup> )	1,040	( <sup>1</sup> )
1890 to 1899.....	209,889	8.1	212,829	6.9
1900 to 1904.....	348,941	13.4	400,271	12.9
1905 to 1909.....	1,163,447	44.8	1,354,072	43.6
1910 to 1914.....	706,508	27.2	935,848	30.1
1915 to 1919.....	159,643	6.1	194,143	6.3
Not reported.....	6,736	0.3	6,736	0.2

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 14.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$20,723,128	100.0	\$4,026,607
1880 to 1889.....	1,500	( <sup>1</sup> )	.....
1890 to 1899.....	522,995	2.9	.....
1900 to 1904.....	1,875,095	9.0	225,710
1905 to 1909.....	10,063,182	48.6	641,380
1910 to 1914.....	6,829,206	33.0	2,139,427
1915 to 1919.....	1,313,150	6.3	999,090
Not reported.....	48,000	0.2	21,000

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 15.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1880 to 1889.....	5.0	0.1	.....	.....	.....	.....
1890 to 1899.....	245.5	6.3	.....	.....	13.8	2.6
1900 to 1904.....	441.8	11.3	10.0	22.4	40.3	7.6
1905 to 1909.....	1,633.4	41.9	.....	.....	191.7	36.0
1910 to 1914.....	1,186.7	30.4	24.3	54.4	217.4	40.9
1915 to 1919.....	366.7	9.4	7.4	16.6	55.9	10.5
Not reported.....	20.0	0.5	3.0	6.7	12.7	2.4

Crops.—The principal crops grown upon the drained land in drainage enterprises, are corn, cotton, and wheat. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—MISSOURI.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adair.	Andrew.	Atchl- son.	Andrain.	Barton.	Bates.	Benton.	Bollin- ger.
1	Number of all farms in the state or county.....	263,004	2,453	2,334	1,541	2,521	2,362	3,500	2,157	3,226
2	Farms reporting land having drainage.....	11,917	53	135	330	21	64	193	13	32
3	Farms reporting land needing drainage.....	19,572	154	82	115	120	125	193	47	191
4	Farms in drainage and levee districts.....	7,743	6	2	194	11	2	106	.....	13
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county.....acres..	43,985,280	365,440	273,920	337,920	438,400	381,440	556,800	476,800	389,760
6	All land in farms.....acres..	34,774,679	326,387	258,973	308,224	418,334	334,647	510,067	368,029	289,879
7	Improved land in farms.....acres..	24,832,966	265,708	215,606	297,910	381,592	304,550	443,245	199,021	155,334
8	Woodland in farms.....acres..	8,553,857	51,765	33,136	15,235	30,990	20,774	43,326	145,196	130,775
9	Other unimproved land in farms.....acres..	1,387,856	8,914	10,221	5,079	6,262	9,323	23,496	23,812	3,770
10	Farm land reported as provided with drainage.....acres..	859,683	3,134	3,769	31,307	1,496	1,645	10,282	795	1,044
11	Farm land reported as needing drainage.....acres..	830,683	5,192	1,910	6,271	3,257	2,638	8,652	1,581	5,868
12	Drainage only.....acres..	163,178	541	1,058	5,033	140	381	2,252	15	333
13	Drainage and clearing.....acres..	667,515	4,651	852	1,238	3,147	2,307	6,400	1,566	5,485

		Boone.	Buch- anan.	Butler.	Caldwell.	Callaway.	Camden.	Cape Gir- ardeau.	Carroll.	Cass.
1	Number of all farms in the county.....	3,325	2,627	2,105	1,963	3,284	1,739	2,661	3,077	3,036
2	Farms reporting land having drainage.....	10	106	154	75	11	11	141	388	149
3	Farms reporting land needing drainage.....	205	104	569	61	66	134	188	75	273
4	Farms in drainage and levee districts.....	4	16	426	30	2	1	76	247	59
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	440,320	261,120	447,360	277,120	517,120	439,680	371,200	449,920	461,440
6	All land in farms.....acres..	404,037	238,542	209,340	264,513	476,351	309,482	340,928	413,347	417,564
7	Improved land in farms.....acres..	327,301	186,407	105,269	241,278	344,458	103,789	230,275	379,495	357,538
8	Woodland in farms.....acres..	61,385	37,741	88,741	18,012	113,559	197,546	105,304	24,395	40,951
9	Other unimproved land in farms.....acres..	15,951	14,394	17,330	5,223	18,334	8,147	5,380	9,457	19,075
10	Farm land reported as provided with drainage.....acres..	1,260	2,956	6,545	2,364	663	579	21,690	40,942	5,168
11	Farm land reported as needing drainage.....acres..	4,689	2,719	36,933	1,380	1,911	5,263	11,144	5,453	9,599
12	Drainage only.....acres..	100	972	4,899	176	231	122	2,415	2,627	2,617
13	Drainage and clearing.....acres..	4,589	1,747	32,034	1,204	1,680	5,141	8,729	2,826	6,961

		Cedar.	Chariton.	Clark.	Clay.	Clinton.	Cole.	Cooper.	Davies.	Dunklin.
1	Number of all farms in the county.....	2,448	3,426	1,908	1,973	1,576	1,621	2,419	2,731	3,933
2	Farms reporting land having drainage.....	126	138	156	21	73	26	46	60	920
3	Farms reporting land needing drainage.....	208	146	102	99	71	98	52	246	519
4	Farms in drainage and levee districts.....	2	42	144	18	.....	.....	3	9	973
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	318,720	491,520	318,720	257,280	270,720	248,960	357,120	360,960	339,200
6	All land in farms.....acres..	284,142	445,102	290,472	236,581	255,448	232,481	331,699	345,189	186,904
7	Improved land in farms.....acres..	199,830	386,055	218,622	201,678	233,944	140,846	272,882	272,171	160,004
8	Woodland in farms.....acres..	68,790	46,103	43,349	25,772	16,922	79,878	51,080	45,218	24,187
9	Other unimproved land in farms.....acres..	15,472	12,944	30,501	9,131	4,582	11,757	7,737	27,806	2,619
10	Farm land reported as provided with drainage.....acres..	2,667	17,721	15,599	2,020	3,462	1,745	1,267	1,840	41,682
11	Farm land reported as needing drainage.....acres..	4,731	5,531	4,075	2,163	1,473	2,462	1,345	7,982	17,763
12	Drainage only.....acres..	2,043	2,252	2,238	102	1,183	129	948	2,667	3,581
13	Drainage and clearing.....acres..	2,688	3,329	1,837	2,061	2,265	2,333	397	5,285	14,187

		Gascon- ade.	Gentry.	Grundy.	Harris- son.	Henry.	Holt.	Howard.	Jackson.	Jasper.
1	Number of all farms in the county.....	1,768	2,269	1,915	3,135	3,098	1,814	1,698	3,345	2,786
2	Farms reporting land having drainage.....	20	22	32	19	98	172	45	189	77
3	Farms reporting land needing drainage.....	451	63	163	184	160	57	23	71	100
4	Farms in drainage and levee districts.....	2	1	13	7	66	168	6	23	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	328,960	313,600	277,120	461,440	476,160	285,440	299,520	390,400	406,400
6	All land in farms.....acres..	300,700	302,056	271,495	438,184	432,719	253,653	265,679	312,321	328,793
7	Improved land in farms.....acres..	129,672	266,195	217,478	372,930	371,637	326,937	202,581	257,123	260,483
8	Woodland in farms.....acres..	159,797	32,778	39,788	46,599	47,921	17,243	53,834	39,848	36,992
9	Other unimproved land in farms.....acres..	11,231	13,083	15,229	18,655	13,161	9,473	9,264	15,351	31,306
10	Farm land reported as provided with drainage.....acres..	506	875	4,572	1,890	4,867	18,811	2,327	9,836	1,939
11	Farm land reported as needing drainage.....acres..	13,164	1,378	10,142	8,578	7,320	3,004	370	1,817	2,251
12	Drainage only.....acres..	112	505	5,266	4,327	2,599	1,930	148	502	373
13	Drainage and clearing.....acres..	13,052	873	4,876	4,251	4,721	1,074	222	1,315	1,879

DRAINAGE—MISSOURI.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Johnson.	Knox.	Lafayette.	Lewis.	Lincoln.	Linn.	Livingston.	Macon.	Marion.
1	Number of all farms in the county.....	3,590	1,890	2,807	1,878	2,540	2,513	2,316	3,759	1,623
2	Farms reporting land having drainage.....	82	32	592	61	73	52	97	60	65
3	Farms reporting land needing drainage.....	36	86	201	232	148	319	46	460	92
4	Farms in drainage and levee districts.....	69	20	27	31	33	14	57	29	84
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	531,840	328,960	391,680	322,560	368,480	400,640	339,840	517,760	279,040
6	All land in farms.....acres..	496,643	302,841	357,077	305,155	343,700	390,560	304,474	480,514	246,164
7	Improved land in farms.....acres..	437,752	262,247	324,038	243,210	255,015	324,864	253,365	403,863	190,457
8	Woodland in farms.....acres..	45,990	33,054	23,636	51,342	77,866	42,871	36,772	67,704	38,076
9	Other unimproved land in farms.....acres..	12,901	7,540	9,403	10,603	10,819	12,825	14,337	8,942	17,631
10	Farm land reported as provided with drainage.....acres..	5,493	2,030	35,864	6,645	10,351	4,749	6,719	3,504	6,898
11	Farm land reported as needing drainage.....acres..	1,631	2,538	10,989	6,942	7,192	13,145	3,793	18,603	6,994
12	Drainage only.....acres..	248	320	8,702	424	1,948	5,557	2,768	3,479	3,817
13	Drainage and clearing.....acres..	1,383	2,218	2,287	6,518	5,244	7,588	1,025	15,124	3,177

		Miller.	Mississippi.	Morgan.	New Madrid.	Nodaway.	Osage.	Pemiscot.	Perry.	Pettis.
1	Number of all farms in the county.....	2,194	1,184	1,858	2,052	3,657	1,979	2,533	1,972	2,797
2	Farms reporting land having drainage.....	38	434	23	579	488	15	911	41	196
3	Farms reporting land needing drainage.....	152	134	157	711	266	65	309	309	45
4	Farms in drainage and levee districts.....	1	455	1	933	116	19	945	68	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	379,520	204,320	392,660	417,280	557,440	379,520	291,840	295,680	438,400
6	All land in farms.....acres..	336,663	187,266	272,692	243,303	546,068	349,060	122,574	264,228	409,041
7	Improved land in farms.....acres..	164,258	156,279	164,520	195,362	502,989	159,648	118,359	183,909	345,997
8	Woodland in farms.....acres..	182,067	16,430	108,317	41,667	31,270	154,138	10,489	91,686	49,664
9	Other unimproved land in farms.....acres..	10,338	14,557	9,855	6,274	11,809	35,274	3,726	8,633	13,480
10	Farm land reported as provided with drainage.....acres..	708	56,640	649	51,618	23,683	569	39,749	1,788	22,088
11	Farm land reported as needing drainage.....acres..	4,320	11,486	5,397	58,535	9,725	2,104	14,181	9,091	2,630
12	Drainage only.....acres..	266	2,279	256	27,801	6,043	400	7,488	773	1,195
13	Drainage and clearing.....acres..	4,054	9,207	5,141	30,734	3,682	1,704	6,693	8,318	1,335

		Pika.	Platte.	Putnam.	Randolph.	Ray.	Ripley.	St. Charles.	St. Clair.	St. Francois.	St. Louis.
1	Number of all farms in the county.....	2,681	2,021	2,153	2,380	2,541	1,638	2,165	2,649	1,266	3,735
2	Farms reporting land having drainage.....	93	152	44	60	204	125	156	47	3	137
3	Farms reporting land needing drainage.....	147	125	69	176	50	382	336	255	84	66
4	Farms in drainage and levee districts.....	48	11	.....	9	67	149	56	.....	.....	7
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county.....acres..	417,920	265,600	330,880	314,240	361,600	401,280	342,400	451,840	293,120	811,680
6	All land in farms.....acres..	385,501	247,449	312,978	286,546	304,684	186,726	308,424	378,878	182,974	226,566
7	Improved land in farms.....acres..	294,004	187,222	259,820	231,989	264,170	87,978	229,965	242,853	99,976	177,487
8	Woodland in farms.....acres..	73,246	53,650	41,231	44,845	28,054	94,906	63,539	114,885	75,711	40,852
9	Other unimproved land in farms.....acres..	18,251	6,577	11,927	9,711	12,460	3,842	14,920	21,140	7,287	8,156
10	Farm land reported as provided with drainage.....acres..	8,394	3,882	1,589	2,785	12,971	2,783	21,635	1,234	1,544	6,328
11	Farm land reported as needing drainage.....acres..	10,839	3,140	2,184	4,848	1,656	16,124	8,567	9,712	1,893	1,206
12	Drainage only.....acres..	2,443	1,588	183	1,502	591	409	2,496	2,137	29	624
13	Drainage and clearing.....acres..	8,376	1,552	2,001	3,346	1,065	15,715	6,071	7,575	1,864	582

		Salina.	Scottland.	Scott.	Shalby.	Stoddard.	Sullivan.	Vernon.	Webster.	Worth.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	3,024	1,800	1,432	2,195	3,685	2,660	3,267	2,697	1,215	88,794
2	Farms reporting land having drainage.....	583	97	648	49	899	49	177	24	50	307
3	Farms reporting land needing drainage.....	275	80	186	23	716	103	272	266	55	6,630
4	Farms in drainage and levee districts.....	54	90	580	37	1,039	15	4	.....	9	44
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county.....acres..	482,560	280,960	268,160	326,760	521,600	415,360	536,960	374,400	169,600	17,113,600
6	All land in farms.....acres..	424,702	268,843	202,403	301,155	347,974	388,429	464,069	314,505	182,744	11,717,679
7	Improved land in farms.....acres..	368,505	231,115	174,634	261,434	267,405	340,483	397,497	201,737	144,165	6,806,497
8	Woodland in farms.....acres..	35,940	30,050	24,924	34,823	72,728	34,028	52,212	104,561	13,345	4,405,282
9	Other unimproved land in farms.....acres..	20,257	7,678	2,845	4,898	7,841	18,918	14,360	8,207	5,234	505,620
10	Farm land reported as provided with drainage.....acres..	58,173	4,661	80,629	2,805	80,250	2,745	7,190	1,450	1,514	7,633
11	Farm land reported as needing drainage.....acres..	8,947	4,014	11,594	1,182	38,499	4,375	9,219	9,518	2,569	261,162
12	Drainage only.....acres..	4,669	854	1,961	745	1,885	4,601	1,750	4	1,150	5,877
13	Drainage and clearing.....acres..	4,278	3,160	9,633	438	36,614	774	7,469	9,514	1,419	275,286

<sup>1</sup> No drainage on farms reported in Carter, Douglas, McDonald, Osark, Stone, or Wright Counties.

DRAINAGE—MISSOURI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Adair.	Atchison.	Bates.	Bollinger.	Butler.	Cape Girardeau.	Carroll.	
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres.	43,985,280	365,440	337,920	556,800	389,760	447,360	371,200	449,020
2	All land in operating drainage enterprises.....acres.	2,596,284	8,800	46,982	49,626	33,765	232,800	37,236	52,224
3	Improved land.....acres.	1,474,302	7,200	43,364	24,813	1,712	63,800	23,477	45,038
4	Per cent of all improved land in farms.....	5.9	2.7	15.1	5.6	1.1	60.6	10.2	11.9
5	Timber and cut-over land.....acres.	1,074,880	1,000	98	11,808	32,053	169,000	13,759	2,194
6	Other unimproved land.....acres.	47,042	600	3,520	13,005				5,002
7	Swampy or subject to overflow, in enterprises.....acres.	454,360		10,987	6,276	31,621	103,700	1,151	
8	Suffering a loss of crops from defective drainage.....acres.	242,258	525	9,444	1,048	1,284	36,210		225
9	Assessed acreage.....acres.	3,104,889	8,800	46,982	49,626	33,765	232,800	37,236	72,464
10	Excess over all land in operating enterprises.....acres.	608,685							20,240
<b>DRAINAGE WORKS.</b>									
Open ditches:									
11	Completed.....miles.	3,438.7	12.3	103.8	39.5	9.4	177.4	71.9	78.6
12	Additional under construction.....miles.	460.4	4.7	6.4	5.8		168.4		
13	Maximum completed in any enterprise.....miles.	179.3	10.0	45.0	33.5	9.4	90.0	71.9	42.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet.	125	20	30	60	80	55	11	60
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet.	22.0	14.0	11.4	16.0	17.0	10.0	14.0	15.0
16	Mean depth of branch ditches <sup>1</sup> .....feet.	7.0		6.4	8.0		7.5	8.0	7.8
Tile drains:									
17	Completed.....miles.	38.3							6.1
18	Additional under construction.....miles.	5.9							2.9
19	Maximum completed in any enterprise.....miles.	15.0							3.0
20	Maximum size of tile <sup>1</sup> .....inches.	30							18
Accessory levees and dikes:									
21	Completed.....miles.	456.9		8.2		11.6	49.9	24.6	10.3
22	Additional under construction.....miles.	74.9		4.5			26.6		2.1
Pumping plants:									
23	Engine capacity.....horsepower.	2,785		125					
24	Pump capacity.....gallons per minute.	552,000		30,000					
25	Area served by pumps.....acres.	70,308		3,000					
26	Area drained by open ditches only <sup>1</sup> .....acres.	1,612,085	8,800	5,587	49,626		25,800		9,800
27	Length of these ditches.....miles.	2,450.3	17.0	19.8	44.8		47.8		31.6
28	Average length per acre.....feet.	8.1	10.2	18.7	4.8		9.8		17.0
29	Area having open ditches and levees <sup>1</sup> .....acres.	883,432		41,395		33,765	207,000	37,236	2,908
30	Length of these ditches.....miles.	1,278.3		20.4		9.4	298.0	71.9	4.5
31	Average length per acre.....feet.	7.6		11.5		1.5	7.6	10.2	8.2
32	Length of the accessory levees.....miles.	481.7		12.7		11.6	76.5	34.6	5.2
33	Area drained by tile only <sup>1</sup> .....acres.	760							
34	Length of these tile.....miles.	4.0							
35	Average length per acre.....feet.	27.8							
36	Area having tile and levees <sup>1</sup> .....acres.	7,000							7,000
37	Length of these tile.....miles.	3.0							3.0
38	Average length per acre.....feet.	2.3							2.3
39	Length of the accessory levees.....miles.	2.5							2.5
40	Area drained by open ditches and tile <sup>1</sup> .....acres.	46,240							31,680
41	Length of these drains.....miles.	88.9							45.0
42	Average length per acre.....feet.	10.2							7.5
43	Area having open ditches, tile, and levees <sup>1</sup> .....acres.	46,687							836
44	Length of these drains.....miles.	89.3							3.5
45	Average length per acre.....feet.	10.1							22.1
46	Length of the accessory levees.....miles.	47.6							4.7
<b>DEVELOPMENT OF LAND.</b>									
47	Improved land in operating enterprises, 1920.....acres.	1,474,302	7,200	43,364	24,813	1,712	63,800	23,477	45,038
48	Improved land prior to drainage.....acres.	760,793	2,300	36,081	3,138	1,688	39,200	1,862	34,356
49	Increase since drainage.....acres.	713,506	4,900	7,283	21,675	24	24,600	21,615	10,682
50	Per cent of increase <sup>2</sup> .....	93.8	213.0	20.2	680.7	1.4	62.8		31.1
51	Per cent increase is of all improved land in farms, 1920.....	2.9	1.8	2.5	4.9	(*)	23.4	9.4	2.8
52	Timber and cut-over land, 1920.....acres.	1,074,880	1,000	98	11,808	32,053	169,000	13,759	2,194
53	Timber and cut-over land prior to drainage.....acres.	1,646,297	3,800	1,418	11,808	32,077	193,600	35,374	8,156
54	Decrease since drainage.....acres.	571,417	2,800	1,320		24	24,600	21,615	5,972
55	Per cent of decrease.....	34.7	73.7	93.1		0.1	12.7	61.1	73.2
56	Other unimproved land, 1920.....acres.	47,042	600	3,520	13,005				5,002
57	Other unimproved land prior to drainage.....acres.	189,111	2,700	9,483	34,680				9,712
58	Decrease since drainage.....acres.	142,069	2,100	5,963	21,675				4,710
59	Per cent of decrease.....	76.1	77.8	62.9	62.5				48.5
60	Swampy or subject to overflow, 1920.....acres.	454,360		10,987	6,276	31,621	103,700	1,151	
61	Swampy or subject to overflow, prior to drainage.....acres.	2,013,704	2,100	27,099	49,626	32,077	211,940	35,374	25,006
62	Decrease since drainage.....acres.	1,559,344	2,100	16,112	43,350	456	108,240	34,223	25,006
63	Per cent of decrease.....	77.4	100.0	59.5	87.4	1.4	51.1	96.7	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
64	Total capital invested in and required for completion of operating enterprises.....dollars.	24,749,735	70,328	512,988	700,108	5,000	2,264,672	374,000	348,700
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	20,723,128	53,328	386,748	625,797	5,000	1,264,672	374,000	328,700
66	Additional capital required to complete these enterprises.....dollars.	4,026,607	17,000	126,240	74,311		1,000,000		20,000
67	Average cost per acre when completed.....dollars.	9.53	7.99	10.92	14.11	0.15	6.73	10.04	6.68
68	Enterprises constructing open ditches only.....dollars.	13,442,666	70,328	55,488	700,108		117,672		54,000
69	Average cost per acre when completed.....dollars.	8.34	7.99	9.93	14.11		4.56		6.51
70	Enterprises constructing open ditches and levees.....dollars.	9,215,065		457,565		5,000	2,147,000	374,000	10,700
71	Average cost per acre when completed.....dollars.	10.43		11.05		0.15	10.37	10.04	8.68
72	Enterprises constructing tile drains only.....dollars.	17,500							
73	Average cost per acre when completed.....dollars.	28.03							
74	Enterprises constructing tile drains and levees.....dollars.	14,000							14,000
75	Average cost per acre when completed.....dollars.	2.00							2.00
76	Enterprises constructing open ditches and tile drains.....dollars.	485,230							230,000
77	Average cost per acre when completed.....dollars.	10.49							7.28
78	Enterprises constructing open ditches, tile drains, and levees.....dollars.	1,575,274							40,000
79	Average cost per acre when completed.....dollars.	33.74							47.85
<b>CROPS.</b>									
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres.	980,387	7,200	43,364	24,813	1,712	63,800	23,477	31,540
81	Cotton as principal crop on drained land.....acres.	250,681							
82	Wheat as principal crop on drained land.....acres.	243,254							13,498

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

<sup>3</sup> Less than one-tenth of 1 per cent.



# DRAINAGE—MISSOURI.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Cass.	Chariton.	Clark.	Dunklin.	Henry.	Holt.	Johnson.	Knott.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres	461,440	491,520	318,720	339,200	476,160	285,440	531,840	828,960
2	All land in operating drainage enterprises.....	acres	13,180	49,554	25,474	250,483	11,407	41,708	34,657	6,811
3	Improved land.....	acres	6,590	41,170	21,344	150,143	10,266	40,259	28,235	3,481
4	Per cent of all improved land in farms.....		1.8	10.7	9.9	88.8	2.8	17.7	6.4	1.8
5	Timber and out-over land.....	acres	6,590	8,130	1,890	100,340	1,141	744	6,422	2,467
6	Other unimproved land.....	acres		254	2,240			705		863
7	Swampy or subject to overflow, in enterprises.....	acres	13,180	254	3,627	58,983		1,676		98
8	Suffering a loss of crops from defective drainage.....	acres	2,197	4,878	3,625	14,287		2,223		
9	Assessed acreage.....		13,180	49,554	25,474	250,483	11,407	41,708	34,657	6,811
10	Excess over all land in operating enterprises.....	acres								
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....	miles	12.2	53.2	44.7	800.6	26.5	67.8	89.8	12.8
12	Additional under construction.....	miles	11.6					1.4	3.4	
13	Maximum completed in any enterprise.....	miles	12.2	33.0	15.7	68.7	15.3	31.7	40.0	4.9
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet	25	30	70	123	18	100	80	75
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet	16.0	16.0	14.0	9.0	14.0	12.0	18.0	14.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet	8.0	5.9	4.5	7.2	3.0	5.2	3.5	7.8
Tile drains:										
17	Completed.....	miles			0.6	0.7				
18	Additional under construction.....	miles						0.8		
19	Maximum completed in any enterprise.....	miles			0.6	0.7				
20	Maximum size of tile <sup>1</sup> .....	inches			12	20				
Accessory levees and dikes:										
21	Completed.....	miles			19.0	66.0	3.0	12.7	3.0	
22	Additional under construction.....	miles							0.7	
Pumping plants:										
23	Engine capacity.....	horsepower			550					
24	Pump capacity.....	gallons per minute			100,000					
25	Area served by pumps.....	acres			6,100					
26	Area drained by open ditches only <sup>1</sup> .....	acres	13,180	49,554	8,874	136,512	6,971	18,208	26,845	6,811
27	Length of these ditches.....	miles	23.8	53.2	19.0	175.3	11.2	37.5	62.0	12.8
28	Average length per acre.....	feet	9.5	5.7	11.3	6.8	8.5	10.9	12.2	9.9
29	Area having open ditches and levees <sup>1</sup> .....	acres			10,500	118,171	4,436	23,500	3,208	
30	Length of these ditches.....	miles			15.7	122.6	15.3	31.7	11.2	
31	Average length per acre.....	feet			7.9	5.7	18.2	7.1	18.4	
32	Length of the accessory levees.....	miles			18.0	66.0	3.0	12.7	3.0	
33	Area drained by tile only <sup>1</sup> .....	acres								
34	Length of these tile.....	miles								
35	Average length per acre.....	feet								
36	Area having tile and levees <sup>1</sup> .....	acres								
37	Length of these tile.....	miles								
38	Average length per acre.....	feet								
39	Length of the accessory levees.....	miles								
40	Area drained by open ditches and tile <sup>1</sup> .....	acres				800				
41	Length of these drains.....	miles				3.4				
42	Average length per acre.....	feet				22.4				
43	Area having open ditches, tile, and levees <sup>1</sup> .....	acres			6,100				4,604	
44	Length of these drains.....	miles			10.6				20.8	
45	Average length per acre.....	feet			9.2				23.9	
46	Length of the accessory levees.....	miles			6.0				0.7	
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920.....	acres	6,590	41,170	21,344	150,143	10,266	40,259	28,235	3,481
48	Improved land prior to drainage.....	acres	6,590	24,790	14,130	105,201	3,834	27,925	10,599	1,380
49	Increase since drainage.....	acres		16,380	7,214	44,942	6,432	12,334	17,636	2,101
50	Per cent of increase.....			66.1	51.1	42.7	167.8	44.2	166.4	152.2
51	Per cent increase is of all improved land in farms, 1920.....			4.2	8.8	28.1	1.7	5.4	4.0	0.8
52	Timber and out-over land, 1920.....	acres	6,590	8,130	1,890	100,340	1,141	744	6,422	2,467
53	Timber and out-over land prior to drainage.....	acres	6,590	16,260	3,436	145,282	2,630	1,792	9,355	2,820
54	Decrease since drainage.....	acres		8,130	1,546	44,942	1,489	1,048	2,933	353
55	Per cent of decrease.....			50.0	45.0	30.9	56.6	58.5	31.4	12.5
56	Other unimproved land, 1920.....	acres		254	2,240			705		863
57	Other unimproved land prior to drainage.....	acres		8,504	7,908		4,943	11,991	14,708	2,611
58	Decrease since drainage.....	acres		8,250	5,668		4,943	11,266	14,703	1,748
59	Per cent of decrease.....			97.0	71.7		100.0	94.1	100.0	66.9
60	Swampy or subject to overflow, 1920.....	acres	13,180	254	3,627	58,983		1,676		98
61	Swampy or subject to overflow, prior to drainage.....	acres	13,180	49,554	16,397	141,918	10,520	34,449	20,688	3,421
62	Decrease since drainage.....	acres		49,300	12,770	82,935	10,520	32,773	20,688	3,323
63	Per cent of decrease.....			99.5	77.9	58.4	100.0	95.1	100.0	97.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises.....	dollars	341,892	270,420	444,378	1,147,685	139,353	398,850	351,553	55,082
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	181,203	270,420	444,378	1,147,685	139,353	397,850	323,378	55,082
66	Additional capital required to complete these enterprises.....	dollars	160,689					1,000	28,175	
67	Average cost per acre when completed.....	dollars	25.94	5.46	17.44	4.58	12.22	9.56	10.14	8.09
68	Enterprises constructing open ditches only.....	dollars	341,892	270,420	81,378	430,639	90,804	212,000	190,000	55,082
69	Average cost per acre when completed.....	dollars	25.94	5.46	9.17	3.15	13.03	11.64	7.03	8.09
70	Enterprises constructing open ditches and levees.....	dollars			180,000	706,816	48,649	186,850	35,109	
71	Average cost per acre when completed.....	dollars			17.14	6.25	10.94	7.95	10.94	
72	Enterprises constructing tile drains only.....	dollars								
73	Average cost per acre when completed.....	dollars								
74	Enterprises constructing tile drains and levees.....	dollars								
75	Average cost per acre when completed.....	dollars								
76	Enterprises constructing open ditches and tile drains.....	dollars				10,230				
77	Average cost per acre when completed.....	dollars				12.79				
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars			183,000				126,444	
79	Average cost per acre when completed.....	dollars			30.00				27.46	
<b>CROPS.</b>										
Improved land in enterprises reporting—										
80	Corn as principal crop on drained land.....	acres	6,590	39,130	10,919	1,106		40,259		3,481
81	Cotton as principal crop on drained land.....	acres				149,037				
82	Wheat as principal crop on drained land.....	acres		1,990	1,425		10,266		28,235	

<sup>1</sup> When works under construction have been completed.



COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Lafayette.	Lewis.	Lincoln.	Livingston.	Macon.	Marion.	Mississippi.	New Madrid.	Nodaway.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres	391,680	322,560	388,480	339,840	517,760	279,040	264,320	417,280	557,440
2	All land in operating drainage enterprises.....acres	12,079	16,125	16,800	48,207	17,244	23,794	204,845	371,287	16,208
3	Improved land.....acres	10,871	14,040	16,050	39,165	8,622	20,084	130,575	190,039	14,624
4	Per cent of all improved land in farms.....	3.4	5.8	6.3	15.6	2.1	10.5	83.6	97.3	2.9
5	Timber and cut-over land.....acres	1,208	1,747	750	9,042	1,724	2,052	73,314	181,248	1,584
6	Other unimproved land.....acres		338			6,898	1,658	956		
7	Swampy or subject to overflow, in enterprises.....acres	381	172	750	27,243	1,724		35,275	57,169	36
8	Suffering a loss of crops from defective drainage.....acres		453		5,323	86	1,436	31,846	20,512	208
9	Assessed acreage.....acres	12,079	16,125	16,800	48,207	17,244	23,794	338,235	650,953	16,208
10	Excess over all land in operating enterprises.....acres							133,390	279,606	
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....miles	23.1	32.7	29.2	74.7	19.0	17.7	210.5	698.6	36.2
12	Additional under construction.....miles							23.3	27.2	
13	Maximum completed in any enterprise.....miles	9.5	10.0	19.2	14.1	19.0	7.5	55.0	126.5	17.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	8	75	30	25	125	40	45	122	60
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	8.0	14.0	18.0	12.0	22.0	11.0	16.0	12.0	13.0
16	Mean depth of branch ditches <sup>1</sup> .....feet	3.0	7.0	3.9	3.6	8.0	5.5	8.1	6.4	4.0
<b>Tile drains:</b>										
17	Completed.....miles		1.3				26.9	2.8		
18	Additional under construction.....miles							1.7		
19	Maximum completed in any enterprise.....miles		1.0				15.0	1.5		
20	Maximum size of tile <sup>1</sup> .....inches		14				20	22		
<b>Accessory levees and dikes:</b>										
21	Completed.....miles	1.2	8.4	24.0			23.6	20.8	45.7	
22	Additional under construction.....miles				6.0			9.1	7.7	
<b>Pumping plants:</b>										
23	Engine capacity.....horsepower		( <sup>2</sup> )	( <sup>2</sup> )			1,500			
24	Pump capacity.....gallons per minute		( <sup>2</sup> )	( <sup>2</sup> )			225,000			
25	Area served by pumps.....acres		6,984	15,000			23,794			
26	Area drained by open ditches only <sup>1</sup> .....acres	6,950	9,141		40,653	17,244		197,521	247,105	16,208
27	Length of these ditches.....miles	21.5	24.1		60.6	19.0		209.5	608.0	36.2
28	Average length per acre.....feet	16.3	13.9		7.9	5.8		5.6	13.0	11.8
29	Area having open ditches and levees <sup>1</sup> .....acres	5,129		16,800	7,554			( <sup>4</sup> )	124,182	
30	Length of these ditches.....miles	1.6		29.2	14.1			6.8	117.8	
31	Average length per acre.....feet	1.6		9.2	9.9				5.0	
32	Length of the accessory levees <sup>1</sup> .....miles	1.2		24.0	6.0			29.7	53.4	
33	Area drained by tile only <sup>1</sup> .....acres							760		
34	Length of these tile.....miles							4.0		
35	Average length per acre.....feet							27.8		
36	Area having tile and levees <sup>1</sup> .....acres									
37	Length of these tile.....miles									
38	Average length per acre.....feet									
39	Length of the accessory levees.....miles									
40	Area drained by open ditches and tile <sup>1</sup> .....acres						4,010			
41	Length of these drains.....miles						22.5			
42	Average length per acre.....feet						29.6			
43	Area having open ditches, tile, and levees <sup>1</sup> .....acres		6,984				19,784	6,564		
44	Length of these drains.....miles		9.9				22.1	18.0		
45	Average length per acre.....feet		7.5				5.9	14.5		
46	Length of the accessory levees.....miles		8.4				23.6	0.2		
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920.....acres	10,871	14,040	16,050	39,165	8,622	20,084	130,575	190,039	14,624
48	Improved land prior to drainage.....acres	10,871	7,172	5,460	38,036	1,724	7,125	61,991	77,511	13,312
49	Increase since drainage.....acres		6,868	10,590	1,129	6,898	12,959	68,584	112,528	811
50	Per cent of increase.....		95.8	194.0	3.0	400.1	181.9	110.6	145.2	5.9
51	Per cent increase is of all improved land in farms, 1920.....		2.8	4.2	0.4	1.7	6.8	43.9	57.6	0.2
52	Timber and cut-over land, 1920.....acres	1,208	1,747	750	9,042	1,724	2,052	73,314	181,248	1,584
53	Timber and cut-over land prior to drainage.....acres	1,208	4,017	7,590	10,171	1,724	7,265	138,073	293,776	2,395
54	Decrease since drainage.....acres		2,270	6,840	1,129		5,213	64,759	112,528	811
55	Per cent of decrease.....		56.5	90.1	11.1		71.8	46.9	38.3	33.9
56	Other unimproved land, 1920.....acres		338			6,898	1,658	956		
57	Other unimproved land prior to drainage.....acres		4,936	3,750		13,796	9,404	4,781		
58	Decrease since drainage.....acres		4,598	3,750		6,898	7,746	3,825		
59	Per cent of decrease.....		93.2	100.0		50.0	82.4	80.0		
60	Swampy or subject to overflow, 1920.....acres	381	172	750	27,243	1,724		35,275	57,169	36
61	Swampy or subject to overflow prior to drainage.....acres	12,079	16,125	12,870	43,336	17,244	23,794	126,955	263,087	16,062
62	Decrease since drainage.....acres	11,698	15,953	12,120	16,143	15,520	23,794	91,680	205,918	16,026
63	Per cent of decrease.....	96.8	98.9	94.2	37.2	90.0	100.0	72.2	78.3	99.8
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises.....dollars	50,965	396,113	273,400	326,710	140,000	919,605	1,679,300	3,976,150	130,000
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars	50,965	396,113	273,400	278,710	140,000	919,605	1,435,050	3,640,650	130,000
66	Additional capital required to complete these enterprises.....dollars				48,000			244,250	335,500	
67	Average cost per acre when completed.....dollars	4.23	24.57	16.27	6.78	8.12	38.65	8.20	10.71	8.08
68	Enterprises constructing open ditches only.....dollars	37,137	119,888		166,710	140,000		1,067,800	3,080,180	130,000
69	Average cost per acre when completed.....dollars	5.34	13.12		4.10	8.12		5.41	12.46	8.02
70	Enterprises constructing open ditches and levees.....dollars	13,828		273,400	160,000			454,000	896,000	
71	Average cost per acre when completed.....dollars	2.70		16.27	21.18				7.22	
72	Enterprises constructing tile drains only.....dollars							17,500		
73	Average cost per acre when completed.....dollars							23.03		
74	Enterprises constructing tile drains and levees.....dollars									
75	Average cost per acre when completed.....dollars									
76	Enterprises constructing open ditches and tile drains.....dollars						150,000			
77	Average cost per acre when completed.....dollars						37.41			
78	Enterprises constructing open ditches, tile drains, and levees.....dollars		278,225				769,605	140,000		
79	Average cost per acre when completed.....dollars		39.55				33.90	21.33		
<b>CROPS.</b>										
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres	10,871	8,419	1,800	33,500	8,622		74,085	154,239	14,624
81	Cotton as principal crop on drained land.....acres								39,800	
82	Wheat as principal crop on drained land.....acres		5,621	14,260	8,665		20,084	56,490	6,000	

<sup>1</sup> When works under construction have been completed.  
<sup>2</sup> Pump located in Marion County.

<sup>3</sup> Pump located in Pike County.  
<sup>4</sup> Included in area drained by open ditches only.

DRAINAGE—MISSOURI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Pemiscot.	Perry.	Pika.	Platte.	Ray.	Ripley.	St. Charles.	St. Louis.	
<b>LAND AREA.</b>									
1	Approximate land area of the county.....acres	291,940	295,680	417,920	265,600	361,600	401,280	342,400	311,680
2	All land in operating drainage enterprises.....acres	270,118	26,000	14,430	4,914	7,448	29,576	18,275	4,500
3	Improved land.....acres	81,641	22,000	8,608	4,914	6,897	17,745	17,070	4,500
4	Per cent of all improved land in farms.....	89.0	13.4	2.9	2.6	2.6	20.2	7.4	2.5
5	Timber and cut-over land.....acres	188,477	3,000	5,822			11,831	1,138	
6	Other unimproved land.....acres					551		67	
7	Swampy or subject to overflow, in enterprises.....acres			5,400		551	7,394	2,100	
8	Suffering a loss of crops from defective drainage.....acres	71,815				248	4,436	49	
9	Assessed acreage.....acres	270,118	26,000	14,430	4,914	7,448	29,576	18,275	4,500
10	Excess over all land in operating enterprises.....acres								
<b>DRAINAGE WORKS.</b>									
11	Open ditches: Completed.....miles	246.8	20.0	17.7	3.2	17.8	31.2	18.7	14.5
12	Additional under construction.....miles	116.0						0.4	
13	Maximum completed in any enterprise.....miles	130.1	20.0	10.7	3.2	11.0	13.1	8.1	10.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	123	20	30	12	40	30	32	14
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	12.0	8.0	18.0	12.0	10.0	7.5	20.0	9.0
16	Mean depth of branch ditches <sup>1</sup> .....feet	7.4	6.0	4.0		4.0	6.1		4.0
17	Tile drains: Completed.....miles								
18	Additional under construction.....miles								
19	Maximum completed in any enterprise.....miles								
20	Maximum size of tile <sup>1</sup> .....inches								
21	Accessory levees and dikes: Completed.....miles	20.0	10.0	33.3		1.3			
22	Additional under construction.....miles			2.2					
23	Pumping plants: Engine capacity.....horsepower			550					
24	Pump capacity.....gallons per minute			190,000					
25	Area served by pumps.....acres			14,430					
26	Area drained by open ditches only <sup>1</sup> .....acres	101,508			4,914	1,938	29,576	18,275	4,500
27	Length of these ditches.....miles	232.7			3.2	6.8	31.2	19.1	14.5
28	Average length per acre.....feet	6.4			3.4	18.5	5.6	5.5	17.0
29	Area having open ditches and levees <sup>1</sup> .....acres	78,610	26,000	14,430		5,610			
30	Length of these ditches.....miles	130.1	20.0	17.7		11.0			
31	Average length per acre.....feet	8.7	4.2	6.5		10.5			
32	Length of the accessory levees.....miles	20.0	10.0	26.5		1.3			
33	Area drained by tile only <sup>1</sup> .....acres								
34	Length of these tile.....miles								
35	Average length per acre.....feet								
36	Area having tile and levees <sup>1</sup> .....acres								
37	Length of these tile.....miles								
38	Average length per acre.....feet								
39	Length of the accessory levees.....miles								
40	Area drained by open ditches and tile <sup>1</sup> .....acres								
41	Length of these drains.....miles								
42	Average length per acre.....feet								
43	Area having open ditches, tile, and levees <sup>1</sup> .....acres								
44	Length of these drains.....miles								
45	Average length per acre.....feet								
46	Length of the accessory levees.....miles								
<b>DEVELOPMENT OF LAND.</b>									
47	Improved land in operating enterprises, 1920.....acres	81,641	22,000	8,608	4,914	6,897	17,745	17,070	4,500
48	Improved land prior to drainage.....acres	40,860	22,000	2,708	2,457	2,128	11,831	12,829	2,615
49	Increase since drainage.....acres	40,881		5,900	2,457	4,769	5,914	4,241	1,884
50	Per cent of increase.....	100.0		217.9	100.0	224.1	50.0	33.1	72.4
51	Per cent increase is of all improved land in farms, 1920.....	34.6		2.0	1.3	1.8	6.7	1.8	1.1
52	Timber and cut-over land, 1920.....acres	188,477	3,000	5,822			11,831	1,138	
53	Timber and cut-over land prior to drainage.....acres	229,458	3,000	9,615		97	17,745	1,138	792
54	Decrease since drainage.....acres	40,981		3,793		97	5,914		792
55	Per cent of decrease.....	17.9		39.4		100.0	33.3		100.0
56	Other unimproved land, 1920.....acres					551		67	
57	Other unimproved land prior to drainage.....acres			2,107	2,457	5,223		4,308	1,102
58	Decrease since drainage.....acres			2,107	2,457	4,872		4,241	1,102
59	Per cent of decrease.....			100.0	100.0	89.5		68.4	100.0
60	Swampy or subject to overflow, 1920.....acres			5,400		551	7,394	2,100	
61	Swampy or subject to overflow prior to drainage.....acres	267,760	17,500	11,722	4,914	5,611	17,745	3,750	8,907
62	Decrease since drainage.....acres	267,760	17,500	6,322	4,914	5,060	10,351	1,650	8,907
63	Per cent of decrease.....	100.0	100.0	53.9	100.0	90.2	58.3	44.0	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
64	Total capital invested in and required for completion of operating enterprises.....dollars	3,624,505	122,000	504,600	15,000	77,175	90,260	80,339	39,294
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars	2,359,968	122,000	484,600	15,000	77,175	90,260	79,339	39,294
66	Additional capital required to complete these enterprises.....dollars	1,264,517		20,000				1,000	
67	Average cost per acre when completed.....dollars	13.42	4.68	34.97	3.05	10.36	3.05	4.40	8.71
68	Enterprises constructing open ditches only.....dollars	2,410,508			15,000	24,785	90,260	80,339	39,294
69	Average cost per acre when completed.....dollars	12.62			3.05	12.79	3.05	4.40	8.71
70	Enterprises constructing open ditches and levees.....dollars	1,208,000	122,000	504,600		52,390			
71	Average cost per acre when completed.....dollars	15.37	4.68	34.97		9.51			
72	Enterprises constructing tile drains only.....dollars								
73	Average cost per acre when completed.....dollars								
74	Enterprises constructing tile drains and levees.....dollars								
75	Average cost per acre when completed.....dollars								
76	Enterprises constructing open ditches and tile drains.....dollars								
77	Average cost per acre when completed.....dollars								
78	Enterprises constructing open ditches, tile drains, and levees.....dollars								
79	Average cost per acre when completed.....dollars								
<b>CROPS.</b>									
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres	9,797	22,000	600	4,914	4,959	17,745		
81	Cotton as principal crop on drained land.....acres	71,844							
82	Wheat as principal crop on drained land.....acres			8,008		1,938		17,070	4,500

<sup>1</sup> When works under construction have been completed.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Saline.	Scotland.	Scott.	Shelby.	Stoddard.	Wayne.	Worth.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres.	482,560	280,960	268,160	225,760	531,600	498,000	169,600	3,862,400
2	All land in operating drainage enterprises.....	acres.	7,184	15,110	154,335	9,697	375,037	9,000	7,013	23,232
3	Improved land.....	acres.	6,713	6,867	116,441	7,453	194,315	900	3,156	20,111
4	Per cent of all improved land in farms.....		1.8	3.0	68.7	2.9	72.7	0.9	2.2	0.7
5	Timber and cut-over land.....	acres.	471	3,445	37,894	2,244	180,722	8,100	351	1,070
6	Other unimproved land.....	acres.		4,798					3,506	2,081
7	Swampy or subject to overflow, in enterprises.....	acres.	471	1,300	1,950		62,837	8,100	5,961	3,993
8	Suffering a loss of crops from defective drainage.....	acres.			5,682	7,936	13,969	450		1,865
9	Assessed acreage.....		7,184	15,110	229,724	9,697	375,037	9,000	7,013	23,232
10	Excess over all land in operating enterprises.....	acres.			75,389					
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....	miles.	21.3	37.5	245.2	12.7	459.5	0.5	2.3	47.6
12	Additional under construction.....	miles.			3.1		48.4	22.2	15.1	3.5
13	Maximum completed in any enterprise.....	miles.	6.5	17.5	55.7	10.2	179.3	0.5	2.3	10.8
14	Maximum width at bottom of ditch.....	feet.	35	18	60	75	81	40	22	60
15	Maximum of average depths of outlet ditches.....	feet.	8.0	9.0	15.0	14.5	12.0	12.0	15.0	12.0
16	Mean depth of branch ditches.....	feet.	4.0		7.2	7.0	7.2	8.0	7.0	6.6
<b>Tile drains:</b>										
17	Completed.....	miles.								0.4
18	Additional under construction.....	miles.			0.5					
19	Maximum completed in any enterprise.....	miles.								0.2
20	Maximum size of tile.....	inches.								12
<b>Accessory levees and dikes:</b>										
21	Completed.....	miles.	9.4		25.0	10.2	0.5			5.2
22	Additional under construction.....	miles.					5.4	2.6		3.0
<b>Pumping plants:</b>										
23	Engine capacity.....	horsepower.	60							
24	Pump capacity.....	gallons per minute.	7,000							
25	Area served by pumps.....	acres.	1,000							
26	Area drained by open ditches only.....	acres.		15,110	70,359	1,200	347,537		7,013	18,756
27	Length of these ditches.....	miles.		37.5	100.1	2.5	444.4		17.4	36.2
28	Average length per acre.....	feet.		13.1	7.5	11.0	6.8		13.1	10.2
29	Area having open ditches and levees.....	acres.	7,184		74,226	8,497	27,500	9,000		2,601
30	Length of these ditches.....	miles.	21.3		130.7	10.2	63.5	22.7		10.9
31	Average length per acre.....	feet.	15.7		9.3	6.3	12.2	13.3		21.4
32	Length of the accessory levees.....	miles.	9.4		25.0	10.2	5.9	2.6		9.2
33	Area drained by tile only.....	acres.								
34	Length of these tile.....	miles.								
35	Average length per acre.....	feet.								
36	Area having tile and levees.....	acres.								
37	Length of these tile.....	miles.								
38	Average length per acre.....	feet.								
39	Length of the accessory levees.....	miles.								
40	Area drained by open ditches and tile.....	acres.			9,759					
41	Length of these drains.....	miles.			18.0					
42	Average length per acre.....	feet.			9.7					
43	Area having open ditches, tile, and levees.....	acres.								1,815
44	Length of these drains.....	miles.								4.4
45	Average length per acre.....	feet.								12.8
46	Length of the accessory levees.....	miles.								4.0
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920.....	acres.	6,713	6,867	116,441	7,453	194,315	900	3,156	20,111
48	Improved land prior to drainage.....	acres.	4,343	4,533	29,354	430	71,309	900	3,156	12,716
49	Increase since drainage.....	acres.	2,370	2,334	87,087	6,973	123,006			7,395
50	Per cent of increase.....		54.6	51.5	296.7	2.7	172.5			58.2
51	Per cent increase is of all improved land in farms, 1920.....		0.6	1.0	49.9	2.7	46.0			0.3
52	Timber and cut-over land, 1920.....	acres.	471	3,445	37,894	2,244	180,722	8,100	351	1,070
53	Timber and cut-over land prior to drainage.....	acres.	471	5,268	120,680	3,274	303,728	8,100	351	1,943
54	Decrease since drainage.....	acres.		1,843	82,786	1,030	123,006			873
55	Per cent of decrease.....			34.9	68.6	31.5	40.5			44.9
56	Other unimproved land, 1920.....	acres.		4,798					3,506	2,081
57	Other unimproved land prior to drainage.....	acres.	2,370	5,289	4,301	5,943			3,506	3,603
58	Decrease since drainage.....	acres.	2,370	491	4,301	5,943				6,522
59	Per cent of decrease.....		100.0	9.3	100.0	100.0				75.8
60	Swampy or subject to overflow, 1920.....	acres.	471	1,300	1,950		62,837	8,100	5,961	3,993
61	Swampy or subject to overflow prior to drainage.....	acres.	3,927	15,110	114,947	6,723	303,728	8,100	5,961	17,245
62	Decrease since drainage.....	acres.	3,456	13,810	112,997	6,723	240,891			13,252
63	Per cent of decrease.....		88.0	91.4	98.3	100.0	79.3			77.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises.....	dollars.	82,542	144,324	1,008,981	90,588	2,996,940	155,000	170,000	230,935
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.	82,542	144,324	989,981	90,588	2,659,540	3,100	16,000	207,310
66	Additional capital required to complete these enterprises.....	dollars.			19,000		337,400	161,900	154,000	23,625
67	Average cost per acre when completed.....	dollars.	11.49	9.55	6.54	9.34	7.99	17.22	24.24	9.93
68	Enterprises constructing open ditches only.....	dollars.		144,324	227,517	18,588	2,644,623		170,000	169,935
69	Average cost per acre when completed.....	dollars.		9.55	3.23	15.49	7.61		24.24	8.53
70	Enterprises constructing open ditches and levees.....	dollars.	82,542		698,464	72,000	352,317	155,000		31,000
71	Average cost per acre when completed.....	dollars.	11.49		9.25	5.47	12.81	17.22		11.52
72	Enterprises constructing tile drains only.....	dollars.			95,000					
73	Average cost per acre when completed.....	dollars.			9.74					
74	Enterprises constructing open ditches and tile drains.....	dollars.								
75	Average cost per acre when completed.....	dollars.								
76	Enterprises constructing tile drains and levees.....	dollars.								
77	Average cost per acre when completed.....	dollars.								
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars.								40,000
79	Average cost per acre when completed.....	dollars.								22.04
<b>CROPS.</b>										
80	Improved land in enterprises reporting— Corn as principal crop on drained land.....	acres.	4,341	6,867	76,371	7,453	194,315	900	3,156	14,468
81	Cotton as principal crop on drained land.....	acres.								
82	Wheat as principal crop on drained land.....	acres.	2,472		40,070					5,643

<sup>1</sup> Includes only Andrew, Buchanan, Caldwell, Callaway, Clay, Grundy, Howard, Jackson, Linn, Osage, Putnam, and Schuyler Counties.  
<sup>2</sup> When works under construction have been completed. <sup>3</sup> Per cent not shown when more than 1,000.

# MONTANA.

The following pages present the statistics of drainage for Montana collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The

statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

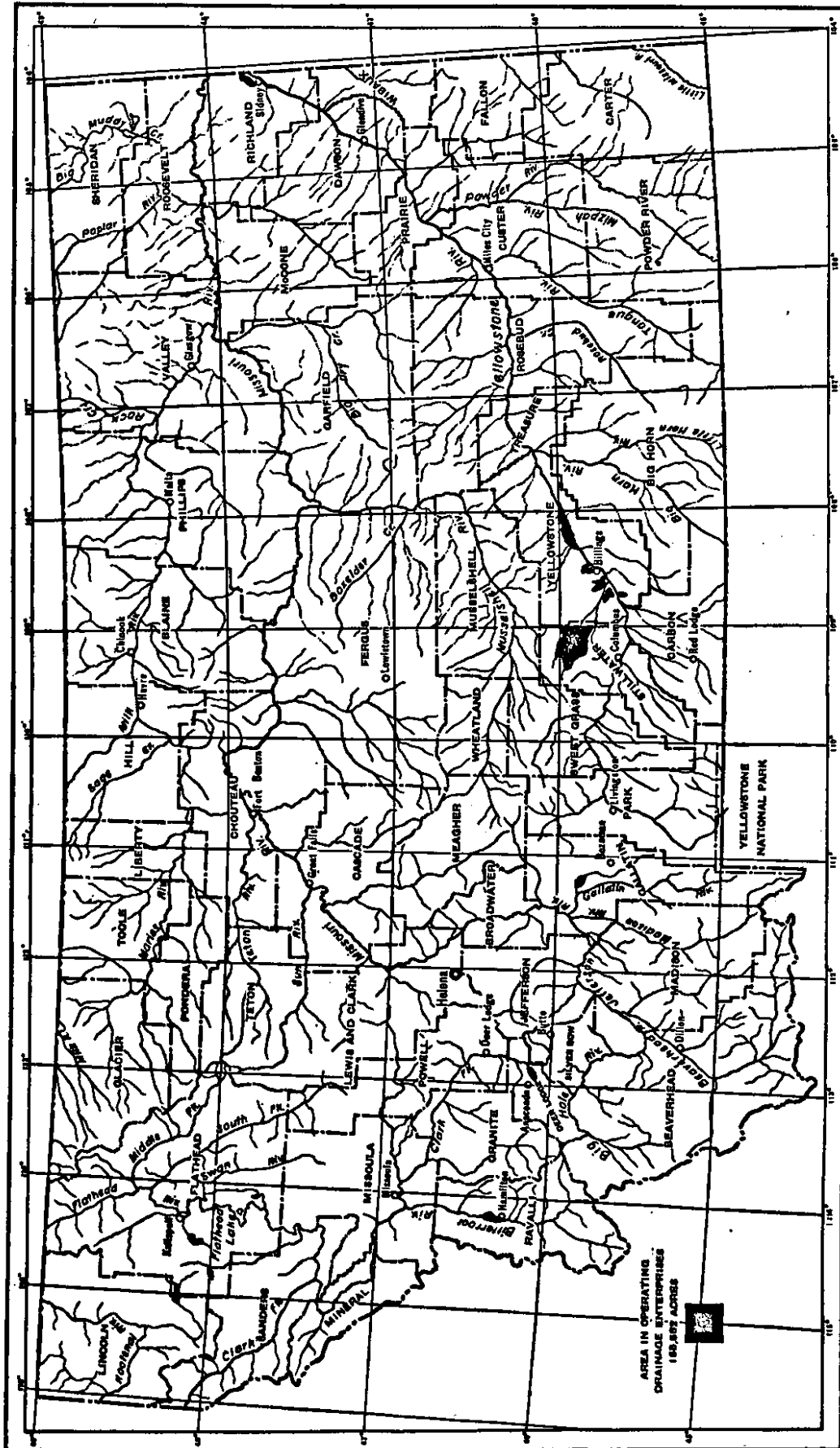
ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	57,677	100.0
Farms reporting land having drainage.....	758 <sup>1</sup>	1.3
Farms reporting land needing drainage.....	1,728	3.0
All land in farms..... acres..	35,070,656	100.0
Improved land in farms..... acres..	11,007,278	31.4
Farm land reported as provided with drainage..... acres..	51,146	0.1
Farm land reported as needing drainage..... acres..	113,293	0.3
Needing drainage only..... acres..	36,342	0.1
Needing drainage and clearing..... acres..	76,951	0.2
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	98,523,840	100.0
All land in operating drainage enterprises..... acres..	168,682	0.2
Improved land..... acres..	141,252	0.2
Per cent of all improved land in farms.....	1.3	
Unimproved land <sup>1</sup> ..... acres..	27,430	(2)
Swampy, subject to overflow, seeped, or alkali..... acres..	19,630	(2)
Suffering a loss of crops from defective drainage..... acres..	21,964	(2)
Improved land prior to drainage..... acres..	107,645	0.1
Increase since drainage began..... acres..	33,607	(2)
Land in nonoperating enterprises..... acres..		
Open ditches in operating enterprises..... miles..	103.4	100.0
Completed..... miles..	102.1	98.7
Additional under construction..... miles..	1.3	1.3
Tile drains in operating enterprises..... miles..	36.9	100.0
Completed..... miles..	50.7	58.3
Additional under construction..... miles..	36.2	41.7
Total capital invested in and required for completion of operating enterprises..	\$346,466	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	664,990	78.6
Additional capital required to complete these enterprises.....	181,476	21.4
Average cost per acre when completed.....	5.02	

<sup>1</sup> No timber or cut-over land reported.

<sup>2</sup> Less than one-tenth of 1 per cent.

# MONTANA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in Montana. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>2</sup> ...	168,682	100.0	\$664,990	100.0	\$181,476
With works completed.....	44,682	26.5	393,969	59.2	.....
With works under construction..	124,000	73.5	271,021	40.8	181,476

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

<sup>2</sup> No nonoperating enterprises in Montana.

Location of enterprises.—Of the 17 drainage enterprises in Montana, 8 are situated in Yellowstone County, in the south-central part of the state, 6 are west of the Continental Divide, and the 3 others are in Gallatin, Richland, and Stillwater Counties.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> ....	168,682	100.0	\$664,990	100.0	\$181,476
Clarks Fork.....	6,700	4.0	22,766	3.4	.....
Kootenai River.....	7,650	4.5	127,000	19.1	.....
Yellowstone River.....	149,332	88.5	510,974	76.8	181,476
Missouri River.....	5,000	3.0	4,250	0.6	.....

<sup>1</sup> No nonoperating enterprises in Montana.

Condition of land in enterprises.—With one exception, all the enterprises east of the Continental Divide are for the drainage and protection of land damaged or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. The enterprises on the Pacific slope are reported as all for the drainage and protection of land that was swampy or subject to overflow by stream floods.

For the state, 3,930 acres in drainage districts and 61,831 acres in United States Reclamation Service projects are reported as not having needed drainage, or not expected to receive drainage or protection from

the improvement works authorized, but as having been assessed merely as being responsible for damage to the other land. This acreage in the United States Reclamation Service projects has been omitted from the tabulations in this bulletin.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES. <sup>1</sup>			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	168,682	100.0	44,682	124,000
Improved land.....	141,252	83.7	38,642	102,610
Unimproved land <sup>2</sup> .....	27,430	16.3	6,040	21,390
Swampy, subject to overflow, seeped, etc.	19,630	11.6	1,640	17,990
Suffering a loss of crops.....	21,964	13.0	3,004	18,960

<sup>1</sup> No nonoperating enterprises in Montana.

<sup>2</sup> No timber or cut-over land reported.

Size of enterprises.—The average area included in the 17 drainage enterprises in Montana is 9,922 acres. None of the enterprises embraces land in more than one county, and there is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	168,682	168,682	100.0
500 to 999 acres.....	1,307	1,307	0.8
1,000 to 4,999 acres.....	23,711	23,711	14.1
5,000 to 9,999 acres.....	19,664	19,664	11.7
10,000 to 49,999 acres.....	24,000	24,000	14.2
50,000 to 99,999 acres.....	.....	.....	.....
100,000 to 499,999 acres.....	100,000	100,000	59.3

Character of enterprises.—Most of the drainage enterprises organized under the state laws were established in accordance with the law of March 7, 1905 (ch. 106). That law provided for a county drain commissioner, with duties generally the same as provided in the law of March 11, 1915 (ch. 147), and for a very similar method of organizing drainage districts. Amendments made in 1907 and 1909 did not affect the form of organization.

The drainage law of 1915 provides for the appointment of a county drain commissioner by the board of county commissioners, to have jurisdiction over all established drains in his county. A petition for a drain must be signed by not less than ten freeholders of the county, including at least five (or at least half when the whole number is five or less) who own land liable for assessment for the proposed improvement. The tracts of land and the cities, towns, counties, railways, and irrigation ditches assessed for the construction of a drain comprise the drainage district. Land liable to become water-logged may be included. Damages and inconvenience caused by seepage and waste water from irrigation ditches and higher land are to be considered in apportioning the cost, which is borne by the various parts of the district in proportion to the benefits that will be conferred.

A first order of determination for the drainage district is issued by the drain commissioner if his preliminary examination indicates that the enterprise is practicable; the final order of determination is issued when right of way for the drain has been secured. The plan of drainage is determined by the drain commissioner, who lets contract for construction. Damages for right of way are awarded by a board of special commissioners appointed by the district court. If this board decides that the drain is unnecessary, proceedings for establishing the drain are dismissed at the applicants' expense. Appeal from this board's award may be taken to the district court for jury trial. Apportionment of the cost is made by the drain commissioner, subject to review by a board appointed by the district court and to further appeal for jury trial. This board of review may add to the district or eliminate any part of it. Public hearings are held upon the petition for commissioners to determine damages and upon the drain commissioner's apportionment of cost. Damages awarded each individual are deducted from the assessment of cost made against him. The number of installments for collecting the drainage taxes, which must not extend more than 10 years, is determined by the drain commissioner. Payments for damages, services, and materials are made by warrants drawn upon the funds of the district, but those for land and for damages in excess of benefits will be paid from general county funds, which will be reimbursed by the district.

Petition for a drain to be located or to confer benefits in more than one county may be filed in either county affected. The drain commissioners act jointly, but after they apportion the total cost between the counties each makes the apportionment within his own county.

Drainage and protection against seepage and alkali for land in projects of the United States Reclamation Service may be provided by that service as such improvement works are deemed necessary.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	168,682	100.0	\$664,990	100.0	\$181,476
Drainage districts.....	129,432	76.7	208,173	31.3	104,043
Laws of 1905, ch. 106.....	29,432	17.4	133,150	27.5	.....
Laws of 1915, ch. 147.....	100,000	59.3	25,023	3.8	104,043
U. S. Reclamation Service.....	25,600	15.2	322,567	48.5	77,433
Individual ownership <sup>2</sup> .....	13,650	8.1	134,250	20.2	.....

<sup>1</sup> No nonoperating enterprises in Montana.

<sup>2</sup> Includes 1,000 acres in commercial development.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 102.1 miles of open ditches and 50.7 miles of tile drains; the additional lengths under construction were 1.3 miles of open ditches and 36.2 miles of tile drains. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises. No levees or dikes have been built or authorized by any of the drainage enterprises. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	168,682	100.0	\$664,990	100.0	\$181,476
Open ditches only.....	42,082	24.9	314,400	47.3	.....
Open ditches and tile drains <sup>1</sup> .....	126,600	75.1	350,590	52.7	181,476

<sup>1</sup> Includes 1,000 acres drained by tile only.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were

omitted; to include this group, computed as 3 feet, would show the mean depth for the state 6.0 instead of 6.3 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	168,682	100.0
Less than 3 feet.....	3,650	2.2
3.0 to 3.9 feet.....	5,000	3.0
4.0 to 4.9 feet.....	4,000	2.4
5.0 to 5.9 feet.....	24,000	14.2
6.0 to 6.9 feet.....	132,032	78.3
7.0 to 7.9 feet.....		
Not reporting branches.....		

**Maintenance of works.**—The drainage law of 1915 requires the county drain commissioner to keep the drains under his supervision in proper repair, and to include in his annual report to the board of county commissioners an estimate of the funds that will be required during the ensuing year for inspection and maintenance of each drain. The assessment for maintenance and repair shall not exceed in any year 5 per cent of the cost of original construction. The cost of the maintenance work is assessed against the parts of the district according to the benefits that will accrue, though this may be different from the apportionment of the cost of original construction. If the total cost for any maintenance work is estimated to exceed the funds available for that drain, application must be filed and a special assessment levied, in most respects the same as for establishing a new drain.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	168,682	100.0	\$664,990	100.0	\$181,476
By district forces.....	25,000	15.2	\$22,567	48.5	77,433
By contract.....	23,732	14.1	183,384	24.6	
No maintenance provided <sup>1</sup> .....	10,350	6.1	55,250	8.3	
Not reporting.....	109,000	64.6	123,789	18.6	104,043

<sup>1</sup> Includes 3,650 acres maintained by landowners.

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the drain commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or

of the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	168,682	100.0	168,682	100.0
1905 to 1909.....	21,533	12.8	21,533	12.8
1910 to 1914.....	30,499	18.1	30,499	18.1
1915 to 1919.....	104,090	61.7	104,090	61.7
Not reported <sup>1</sup> .....	12,650	7.5	12,650	7.5

<sup>1</sup> All under individual ownership.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$664,990	100.0	\$181,476
1905 to 1909.....	105,248	15.8	
1910 to 1914.....	87,136	10.1	
1915 to 1919.....	284,787	42.8	181,476
Not reported <sup>1</sup> .....	207,819	31.3	

<sup>1</sup> All under individual ownership.

TABLE 12.—DRAINS (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains.....	103.4	100.0	86.9	100.0
1905 to 1909.....	24.0	23.2		
1910 to 1914.....	11.2	10.8	82.0	94.4
1915 to 1919.....	20.7	20.0	3.8	4.4
Not reported <sup>1</sup> .....	47.5	45.9	1.1	1.3

<sup>1</sup> All under individual ownership.

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are wheat, alfalfa, and hay other than alfalfa. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.



DRAINAGE—MONTANA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Beaverhead.	Blaine.	Carbon.	Deer Lodge.	Flathead.
1	Number of all farms in the state or county.....	57,677	642	1,761	1,353	202	1,923
2	Farms reporting land having drainage.....	758	9	4	35	57	111
3	Farms reporting land needing drainage.....	1,728	39	9	79	11	410
4	Farms in drainage and levee districts.....	336			3	50	23
<b>LAND AND FARM AREA.</b>							
5	Approximate land area of the state or county.....acres..	93,523,840	3,620,480	2,706,560	1,318,400	476,800	3,909,760
6	All land in farms.....acres..	35,070,656	637,009	1,159,056	446,386	58,484	470,283
7	Improved land in farms.....acres..	11,007,278	270,603	291,431	178,503	24,210	179,201
8	Woodland in farms.....acres..	1,646,462	7,142	11,334	17,644	3,143	127,244
9	Other unimproved land in farms.....acres..	22,416,916	359,264	856,291	250,239	31,131	163,838
10	Farm land reported as provided with drainage.....acres..	51,146	977	950	1,145	1,127	7,898
11	Farm land reported as needing drainage.....acres..	113,293	2,025	432	3,316	733	24,598
12	Drainage only.....acres..	36,342	1,231	167	1,805	360	1,297
13	Drainage and clearing.....acres..	76,951	794	265	1,511	373	23,301

		Gallatin.	Granite.	Jefferson.	Lincoln.	Madison.	Missoula.
1	Number of all farms in the county.....	1,349	354	555	341	901	1,323
2	Farms reporting land having drainage.....	48	12	6	34	11	39
3	Farms reporting land needing drainage.....	109	60	17	59	57	83
4	Farms in drainage and levee districts.....	12			1	1	2
<b>LAND AND FARM AREA.</b>							
5	Approximate land area of the county.....acres..	1,604,480	1,068,880	1,044,480	2,319,360	2,318,080	2,030,720
6	All land in farms.....acres..	783,189	254,148	281,494	65,050	564,516	388,408
7	Improved land in farms.....acres..	350,776	72,336	80,933	16,894	168,635	173,031
8	Woodland in farms.....acres..	35,261	30,961	4,421	33,979	11,162	72,897
9	Other unimproved land in farms.....acres..	397,152	150,851	196,140	14,177	384,719	142,480
10	Farm land reported as provided with drainage.....acres..	5,881	1,407	870	1,324	546	4,628
11	Farm land reported as needing drainage.....acres..	6,587	4,914	348	4,095	6,316	6,126
12	Drainage only.....acres..	3,687	373	208	361	4,755	515
13	Drainage and clearing.....acres..	2,900	4,541	140	3,734	1,561	5,611

		Phillips.	Powell.	Ravalli.	Richland.	Yellowstone.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,014	476	1,231	1,577	2,211	39,564
2	Farms reporting land having drainage.....	7	13	42	7	260	61
3	Farms reporting land needing drainage.....	7	51	180	46	147	364
4	Farms in drainage and levee districts.....		2	6	1	222	13
<b>LAND AND FARM AREA.</b>							
5	Approximate land area of the county.....acres..	3,313,920	1,490,560	1,530,240	1,345,920	1,671,040	61,724,160
6	All land in farms.....acres..	1,084,725	520,065	245,965	812,194	1,067,425	26,232,259
7	Improved land in farms.....acres..	227,811	125,924	114,473	311,006	333,174	8,088,337
8	Woodland in farms.....acres..	6,239	73,902	43,460	11,242	268,423	887,988
9	Other unimproved land in farms.....acres..	850,675	320,239	88,032	489,946	465,828	17,255,934
10	Farm land reported as provided with drainage.....acres..	780	2,642	1,190	1,047	15,592	3,142
11	Farm land reported as needing drainage.....acres..	311	4,026	7,335	2,806	3,955	35,370
12	Drainage only.....acres..	210	1,681	903	1,425	3,339	14,025
13	Drainage and clearing.....acres..	101	2,345	6,432	1,381	616	21,345

<sup>1</sup> No drainage on farms reported in Carter, Chouteau, Custer, Garfield, Hill, Liberty, Pondera, Powder River, Prairie, Roosevelt, Sheridan, Stillwater, Valley, Wheatland, and Wibaux Counties.

# DRAINAGE—MONTANA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Deer Lodge, Flathead, Lincoln, and Ravalli.	Gallatin, Richland, and Stillwater.	Yellow- stone.
<b>LAND AREA.</b>					
1	Approximate land area of the state or county.....	93,523,840	8,236,160	4,087,680	1,671,040
2	All land in operating drainage enterprises.....	168,682	14,350	106,600	47,732
3	Improved land.....	141,252	9,150	89,170	42,932
4	Per cent of all improved land in farms.....	1.3	2.7	9.5	12.9
5	Unimproved land.....	27,430	5,200	17,430	4,800
6	Swampy, subject to overflow, seeped, or alkali land, in enterprises.....	19,630	800	17,430	1,400
7	Suffering a loss of crops from defective drainage.....	21,964	300	21,664	.....
8	Assessed acreage.....	168,682	14,350	106,600	47,732
9	Excess over all land in enterprises.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>					
Open ditches:					
10	Completed.....	102.1	45.7	15.2	41.2
11	Additional under construction.....	1.3	.....	1.3	.....
12	Maximum completed in any enterprise.....	20.0	20.0	8.5	16.0
13	Maximum width at bottom of ditch <sup>1</sup> .....	25	25	8	10
14	Maximum of average depths of outlet ditches <sup>2</sup> .....	12.0	10.0	9.0	12.0
15	Mean depth of branch ditches <sup>2</sup> .....	6.3	5.0	4.0	7.0
Tile drains:					
16	Completed.....	50.7	0.8	1.1	48.8
17	Additional under construction.....	35.2	.....	3.8	32.4
18	Maximum completed in any enterprise.....	48.8	0.8	3.8	48.8
19	Maximum size of tile <sup>3</sup> .....	24	24	20	20
20	Area drained by open ditches only <sup>4</sup> .....	42,082	13,350	5,000	23,732
21	Length of these ditches.....	79.4	45.7	8.5	25.2
22	Average length per acre.....	10.0	18.1	9.0	5.6
23	Area drained by open ditches and tile <sup>4</sup> .....	*126,600	1,000	101,600	24,000
24	Length of these drains.....	110.9	0.8	12.9	97.2
25	Average length per acre.....	4.6	4.2	0.7	21.4
<b>DEVELOPMENT OF LAND.</b>					
26	Improved land in operating enterprises, 1920.....	141,252	9,150	89,170	49,932
27	Improved land prior to drainage.....	107,645	3,000	83,410	21,235
28	Increase since drainage.....	33,607	6,150	5,760	21,697
29	Per cent of increase.....	31.2	205.0	6.9	102.2
30	Per cent increase is of all improved land in farms, 1920.....	0.3	1.8	0.6	6.5
31	Unimproved land, 1920.....	27,430	5,200	17,430	4,800
32	Unimproved land prior to drainage.....	61,037	11,350	23,190	26,497
33	Decrease since drainage.....	33,607	6,150	5,760	21,697
34	Per cent of decrease.....	55.1	54.2	24.8	81.9
35	Swampy, subject to overflow, seeped, or alkali land, 1920.....	19,630	800	17,430	1,400
36	Swampy, subject to overflow, etc., prior to drainage.....	55,470	12,683	23,190	19,697
37	Decrease since drainage.....	35,840	11,883	5,760	18,197
38	Per cent of decrease.....	64.6	93.7	24.8	92.9
<b>CAPITAL INVESTED AND COST PER ACRE.</b>					
39	Total capital invested in and required for completion of operating enterprises.....	\$46,466	149,766	209,885	496,815
40	Capital invested in these enterprises to Dec. 31, 1919.....	664,990	149,766	106,842	409,382
41	Additional capital required to complete these enterprises.....	181,476	.....	104,043	77,433
42	Average cost per acre when completed.....	5.02	10.44	1.97	10.20
43	Enterprises constructing open ditches only.....	\$14,400	148,766	4,250	163,384
44	Average cost per acre when completed.....	7.47	10.99	0.85	6.88
45	Enterprises constructing open ditches and tile drains.....	*632,066	3,000	205,635	323,431
46	Average cost per acre when completed.....	4.20	3.00	2.02	13.48
<b>CROPS.</b>					
Improved land in enterprises reporting—					
47	Wheat as principal crop on drained land.....	107,142	.....	83,410	23,732
48	Alfalfa as principal crop on drained land.....	29,800	.....	1,500	19,200
49	Hay (except alfalfa) as principal crop on drained land.....	12,310	5,150	4,160	.....
50	Other grain as principal crop on drained land.....	1,000	1,000	.....	.....

<sup>1</sup> No timber or cut-over land reported.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Includes 1,000 acres drained by tile only.  
<sup>4</sup> Includes one enterprise drained by tile only.

## NEBRASKA.

The following pages present the statistics of drainage for Nebraska collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

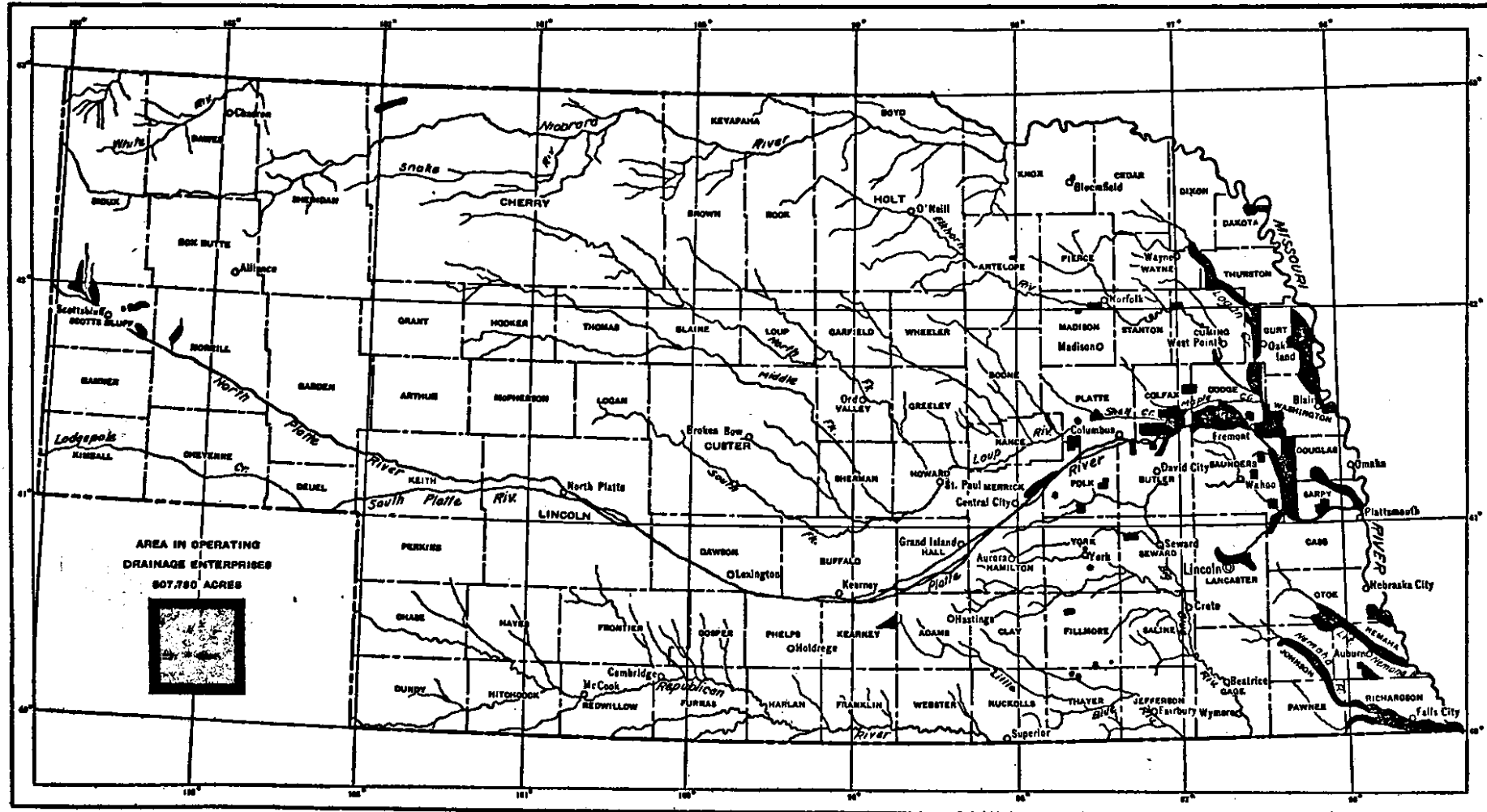
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	124, 417	100. 0
Farms reporting land having drainage.....	2, 356	1. 9
Farms reporting land needing drainage.....	2, 963	2. 4
All land in farms..... acres..	42, 225, 475	100. 0
Improved land in farms..... acres..	23, 109, 624	54. 7
Farm land reported as provided with drainage..... acres..	214, 428	0. 5
Farm land reported as needing drainage..... acres..	145, 818	0. 3
Needing drainage only..... acres..	115, 425	0. 3
Needing drainage and clearing..... acres..	30, 393	0. 1
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	49, 157, 120	100. 0
All land in operating drainage enterprises..... acres..	607, 730	1. 2
Improved land..... acres..	551, 517	1. 1
Per cent of all improved land in farms.....	2. 4	.....
Timber and cut-over land..... acres..	6, 342	(1)
Other unimproved land..... acres..	49, 871	0. 1
Swampy, subject to overflow, seeped, or alkali..... acres..	14, 019	(1)
Suffering a loss of crops from defective drainage..... acres..	19, 575	(1)
Improved land prior to drainage..... acres..	292, 621	0. 6
Increase since drainage began..... acres..	258, 896	0. 5
Land in nonoperating enterprises..... acres..	25, 836	0. 1
Open ditches in operating enterprises..... miles..	753. 2	100. 0
Completed..... miles..	734. 5	97. 5
Additional under construction..... miles..	18. 7	2. 5
Tile drains in operating enterprises..... miles..	373. 6	100. 0
Completed..... miles..	359. 4	96. 2
Additional under construction..... miles..	14. 2	3. 8
Total capital invested in and required for completion of operating enterprises ..	\$4, 886, 681	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	4, 588, 578	93. 9
Additional capital required to complete these enterprises.....	298, 103	6. 1
Average cost per acre when completed.....	8. 04	.....

1 Less than one-tenth of 1 per cent.

# NEBRASKA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	633,566	100.0	\$4,588,578	100.0	\$821,841
Operating enterprises.....	607,730	95.9	4,588,578	100.0	298,103
With works completed.....	565,222	89.2	4,121,486	89.8	.....
With works under construction.....	42,508	6.7	467,092	10.2	298,103
Nonoperating enterprises.....	25,836	4.1	.....	.....	523,738

<sup>1</sup>The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The greater part of the drainage enterprises in Nebraska are situated in the eastern quarter of the state, in the counties bordering or near the Platte and Missouri Rivers. In the central and western sections there is very little land organized in drainage enterprises except a few undertakings on the North Platte in the extreme west end of the state.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	633,566	100.0	\$4,588,578	100.0	\$821,841
Operating enterprises.....	607,730	95.9	4,588,578	100.0	298,103
Missouri River.....	205,432	32.4	2,529,479	55.1	.....
Kansas River.....	9,250	1.5	41,570	0.9	.....
Platte River.....	393,038	62.0	2,017,529	44.0	298,103
Nonoperating enterprises.....	25,836	4.1	.....	.....	523,738
Missouri River.....	12,504	2.0	.....	.....	377,038
Kansas River.....	3,152	0.5	.....	.....	10,700
Platte River.....	10,180	1.6	.....	.....	136,000

Condition of land in enterprises.—About half the total number of the drainage enterprises, comprising a considerably greater portion of the total area in the enterprises, are reported as organized to obtain relief from overflow. Nearly an equal number of smaller enterprises are reported as needing drainage to relieve a generally wet or swampy condition that made cultivation impossible or unprofitable. The enterprises in the west end of the state are for the drainage of land injured by seepage or water-logging as a result of irrigation.

For the state, 78,312 acres of irrigated land were reported as not having needed drainage but as having been assessed as being responsible for injury to the other land. This acreage is omitted from the statistics given in this bulletin.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, seeped, or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres)
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	607,730	100.0	565,222	42,508	25,836
Improved land.....	551,517	90.8	514,438	37,079	5,853
Timber and out-over land.....	6,342	1.0	6,342	.....	267
Other unimproved land.....	49,871	8.2	44,442	5,429	19,716
Swampy, seeped, or subject to overflow.....	14,019	2.3	10,616	3,403	21,636
Suffering a loss of crops.....	19,576	3.2	16,751	2,824	4,700

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 123 operating drainage enterprises are counted in Nebraska, with an average area of 5,760 acres assessed. Of this number, 16 comprise 10,000 acres or more each, 63 comprise 1,000 to 5,000 acres, and 5 are smaller than 500 acres each. The assessed acreage exceeds the land in enterprises by 100,720 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	607,730	708,450	100.0
Less than 200 acres.....	320	320	( <sup>1</sup> )
200 to 499 acres.....	760	1,200	0.2
500 to 999 acres.....	14,570	14,570	2.1
1,000 to 4,999 acres.....	143,052	173,192	24.4
5,000 to 9,999 acres.....	110,106	115,106	16.2
10,000 to 49,999 acres.....	210,422	275,522	38.9
50,000 to 99,999 acres.....	128,500	128,500	18.1

<sup>1</sup>Less than one-tenth of 1 per cent.

**Character of enterprises.**—The drainage enterprises of Nebraska are county drains and drainage districts organized under the general drainage laws of the state, irrigation projects of the United States Reclamation Service, and some drainage undertakings by private owners. The present drainage laws form chapter 19 of the Revised Statutes of Nebraska, 1913, as amended.

The state board of irrigation, highways, and drainage was given jurisdiction in drainage matters, and the act of April 1, 1913 (ch. 25), required that all plans for proposed drainage districts should be approved by that board before contract was let or construction begun. The board was authorized, upon request, to prepare and to furnish at cost plans and specifications for any proposed drainage work. The same provisions are contained in the act of April 19, 1919 (ch. 190), adopting a Civil Administrative Code, by which a department of public works was created and given the powers previously vested in the state board of irrigation, highways, and drainage.

County drains are established under laws of February 28, 1881 (ch. 51), and April 10, 1911 (ch. 140). The later act repealed and reenacted much of the earlier law, but the following provisions are practically alike in both. The drains are established by orders of the county boards of the counties in which the enterprises are located. Upon petition from one or more owners of land to be benefited, the county board investigates the practicability and public utility of a proposed improvement. If they find for the project, the county surveyor or an engineer makes surveys, plans, and estimates for the work and apportions a number of linear feet of drain and cubic yards of excavation to each parcel of land, road, and railroad according to the benefits that each will receive. At public hearing the board considers the public utility of the enterprise, the practicability of the plan of drainage, the apportionment of the benefits, and the claims for compensation on account of damages. Appeals may be taken to the district court of the county. Construction of the works is secured by contracts let by the county board, and is supervised by an engineer appointed by them. For a drain to be

located in more than one county, the petition must be filed in each of the counties and the county boards act jointly. The cost is assessed against the properties in proportion to the benefits, and collected like general taxes. The act of 1911 authorizes the boards to issue bonds for drainage to be paid in not more than 10 annual installments.

County drains, as here classified, include those established under an act of April 11, 1903 (ch. 115). This act provided for drains to be established in each instance upon petition from one or more owners of the land to be drained. Each enterprise was established and controlled by a drainage board consisting of one member selected by the petitioners, one by the county board, and a third by the other two. The assessments of benefits and of damages were made by the drainage board, who also let contracts for construction. The cost was apportioned according to benefits, and each landowner might pay his part in labor. This statute was repealed by act of April 8, 1911 (ch. 142), which provides for establishment and control of these drains by the county board, therein designated as the drainage supervisors, instead of by a separate drainage board for each enterprise. Damages and benefits are to be assessed by three appraisers appointed by the supervisors. No enterprises were reported under the act of 1911.

Drainage districts have been organized under laws of April 2, 1903 (ch. 116), March 29, 1905 (ch. 161), and March 27, 1907 (ch. 153). The act of 1905 repealed that of 1903, to which it was similar, each authorizing the formation of drainage districts by proceedings before the district courts of the counties in which the proposed drainage districts are situated. Articles of association must be signed by a majority in interest of the owners of any contiguous body of swamp or overflowed land, and filed with the district court of the county containing the greatest part of the drainage district. The court may establish the district after public hearing, and exclude any land that will not be benefited. The corporate authority of the district is a board of supervisors elected by the landowners voting each in proportion to his acreage. The cost of the drainage is paid in proportion to benefits assessed against private and corporate land, including railroads and public highways, by the engineer employed by the supervisors to plan the drainage improvements. The tract to receive greatest benefits is rated 100 per cent, and the other tracts in proportion. The assessments are subject to confirmation by the supervisors and to further appeal to the district court. Subdistricts within a drainage district may be formed by proceedings similar to those described, upon petition from one or more owners of land that will be benefited. The supervisors of the main district are the officers of the subdistricts.

Drainage districts under the law of 1907 (ch. 153) are established by vote of the landowners in each district. A petition for organization must describe the proposed district and be signed by 10 or more owners of land in the district, or by a fourth of the owners when the total number is less than 20. The county board may amend the boundaries of the district and determine the number of directors that will form the executive board of the enterprise. Establishment of the district and election of the directors is determined by a majority vote of the landowners, including private, public, and municipal corporations, each having one vote for each acre of his holdings in the district. The directors determine the plan of drainage, apportion the benefits that will accrue to the various tracts of land, and secure construction of the works. The tract to receive least benefit is rated one, and the others are rated higher in proportion. Determination of benefits may be appealed to the district court of the county. Damages are determined by agreement or by eminent domain proceedings. An act of April 7, 1911 (ch. 145), requires that the plan of drainage and estimate of cost must be approved by vote of the landowners before construction is undertaken, and that no indebtedness shall be incurred in excess of the total estimated cost. After such approval the directors shall not make any changes in the plans that will increase the estimated cost more than 15 per cent. The cost is assessed according to the benefits. Bonds may be issued when the sum needed is \$5,000 or more, to be paid in not more than 20 annual installments. For a district in more than one county, the proceedings are in the county having the largest acreage in the district.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises....	633,566	100.0	\$4,588,578	100.0	\$821,841
Operating enterprises.....	607,730	95.9	4,588,578	100.0	298,103
County drains.....	195,260	30.8	530,798	11.6	2,000
Laws of 1881, ch. 51.....	183,380	28.9	490,203	10.7	.....
Laws of 1903, ch. 115.....	9,480	1.5	35,195	0.8	1,000
Laws of 1911, ch. 140.....	2,400	0.4	5,400	0.1	1,000
Drainage districts.....	390,512	62.6	3,549,382	77.4	55,293
Laws of 1903, ch. 110.....	2,611	0.4	24,000	0.5	.....
Laws of 1905, ch. 161.....	224,879	35.3	1,611,219	35.1	9,000
Laws of 1907, ch. 153.....	169,022	26.7	1,914,163	41.7	46,293
U. S. Reclamation Service.....	8,638	1.4	355,048	7.7	240,810
Individual ownership.....	7,270	1.1	163,350	3.5	.....
Nonoperating enterprises.....	25,836	4.1	.....	.....	523,738
County drains.....	1,600	0.3	.....	.....	5,600
Laws of 1911, ch. 140.....	1,600	0.3	.....	.....	5,600
Drainage districts.....	24,236	3.8	.....	.....	518,138
Laws of 1905, ch. 161.....	9,776	1.5	.....	.....	330,638
Laws of 1907, ch. 153.....	14,460	2.3	.....	.....	187,500

<sup>1</sup> Includes two commercial development enterprises.

No enterprises were reported as organized under the drainage law approved February 19, 1877, which

is in effect on the census date. It authorizes the owners of wet or overflowed land to form incorporated companies to secure drainage.

The United States Reclamation Service may provide drainage as needed for any land in its irrigation projects. Each irrigation district organized under the laws of Nebraska is required, by act of April 17, 1915 (ch. 69), to provide drainage for all land within the district that is subirrigated from any cause not the fault of the owner or lessee of the land.

The first general drainage law of Nebraska was passed March 3, 1873. It provided for drainage by the county board on petition from a majority of the resident owners of the land to be affected. The cost was apportioned by the board in proportion to the benefits. This statute was repealed by the act of February 28, 1881 (ch. 51). An act of March 23, 1893 (ch. 39), provided for the establishment of a private drain across the land of an objecting owner by decree of the county court. This act was repealed by that of 1903 (ch. 115), which later was superseded by the one of 1911 (ch. 142).

A considerable number of amendments have been made to the various drainage laws, but those that affect the character of the enterprises as described have been indicated in the foregoing paragraphs.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 734.5 miles of open ditches, 359.4 miles of tile drains, and 26.8 miles of accessory levees; the additional lengths under construction were 18.7 miles of open ditches, 14.2 miles of tile drains, and 2.8 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts among the drainage enterprises in this state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	607,730	100.0	\$4,588,578	100.0	\$298,103
Open ditches only.....	445,431	73.3	2,980,949	65.0	54,000
Open ditches and levees.....	138,551	22.8	1,007,231	22.0	3,293
Tile drains only.....	6,020	1.0	143,000	3.1	.....
Open ditches and tile drains.....	17,728	2.9	457,398	10.0	240,810

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of

County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include this group, computed as 10 feet, would show the mean depth for the state 6.4 instead of 6.1 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	607,730	100.0
Less than 3 feet.....		
3.0 to 3.9 feet.....	5,120	0.8
4.0 to 4.9 feet.....	29,100	4.8
5.0 to 5.9 feet.....	48,101	7.9
6.0 to 6.9 feet.....	173,400	28.5
7.0 to 7.9 feet.....	77,454	12.7
8.0 to 8.9 feet.....	39,628	6.5
9.0 to 9.9 feet.....		
10 feet and more.....	31,431	5.2
Not reporting branches.....	203,496	33.5

Maintenance of works.—The county drain law of 1881 (ch. 51), as amended, authorizes the county board to create a county ditch fund, to consist of taxes collected from county levies and of unexpended balances in special ditch funds, to be used for maintenance of the drainage ditches of the county. An act of April 10, 1911 (ch. 141), provides for cleaning out the drains constructed under the law of 1881, by petition and proceedings similar to those prescribed for establishing a new drain. Owners or tenants of land through which runs a watercourse or ditch are required to clean it out at least once each year, between March 1 and April 15, by a law of April 8, 1911 (ch. 143).

The supervisors of each drainage district organized under the act of 1905 (ch. 161) are authorized to keep the works of the district in repair, and for defraying the cost may levy assessments against the land apportioned like the cost of original construction. The directors of districts organized under the act of 1907 (ch. 153) may maintain the drainage works of the enterprise, and assessments therefor are apportioned according to the benefits determined for constructing the works.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	607,730	100.0	\$4,588,578	100.0	\$298,108
By district forces.....	192,160	31.6	1,943,893	42.4	249,103
By contract.....	169,306	27.9	849,474	18.5	22,000
By method not specified.....	11,651	1.9	51,200	1.1	.....
No maintenance provided.....	230,043	37.9	1,734,330	37.8	26,000
Not reported.....	4,570	0.8	9,681	0.2	1,000

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of enterprises, which are the dates when the drains or districts were established by the county boards or the district courts, since there may be a period of one or more years between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	607,730	100.0	708,450	100.0
1880 to 1889.....	20,940	3.4	20,940	3.0
1890 to 1899.....	96,862	15.9	100,762	14.2
1900 to 1904.....	34,045	5.6	55,907	7.9
1905 to 1909.....	271,626	44.7	282,646	39.9
1910 to 1914.....	109,420	18.0	172,908	24.4
1915 to 1919.....	75,287	12.4	75,287	10.6

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$4,588,578	100.0	\$298,108
1880 to 1889.....	36,992	0.8	.....
1890 to 1899.....	189,831	4.1	.....
1900 to 1904.....	201,704	4.4	.....
1905 to 1909.....	2,238,344	48.8	285,810
1910 to 1914.....	1,440,754	31.4	2,000
1915 to 1919.....	480,953	10.5	10,288



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TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.	753.2	100.0	373.6	100.0	29.6	100.0
1890 to 1899.....	33.6	4.5	.....	.....	1.5	5.1
1900 to 1899.....	77.9	10.2	.....	.....	.....	.....
1900 to 1904.....	35.3	4.7	1.7	0.5	.....	.....
1905 to 1909.....	324.6	43.1	124.7	33.4	13.1	44.3
1910 to 1914.....	179.8	23.9	246.7	66.0	14.5	49.0
1915 to 1919.....	102.9	13.7	0.5	0.1	0.5	1.7

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, small grains, and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Burt.	Butler.	Cam.	Cedar.	Cherry.	Clay.	Colfax.
1 Number of all farms in the state or county.....	124,417	1,417	1,850	1,946	2,064	1,064	1,791	1,392
2 Farms reporting land having drainage.....	2,356	183	61	85	59	70	35	100
3 Farms reporting land needing drainage.....	2,963	166	43	82	50	89	105	29
4 Farms in drainage and levee districts.....	1,064	104	34	8	2	6	11	80
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the state or county.....acres..	49,157,120	304,000	373,120	344,320	470,400	3,326,560	370,560	259,200
6 All land in farms.....acres..	42,225,475	263,631	352,176	319,177	430,453	2,981,685	351,436	251,405
7 Improved land in farms.....acres..	23,109,624	245,739	319,428	280,706	367,547	591,881	313,843	219,479
8 Woodland in farms.....acres..	900,633	7,534	6,658	22,244	11,732	13,023	6,012	3,044
9 Other unimproved land in farms.....acres..	18,214,918	10,358	26,090	16,227	51,173	2,376,781	31,581	28,882
10 Farm land reported as provided with drainage.....acres..	214,428	17,489	5,460	977	2,466	31,975	897	7,641
11 Farm land reported as needing drainage.....acres..	145,818	9,278	303	1,782	2,622	12,681	3,605	5,423
12 Drainage only.....acres..	115,425	6,566	781	384	2,432	12,245	3,457	790
13 Drainage and clearing.....acres..	30,393	2,712	27	1,398	460	435	118	2,633
	Cuming.	Custer.	Dakota.	Dawson.	Dixon.	Dodge.	Douglas.	Fillmore.
1 Number of all farms in the county.....	1,859	3,708	740	1,934	1,441	1,794	1,709	1,975
2 Farms reporting land having drainage.....	65	3	28	18	70	197	38	68
3 Farms reporting land needing drainage.....	71	8	25	37	48	95	102	152
4 Farms in drainage and levee districts.....	26	.....	15	6	2	131	33	20
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	369,280	1,656,320	161,920	630,400	302,080	539,840	211,840	368,640
6 All land in farms.....acres..	359,527	1,495,095	141,859	570,874	274,689	322,428	174,418	350,989
7 Improved land in farms.....acres..	318,176	766,939	117,892	377,185	235,274	268,238	157,327	319,580
8 Woodland in farms.....acres..	10,218	25,709	10,664	5,313	15,332	9,273	8,674	3,569
9 Other unimproved land in farms.....acres..	31,133	702,447	13,309	189,376	24,033	14,917	8,417	27,840
10 Farm land reported as provided with drainage.....acres..	3,084	1,720	2,727	1,549	2,454	17,632	2,172	4,259
11 Farm land reported as needing drainage.....acres..	3,779	254	582	1,787	1,932	4,869	2,458	3,960
12 Drainage only.....acres..	2,884	154	368	1,525	1,588	3,765	1,139	3,241
13 Drainage and clearing.....acres..	895	100	214	243	314	1,104	1,297	719
	Garden.	Garfield.	Grant.	Hall.	Hamilton.	Holt.	Howard.	Jefferson.
1 Number of all farms in the county.....	714	490	151	1,556	1,932	2,263	1,523	1,327
2 Farms reporting land having drainage.....	8	33	16	14	24	118	19	5
3 Farms reporting land needing drainage.....	3	33	29	36	61	113	32	37
4 Farms in drainage and levee districts.....	1	2	12	.....	11	.....	.....	.....
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	1,079,680	368,000	499,200	337,920	344,320	1,531,520	359,040	369,920
6 All land in farms.....acres..	884,328	313,139	561,794	313,006	332,157	1,335,144	347,125	351,184
7 Improved land in farms.....acres..	226,216	110,285	59,823	269,461	306,769	741,859	238,357	266,631
8 Woodland in farms.....acres..	213	7,236	2,234	5,619	1,961	34,769	5,584	14,367
9 Other unimproved land in farms.....acres..	657,799	195,608	499,737	37,981	30,457	858,506	108,184	70,166
10 Farm land reported as provided with drainage.....acres..	530	5,313	12,729	594	1,063	18,708	833	1,917
11 Farm land reported as needing drainage.....acres..	328	3,116	5,190	632	1,304	16,096	1,080	1,935
12 Drainage only.....acres..	326	2,965	5,190	603	1,312	14,768	1,035	145
13 Drainage and clearing.....acres..	.....	151	.....	19	92	1,318	45	1,790

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Johnson.	Keith.	Lancaster.	Lincoln.	Madison.	Merrick.	Nance.	Nemaha.
1	Number of all farms in the county.....	1,167	673	3,259	2,024	1,647	1,364	1,102	1,524
2	Farms reporting land having drainage.....	65	12	67	36	41	72	13	73
3	Farms reporting land needing drainage.....	12	10	69	51	58	49	19	42
4	Farms in drainage and levee districts.....	54	11	80	20	9	57	9	42
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	239,360	683,520	545,920	1,623,040	368,640	296,320	285,440	248,960
6	All land in farms.....acres..	206,424	614,842	507,636	1,383,879	323,335	274,940	257,080	237,021
7	Improved land in farms.....acres..	188,081	218,703	449,223	512,778	280,880	223,436	196,969	209,709
8	Woodland in farms.....acres..	11,483	2,641	13,638	11,802	9,155	7,677	9,323	18,661
9	Other unimproved land in farms.....acres..	6,860	393,499	44,775	850,299	33,300	43,827	51,788	8,651
10	Farm land reported as provided with drainage.....acres..	5,526	888	3,742	3,542	2,282	7,935	1,555	5,560
11	Farm land reported as needing drainage.....acres..	328	401	1,686	4,734	3,398	3,718	650	2,319
12	Drainage only.....acres..	269	401	1,204	4,320	2,296	3,118	245	1,485
13	Drainage and clearing.....acres..	59		482	414	1,102	600	305	833
		Otoe.	Platte.	Polk.	Richardson.	Rock.	Sarpy.	Saunders.	Scotts Bluff.
1	Number of all farms in the county.....	2,253	2,131	1,478	1,974	553	979	2,697	1,391
2	Farms reporting land having drainage.....	225	12	14	32	14	31	32	35
3	Farms reporting land needing drainage.....	183	6	22	41	19	42	65	68
4	Farms in drainage and levee districts.....	94	3	12	18		31	24	24
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	397,840	430,720	275,200	348,800	642,560	153,600	483,840	462,720
6	All land in farms.....acres..	375,290	413,744	266,937	319,820	461,064	136,114	458,228	281,482
7	Improved land in farms.....acres..	336,878	366,247	234,127	262,030	192,729	120,894	413,568	157,176
8	Woodland in farms.....acres..	21,262	13,748	6,543	25,283	6,885	9,496	11,195	5,446
9	Other unimproved land in farms.....acres..	17,150	33,751	26,267	32,522	260,450	5,724	33,465	118,870
10	Farm land reported as provided with drainage.....acres..	10,967	504	815	2,209	5,436	1,885	1,279	3,419
11	Farm land reported as needing drainage.....acres..	2,851	120	540	1,802	1,609	1,864	2,223	4,251
12	Drainage only.....acres..	1,948	115	503	856	652	1,181	1,613	3,946
13	Drainage and clearing.....acres..	903	5	37	945	957	683	610	365
		Seward.	Sheridan.	Thurston.	Washington.	Wayne.	Webster.	York.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,130	1,063	1,105	1,488	1,287	1,530	2,042	49,868
2	Farms reporting land having drainage.....	37	9	38	51	24	7	42	112
3	Farms reporting land needing drainage.....	71	4	83	71	9	8	114	411
4	Farms in drainage and levee districts.....	16	1	19	31		5	15	37
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	367,360	1,580,160	247,680	243,200	288,000	369,920	368,000	23,338,240
6	All land in farms.....acres..	345,869	1,339,444	190,529	229,626	248,107	341,294	348,540	19,582,470
7	Improved land in farms.....acres..	305,923	309,624	177,374	204,830	239,449	261,836	318,376	9,780,679
8	Woodland in farms.....acres..	11,116	26,468	10,644	14,218	1,669	17,325	5,164	399,059
9	Other unimproved land in farms.....acres..	28,830	1,003,262	2,511	10,578	6,989	62,083	23,000	9,402,732
10	Farm land reported as provided with drainage.....acres..	1,277	1,790	3,832	4,577	1,269	4,726	1,211	3,926
11	Farm land reported as needing drainage.....acres..	1,618	1,336	1,846	2,700	315	813	2,925	15,135
12	Drainage only.....acres..	1,397	1,336	370	2,205	315	678	2,901	11,417
13	Drainage and clearing.....acres..	221		1,476	495		135	24	3,718

<sup>1</sup> No drainage on farms reported in Arthur, Banner, Boone, Chase, Cheyenne, Dawes, Deuel, Harlan, Hayes, Hooker, Kimball, Loup, Morrill, Phelps, Pierce, Thomas, and Wheeler Counties.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Burt.	Bntler.	Colfax.	Cuming.	Dakota.	Dodge.	Douglas.	
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres	49,157,120	804,000	373,120	259,200	869,280	161,920	339,940	211,840
2	All land in operating drainage enterprises.....acres	607,730	78,992	10,840	46,340	11,100	7,300	122,760	49,250
3	Improved land.....acres	551,517	60,161	10,840	41,860	8,100	6,570	122,440	48,350
4	Per cent of all improved land in farms.....	2.4	24.5	3.4	19.1	2.5	5.6	41.1	30.7
5	Timber and cut-over land.....acres	6,342						320	900
6	Other unimproved land.....acres	49,871	18,831		4,480	3,000	730		
7	Swampy, seeped, or subject to overflow, in enterprises.....acres	14,019	494						
8	Suffering a loss of crops from defective drainage.....acres	19,575	4,621		180	300	148	2,100	900
9	Assessed acreage.....acres	708,450	170,713	10,840	46,340	11,100	7,300	122,760	49,250
10	Excess over all land in operating enterprises.....acres	100,720	91,720						
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
11	Completed.....miles	734.5	109.8	9.3	30.2	10.8	6.5	77.6	49.2
12	Additional under construction.....miles	18.7	1.0						
13	Maximum completed in any enterprise.....miles	80.0	80.0	3.5	8.5	5.0	6.5	55.0	41.7
14	Maximum width at bottom of ditch <sup>1</sup> .....feet	100	100	10	20	15	30	20	40
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet	18.0	15.0	7.0	12.0	14.0	15.0	12.0	12.0
16	Mean depth of branch ditches <sup>1</sup> .....feet	6.1	9.2					6.3	6.0
<b>Tile drains:</b>									
17	Completed.....miles	359.4	152.3					200.0	
18	Additional under construction.....miles	14.2							
19	Maximum completed in any enterprise.....miles	100.0	100.0					96.0	
20	Maximum size of tile.....inches	48	12					12	
<b>Accessory levees and dikes:</b>									
21	Completed.....miles	26.8	10.0						
22	Additional under construction.....miles	2.8							
23	Area drained by open ditches only <sup>1</sup> .....acres	445,431	22,552	10,840	46,340	11,100	7,300	119,640	40,260
24	Length of these ditches.....miles	528.9	28.3	9.2	30.2	10.8	6.5	77.6	49.2
25	Average length per acre.....feet	6.3	6.6	4.5	3.4	5.1	4.7	3.4	6.3
26	Area having open ditches and levees <sup>1</sup> .....acres	133,551	51,000						
27	Length of these ditches.....miles	177.9	80.0						
28	Average length per acre.....feet	6.8	8.3						
29	Length of the accessory levees.....miles	29.6	10.0						
30	Area drained by tile only <sup>1</sup> .....acres	6,020	2,400					3,120	
31	Length of these tile.....miles	356.5	150.0					206.0	
32	Average length per acre.....feet	312.7	330.0					348.0	
33	Area drained by open ditches and tile <sup>1</sup> .....acres	17,728	2,040						
34	Length of these drains.....miles	63.5	4.7						
35	Average length per acre.....feet	18.9	8.2						
<b>DEVELOPMENT OF LAND.</b>									
36	Improved land in operating enterprises, 1920.....acres	551,517	60,161	10,840	41,860	8,100	6,570	122,440	48,350
37	Improved land prior to drainage.....acres	292,021	27,657	5,400	40,160	3,350	5,475	38,960	48,350
38	Increase since drainage.....acres	259,496	32,504	6,440	1,700	4,750	1,095	83,480	
39	Per cent of increase.....	88.5	118.3	100.7	4.2	141.8	20.0	214.3	
40	Per cent increase is of all improved land in farms, 1920.....	1.1	13.3	1.7	0.8	1.5	0.9	28.0	
41	Timber and cut-over land, 1920.....acres	6,342						320	900
42	Timber and cut-over land prior to drainage.....acres	8,797						320	900
43	Decrease since drainage.....acres	2,455							
44	Per cent of decrease.....	27.9							
45	Other unimproved land, 1920.....acres	49,871	18,831		4,480	3,000	730		
46	Other unimproved land prior to drainage.....acres	306,312	51,435	6,440	6,180	7,750	1,325	83,480	
47	Decrease since drainage.....acres	256,441	32,604	5,440	1,700	4,750	1,095	83,480	
48	Per cent of decrease.....	83.7	63.4	100.0	27.5	61.3	60.0	100.0	
49	Swampy, seeped, or subject to overflow, 1920.....acres	14,019	494						
50	Swampy, seeped, or subject to overflow prior to drainage.....acres	395,253	26,143	8,640	42,308	10,940	5,475	115,248	5,150
51	Decrease since drainage.....acres	381,234	24,649	8,640	42,308	10,940	5,475	115,248	5,150
52	Per cent of decrease.....	96.5	93.0	100.0	100.0	100.0	100.0	100.0	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
53	Total capital invested in and required for completion of operating enterprises.....dollars	4,886,681	850,605	62,257	90,092	56,506	196,165	481,075	259,607
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars	4,588,578	825,605	62,257	90,092	56,506	196,165	481,075	259,607
55	Additional capital required to complete these enterprises.....dollars	298,103	25,000						
56	Average cost per acre when completed.....dollars	8.04	10.77	5.74	1.94	5.09	26.87	3.92	5.27
57	Enterprises constructing open ditches only.....dollars	3,084,949	361,335	62,257	90,092	56,506	196,165	398,075	259,607
58	Average cost per acre when completed.....dollars	6.81	16.02	5.74	1.94	5.09	26.87	3.33	5.27
59	Enterprises constructing open ditches and levees.....dollars	1,010,524	426,037						
60	Average cost per acre when completed.....dollars	7.29	8.33						
61	Enterprises constructing tile drains only.....dollars	143,000	57,500					83,000	
62	Average cost per acre when completed.....dollars	23.75	28.98					26.60	
63	Enterprises constructing open ditches and tile drains.....dollars	698,208	6,738						
64	Average cost per acre when completed.....dollars	39.38	2.21						
<b>CROPS.</b>									
65	Improved land in enterprises reporting—								
66	Corn as principal crop on drained land.....acres	495,683	33,866	10,840	41,860	3,000	6,570	120,440	48,350
67	Small grains as principal crop on drained land.....acres	21,795	21,295						
68	Sugar beets as principal crop on drained land.....acres	21,084							
69	Hay as principal crop on drained land.....acres	12,955				8,100		2,000	

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Includes 4,300 acres reporting vegetables as principal crop on drained land.

DRAINAGE—NEBRASKA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Johnson.	Kearney.	Lancaster.	Merrick.	Nemaha.	Otoe.	Pawnee.	Richardson.	
<b>LAND AREA.</b>									
1	Approximate land area of the county.....	239,360	330,240	545,920	296,320	248,960	387,840	276,840	348,800
2	All land in operating drainage enterprises.....	18,260	9,000	8,000	13,000	20,134	16,437	5,731	35,838
3	Improved land.....	18,260	7,650	7,000	12,500	18,121	16,437	5,158	27,581
4	Per cent of all improved land in farms.....	9.7	3.0	1.6	5.6	8.6	4.9	2.5	10.5
5	Timber and cut-over land.....					2,013			2,269
6	Other unimproved land.....		1,350	1,000	500			573	5,988
7	Swampy, seeped, or subject to overflow, in enterprises.....		720						6,577
8	Suffering a loss of crops from defective drainage.....	825	720			1,206			2,235
9	Assessed acreage.....	18,260	9,000	8,000	13,000	20,134	16,437	5,731	35,838
10	Excess over all land in operating enterprises.....								
<b>DRAINAGE WORKS.</b>									
Open ditches:									
11	Completed.....	30.0	1.3	7.0	6.2	55.0	22.0	14.0	50.5
12	Additional under construction.....				4.2				
13	Maximum completed in any enterprise.....	25.0	1.3	5.0	4.2	42.0	20.0	14.0	38.0
14	Maximum width at bottom of ditch <sup>1</sup> .....	28	45	12	5	30	28	12	25
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	15.9	5.0	10.0	5.0	18.0	15.0	18.0	18.0
16	Mean depth of branch ditches <sup>1</sup> .....	5.0		4.0		7.5	5.0		6.7
Tile drains:									
17	Completed.....								
18	Additional under construction.....								
19	Maximum completed in any enterprise.....								
20	Maximum size of tile <sup>1</sup> .....								
Accessory levees and dikes:									
21	Completed.....	0.5	0.2				1.5		1.3
22	Additional under construction.....								
23	Area drained by open ditches only <sup>1</sup> .....	16,500		8,000	13,000	20,134	2,107	5,731	3,677
24	Length of these ditches.....	25.0		7.0	10.5	55.0	2.6	14.0	8.0
25	Average length per acre.....	3.0		4.6	4.3	14.4	5.0	12.9	11.5
26	Area having open ditches and levees <sup>1</sup> .....	1,760	9,000				14,330		32,161
27	Length of these ditches.....	5.0	1.3				20.0		42.5
28	Average length per acre.....	15.0	0.8				7.4		7.0
29	Length of the accessory levees.....	0.5	0.2				1.5		1.3
30	Area drained by tile only <sup>1</sup> .....								
31	Length of these tile.....								
32	Average length per acre.....								
33	Area drained by open ditches and tile <sup>1</sup> .....								
34	Length of these drains.....								
35	Average length per acre.....								
<b>DEVELOPMENT OF LAND.</b>									
36	Improved land in operating enterprises, 1920.....	18,260	7,650	7,000	12,500	18,121	16,437	5,158	27,581
37	Improved land prior to drainage.....	10,910	5,400	3,000	12,200	10,068	421	2,865	10,764
38	Increase since drainage.....	8,250	2,250	4,000	300	8,053	16,016	2,293	16,817
39	Per cent of increase <sup>1</sup> .....	82.4	41.7	133.3	2.5	80.0		80.0	156.2
40	Per cent increase is of all improved land in farms, 1920.....	4.4	0.9	0.9	0.1	3.8	4.8	1.1	6.4
41	Timber and cut-over land, 1920.....					2,013			2,269
42	Timber and cut-over land prior to drainage.....	1,650				2,013		573	2,269
43	Decrease since drainage.....	1,650						573	
44	Per cent of decrease.....	100.0						100.0	
45	Other unimproved land, 1920.....		1,350	1,000	500			573	5,988
46	Other unimproved land prior to drainage.....	6,600	3,600	5,000	800	8,053	16,016	2,293	22,805
47	Decrease since drainage.....	6,600	2,250	4,000	300	8,053	16,016	1,720	16,817
48	Per cent of decrease.....	100.0	62.5	80.0	37.5	100.0	100.0	75.0	73.7
49	Swampy, seeped, or subject to overflow, 1920.....		720						6,577
50	Swampy, seeped, or subject to overflow prior to drainage.....	8,360	2,700	3,000	13,000	10,217	16,016	5,731	25,011
51	Decrease since drainage.....	8,360	1,980	3,000	13,000	10,217	16,016	5,731	18,434
52	Per cent of decrease.....	100.0	73.3	100.0	100.0	100.0	100.0	100.0	73.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
53	Total capital invested in and required for completion of operating enterprises.....	208,559	9,600	35,500	19,250	346,000	195,889	60,000	339,124
54	Capital invested in these enterprises to Dec. 31, 1919.....	208,559	9,600	35,500	12,250	346,000	195,889	60,000	339,124
55	Additional capital required to complete these enterprises.....				7,000				
56	Average cost per acre when completed.....	11.43	1.07	4.44	1.48	17.18	11.92	10.47	9.46
57	Enterprises constructing open ditches only.....	176,415		35,500	19,250	346,000	3,038	60,000	86,124
58	Average cost per acre when completed.....	10.69		4.44	1.48	17.18	1.44	10.47	23.42
59	Enterprises constructing open ditches and levees.....	32,144	9,600				192,856		263,000
60	Average cost per acre when completed.....	18.26	1.07				13.46		7.87
61	Enterprises constructing tile drains only.....								
62	Average cost per acre when completed.....								
63	Enterprises constructing open ditches and tile drains.....								
64	Average cost per acre when completed.....								
<b>CROPS.</b>									
65	Improved land in enterprises reporting—								
66	Corn as principal crop on drained land.....	18,260	7,650	3,000	13,000	18,121	16,437	5,158	27,581
67	Small grains as principal crop on drained land.....			4,000					
68	Sugar beets as principal crop on drained land.....				500				

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

# DRAINAGE—NEBRASKA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Sarpy.	Saunders.	Scotts Bluff.	Sioux.	Thurston.	Washington.	Wayne.	Other counties. <sup>1</sup>
<b>LAND AREA.</b>									
1	Approximate land area of the county.....	153,600	483,840	462,720	1,315,200	247,680	243,200	288,000	9,484,800
2	All land in operating drainage enterprises.....	32,850	30,960	16,124	4,344	12,300	25,840	6,240	28,080
3	Improved land.....	32,050	29,040	14,110	3,904	12,300	22,760	6,240	20,085
4	Per cent of all improved land in farms.....	26.5	7.0	9.0	3.6	6.9	11.1	2.6	0.5
5	Timber and cut-over land.....	200	280	2,014	440	.....	80	.....	280
6	Other unimproved land.....	600	1,640	.....	.....	.....	3,000	.....	5,725
7	Swampy, seeped, or subject to overflow, in enterprises.....	600	.....	1,579	2,389	.....	400	.....	1,280
8	Suffering a loss of crops from defective drainage.....	1,090	768	1,232	87	475	560	.....	1,960
9	Assessed acreage.....	32,850	30,960	16,124	4,344	12,300	34,840	6,240	28,080
10	Excess over all land in operating enterprises.....	.....	.....	.....	.....	.....	9,000	.....	.....
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
11	Completed.....	54.6	15.9	49.3	5.9	18.0	32.6	3.3	75.5
12	Additional under construction.....	1.7	.....	8.9	2.8	.....	.....	.....	.....
13	Maximum completed in any enterprise.....	22.5	7.5	23.4	5.9	8.0	21.0	3.3	15.0
14	Maximum width at bottom of ditch <sup>2</sup> .....	40	27	20	20	16	100	15	20
15	Maximum of average depths of outlet ditches <sup>2</sup> .....	12.0	12.0	9.0	9.0	17.0	12.0	15.0	15.0
16	Mean depth of branch ditches <sup>2</sup> .....	5.4	4.0	5.7	7.0	8.0	6.6	8.0	5.1
<b>Tile drains:</b>									
17	Completed.....	.....	.....	0.5	.....	.....	.....	.....	0.7
18	Additional under construction.....	.....	.....	13.0	1.2	.....	.....	.....	.....
19	Maximum completed in any enterprise.....	.....	.....	0.5	.....	.....	.....	.....	0.5
20	Maximum size of tile <sup>2</sup> .....	.....	.....	48	.....	.....	.....	.....	24
<b>Accessory levees and dikes:</b>									
21	Completed.....	2.0	9.8	.....	.....	.....	1.5	.....	.....
22	Additional under construction.....	2.5	0.3	.....	.....	.....	.....	.....	.....
23	Area drained by open ditches only <sup>2</sup> .....	25,150	9,360	7,780	.....	12,300	24,840	6,240	23,590
24	Length of these ditches.....	56.3	8.1	25.5	.....	18.0	31.3	3.3	73.0
25	Average length per acre.....	7.6	4.6	17.3	.....	7.7	6.7	2.8	16.3
26	Area having open ditches and levees <sup>2</sup> .....	7,700	21,000	.....	.....	.....	1,000	.....	.....
27	Length of these ditches.....	20.0	7.8	.....	.....	.....	1.3	.....	.....
28	Average length per acre.....	13.7	1.9	.....	.....	.....	6.9	.....	.....
29	Length of the accessory levees.....	4.5	10.1	.....	.....	.....	1.5	.....	.....
30	Area drained by tile only <sup>2</sup> .....	.....	.....	.....	.....	.....	.....	.....	500
31	Length of these tile.....	.....	.....	.....	.....	.....	.....	.....	0.5
32	Average length per acre.....	.....	.....	.....	.....	.....	.....	.....	5.3
33	Area drained by open ditches and tile <sup>2</sup> .....	.....	.....	8,344	4,344	.....	.....	.....	2,000
34	Length of these drains.....	.....	.....	48.2	9.9	.....	.....	.....	2.7
35	Average length per acre.....	.....	.....	29.2	12.0	.....	.....	.....	7.1
<b>DEVELOPMENT OF LAND.</b>									
36	Improved land in operating enterprises, 1920.....	32,050	29,040	14,110	3,904	12,300	22,760	6,240	20,085
37	Improved land prior to drainage.....	10,400	15,270	8,915	3,475	5,120	16,340	2,496	6,625
38	Increase since drainage.....	21,650	13,770	5,195	429	7,180	6,420	3,744	13,460
39	Per cent of increase.....	208.2	90.2	58.3	12.3	140.2	39.3	150.0	203.2
40	Per cent increase is of all improved land in farms, 1920.....	17.9	3.3	3.3	0.4	4.0	3.1	1.6	0.8
41	Timber and cut-over land, 1920.....	200	280	2,014	440	.....	80	.....	280
42	Timber and cut-over land prior to drainage.....	200	280	.....	.....	.....	80	.....	512
43	Decrease since drainage.....	.....	.....	.....	.....	.....	.....	.....	232
44	Per cent of decrease.....	.....	.....	.....	.....	.....	.....	.....	45.3
45	Other unimproved land, 1920.....	600	1,640	2,014	440	.....	3,000	.....	5,725
46	Other unimproved land prior to drainage.....	22,250	15,410	7,209	866	7,180	9,420	3,744	18,953
47	Decrease since drainage.....	21,650	13,770	5,195	429	7,180	6,420	3,744	13,228
48	Per cent of decrease.....	97.3	89.4	72.1	49.4	100.0	68.2	100.0	69.8
49	Swampy, seeped, or subject to overflow, 1920.....	600	.....	1,579	2,389	.....	400	.....	1,280
50	Swampy, seeped, or subject to overflow prior to drainage.....	24,250	13,550	5,464	4,344	8,300	18,960	3,744	19,702
51	Decrease since drainage.....	23,650	13,550	3,885	1,975	8,300	18,560	3,744	18,422
52	Per cent of decrease.....	97.5	100.0	71.1	45.5	100.0	97.9	100.0	93.5
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
53	Total capital invested in and required for completion of operating enterprises.....	266,177	58,696	580,800	198,058	180,100	203,874	6,800	201,947
54	Capital invested in these enterprises to Dec. 31, 1919.....	262,177	57,403	380,000	118,048	180,100	203,874	6,800	201,947
55	Additional capital required to complete these enterprises.....	4,000	1,293	180,800	80,010	.....	.....	.....	.....
56	Average cost per acre when completed.....	8.10	1.90	34.78	45.59	14.64	7.89	1.09	7.74
57	Enterprises constructing open ditches only.....	217,247	18,759	75,000	.....	180,100	194,854	6,800	193,830
58	Average cost per acre when completed.....	8.64	2.00	9.38	.....	14.64	7.84	1.09	8.22
59	Enterprises constructing open ditches and levees.....	48,930	39,937	.....	.....	.....	9,020	.....	.....
60	Average cost per acre when completed.....	6.35	1.85	.....	.....	.....	9.02	.....	.....
61	Enterprises constructing tile drains only.....	.....	.....	.....	.....	.....	.....	.....	2,500
62	Average cost per acre when completed.....	.....	.....	.....	.....	.....	.....	.....	5.00
63	Enterprises constructing open ditches and tile drains.....	.....	.....	487,800	198,058	.....	.....	.....	5,617
64	Average cost per acre when completed.....	.....	.....	58.45	45.59	.....	.....	.....	2.81
<b>CROPS.</b>									
Improved land in enterprises reporting—									
65	Corn as principal crop on drained land.....	32,050	29,040	.....	.....	12,300	22,760	6,240	15,160
66	Small grains as principal crop on drained land.....	.....	.....	.....	.....	.....	.....	.....	600
67	Sugar beets as principal crop on drained land.....	.....	.....	10,880	5,904	.....	.....	.....	2,300
68	Hay as principal crop on drained land.....	.....	.....	3,230	.....	.....	.....	.....	2,125

<sup>1</sup> Includes only Antelope, Cass, Cherry, Dixon, Fillmore, Knox, Madison, Morrill, Nance, Platte, Polk, Seward, Thayer, and York Counties.  
<sup>2</sup> When works under construction have been completed.

# NORTH CAROLINA.

The following pages present the statistics of drainage for North Carolina collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

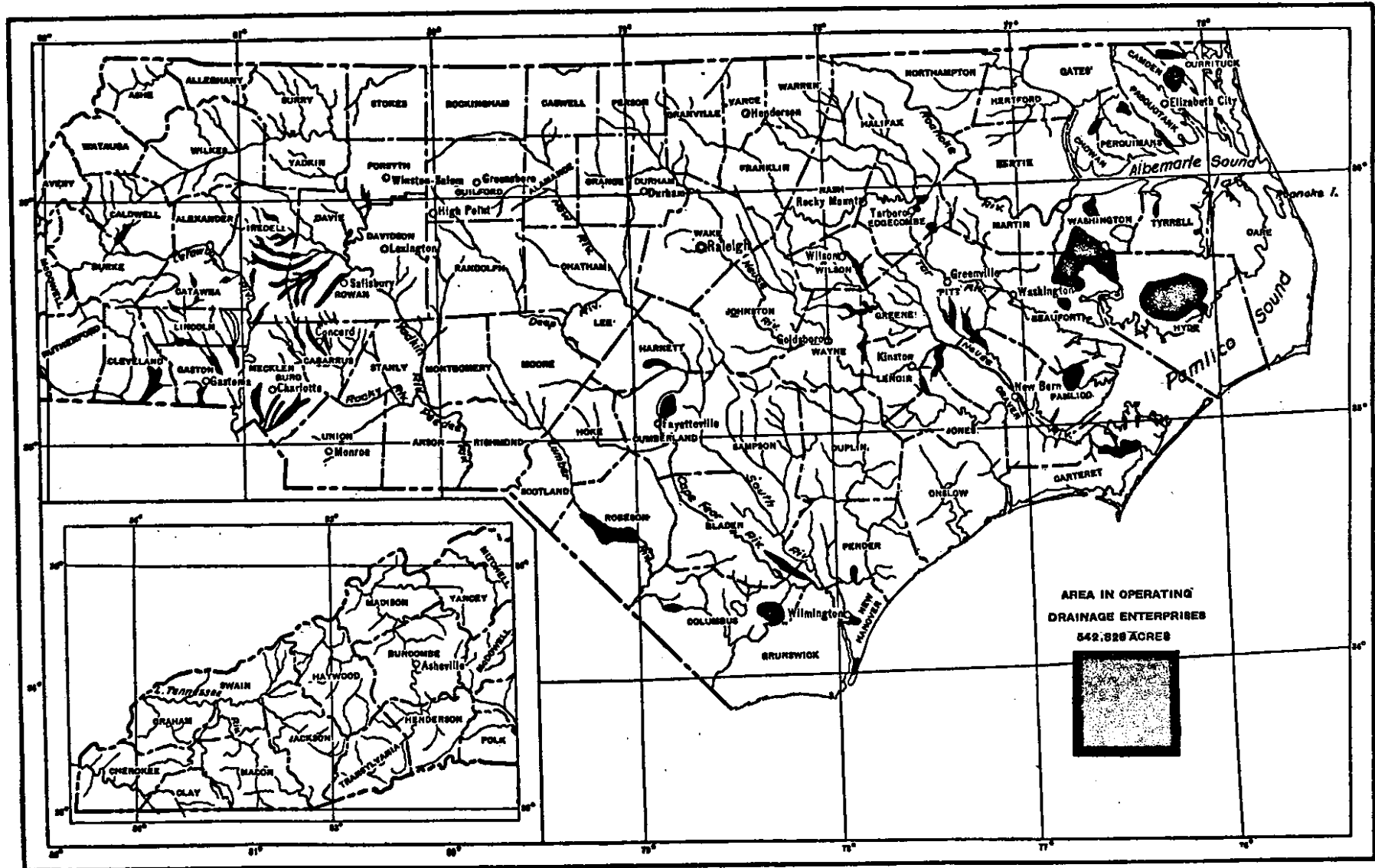
ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	269,763	100.0
Farms reporting land having drainage.....	45,246	16.8
Farms reporting land needing drainage.....	42,247	15.7
All land in farms..... acres.	20,021,736	100.0
Improved land in farms..... acres.	8,198,409	40.9
Farm land reported as provided with drainage..... acres.	1,066,933	5.3
Farm land reported as needing drainage..... acres.	1,925,343	9.6
Needing drainage only..... acres.	189,401	0.9
Needing drainage and clearing..... acres.	1,735,942	8.7
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres.	31,193,600	100.0
All land in operating drainage enterprises..... acres.	542,828	1.7
Improved land..... acres.	204,928	0.7
Per cent of all improved land in farms.....	2.5	
Timber and cut-over land..... acres.	244,576	0.8
Other unimproved land..... acres.	93,324	0.3
Swampy, subject to overflow, seeped, or alkali..... acres.	77,494	0.2
Suffering a loss of crops from defective drainage..... acres.	12,771	(1)
Improved land prior to drainage..... acres.	84,714	0.3
Increase since drainage began..... acres.	120,214	0.4
Land in nonoperating enterprises..... acres.		
Open ditches in operating enterprises..... miles.	1,539.1	100.0
Completed..... miles.	1,171.3	76.1
Additional under construction..... miles.	367.8	23.9
Tile drains in operating enterprises..... miles.		
Completed..... miles.		
Additional under construction..... miles.		
Total capital invested in and required for completion of operating enterprises.....	\$4,526,018	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	3,623,518	80.1
Additional capital required to complete these enterprises.....	902,500	19.9
Average cost per acre when completed.....	8.34	

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<sup>1</sup> Less than one-tenth of 1 per cent.

# NORTH CAROLINA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in North Carolina. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction. Among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>2</sup> .....	542,828	100.0	\$3,623,518	100.0	\$902,500
With works completed.....	440,657	81.2	3,075,018	84.9	.....
With works under construction.	102,171	18.8	548,500	15.1	902,500

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."  
<sup>2</sup> No nonoperating enterprises in North Carolina.

Location of enterprises.—The greater part of the land in drainage enterprises in North Carolina is in the northeastern part of the state. Of the total of 542,828 acres, 475,914 acres, or 87.7 per cent, are in the Coastal Plain region, and only 66,914 acres, or 12.3 per cent, are in the Piedmont section. On the peninsula between Albemarle Sound and Pamlico River are 227,482 acres, or 41.9 per cent of the state total.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	542,828	100.0	\$3,623,518	100.0	\$902,500
Pamlico River.....	118,656	21.5	642,800	17.7	440,000
Neuse River.....	25,499	4.7	339,000	9.4	3,000
Cape Fear River.....	72,472	13.4	448,500	12.4	.....
Peedee River.....	59,369	10.9	593,545	16.4	19,500
Santee River.....	46,145	8.5	439,351	12.1	.....
Atlantic Ocean.....	219,688	40.5	1,160,528	32.0	440,000

<sup>1</sup> No nonoperating enterprises in North Carolina.

Condition of land in enterprises.—In the Coastal Plain region the drainage enterprises are for the reclamation of broad areas that are mostly timbered or cut-over swamp land. In the region of Albemarle and Pamlico Sounds much of the land surface is practically flat and only slightly above sea level. In the Piedmont section of the state the drainage problem is that of preventing damage by overflow

from stream floods of short duration, and the enterprises are generally narrow strips forming the overflowed bottom land between the hills.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES. <sup>1</sup>			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	542,828	100.0	440,657	102,171
Improved land.....	204,928	37.8	188,609	6,419
Timber and cut-over land.....	244,576	45.1	179,934	64,642
Other unimproved land.....	93,324	17.2	62,114	31,210
Swampy or subject to overflow.....	77,494	14.3	25,089	52,405
Suffering a loss of crops.....	12,771	2.4	11,897	874

<sup>1</sup> No nonoperating enterprises in North Carolina.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 104 drainage enterprises are counted in North Carolina, with an average area of 5,312 acres assessed. The assessed acreage exceeds the land in enterprises by 9,600 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	542,828	552,428	100.0
Less than 200 acres.....	120	120	( <sup>1</sup> )
200 to 499 acres.....	2,997	2,997	0.5
500 to 999 acres.....	15,928	15,928	2.9
1,000 to 4,999 acres.....	93,226	98,026	17.4
5,000 to 9,999 acres.....	64,917	71,717	13.0
10,000 to 49,999 acres.....	265,640	265,640	48.1
50,000 to 99,999 acres.....	.....	.....	.....
100,000 to 499,999 acres.....	100,000	100,000	18.1

<sup>1</sup> Less than one-tenth of 1 per cent.



**Character of enterprises.**—The drainage enterprises in North Carolina comprise drainage districts, county drains, incorporated ditches, commercial land development companies, and private undertakings by individual landowners. The drainage districts, county drains, and incorporated ditches have been established under general laws and local or special acts intended to promote the reclamation and improvement of land that is wet or subject to overflow.

There are 81 drainage districts organized under the general drainage law of March 5, 1909 (ch. 442). Such districts are established by the superior courts of the counties in which they are situated. The petition for establishment must be signed by a majority of the resident landowners or by the owners of three-fifths of the land in the proposed district. Three disinterested viewers are appointed by the clerk of the court to report regarding the practicability of the project and the proper boundaries of the district, which must include no land that will not be benefited. If the report recommends against establishment, the petition is dismissed. After the decree of establishment has been issued the viewers prepare plans for the drainage works, assess damages, and divide the land into five classes according to the benefits that will accrue to the various tracts. Public hearings are held by the clerk of the court upon the viewers' reports, before the district is established and after the assessment of damages and the classification of the lands. From the clerk's determinations regarding damages and classification, appeals may be taken to the superior court. Three drainage commissioners are appointed by the clerk of the court, after being elected by the landowners. The drainage works are constructed by the commissioners, who apportion the cost according to the classification of the land. The five classes are assessed, per acre, in the ratio 5:4:3:2:1. If the average cost is less than 25 cents per acre, the assessments are collected in one installment; if it exceeds 25 cents per acre, the drainage commissioners may issue bonds of the district, payable in 3 to 12 years, in an amount not exceeding the unpaid assessments. Districts in more than one county are under the jurisdiction of the court with which the petition is filed. Subdistricts may be organized within any drainage district, in the same manner as main districts.

A drainage district of 3,000 acres has been formed under the general drainage law of March 6, 1905 (ch. 541). Upon petition from a majority of the owners of land adjacent to and on both sides of the creek or branch the county commissioners declare the district established. Each owner then is required to clean out the watercourse through or abutting his property, or the work will be done and the cost assessed against him. One district of 1,700 acres was created by a special act of the legislature.

The county drains are organized under local laws. All but one of the enterprises in Mecklenburg County have been formed under an act of March 3, 1911 (ch. 538), applying in only that county. The law created a county drainage commission to secure such drainage improvements in the county as might seem advantageous. The land to be benefited by each drain is divided by the commission into five classes, and the cost is assessed in the same manner as provided in the drainage district law of 1909. Hearing on the classification is held by the commission, from whose determinations appeal may be taken to the superior court of the county. Damages for lands condemned are determined as in railroad condemnation cases. Plans for the works are prepared and contracts for construction are let by the commission. Assessments are levied annually until the works are paid for, at not to exceed \$5 per acre. Bonds for drainage work may be issued for the commission, not to exceed \$15,000.

One county drain has been established, to benefit 600 acres, under an act of February 27, 1885 (ch. 149), effective in only Rowan, Davidson, Davie, and Catawba Counties. Upon petition from a majority of the owners of land on any one of the streams in the county, five drainage commissioners are appointed by the county commissioners. The drainage commissioners estimate each owner's acreage that will be affected, and the owners then furnish laborers, each in proportion to his acreage and the wetness of his land, to work under overseers appointed by the commissioners.

Incorporated ditches may be established by the superior courts of the counties, under an act of April 10, 1869 (ch. 164). Petition is filed by a landowner who desires drainage and can secure outlet only across the land of another owner who also will be benefited by the drain. Commissioners are appointed by the court to determine the location and size of the drain and the proportion of cost to be paid by each owner benefited. The drain will not be established if the estimated cost exceeds three-fourths of the value of the land to be benefited, if the lower lands will not be increased 25 per cent in value, or if the owners of one-half in value of the land to be affected do not consent. A statute of 1795, also, provided for any landowner needing to secure drainage outlet across the property of an objecting owner. As amended that law requires a petition to the clerk of the superior court, who will appoint commissioners to assess the damages that the petitioner must pay before he may construct the drain.

Many amendments to the laws enumerated above have been made, but without affecting the forms of the enterprises or the methods of organization as described. A large number of local and special laws have been enacted, for which no enterprises were reported.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	542,828	100.0	\$3,623,518	100.0	\$902,500
Drainage districts.....	458,396	84.4	3,161,317	87.2	484,600
County drains.....	17,724	3.3	113,101	3.1	.....
Incorporated ditches.....	6,857	1.3	34,100	0.9	.....
Commercial developments.....	30,976	5.7	170,000	4.7	415,000
Individual ownerships.....	28,576	5.3	145,000	4.0	3,000

<sup>1</sup> No nonoperating enterprises in North Carolina.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 1,171.3 miles of open ditches and 33.5 miles of accessory levees; the additional lengths under construction were 367.8 miles of ditches only. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one pumping district for land drainage in North Carolina. All the drainage water from 100,000 acres is removed by 16 centrifugal pumps of 1,000,000 gallons per minute capacity, operated by steam engines capable of developing 1,000 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	542,828	100.0	\$3,623,518	100.0	\$902,500
Open ditches only.....	435,295	80.2	2,827,144	78.0	902,500
Open ditches and levees.....	107,533	19.8	796,374	22.0	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the

occasional decimals were omitted in making these computations. Depths of 10 feet and more were omitted; to include this group, computed as 10 feet, would show the mean depth for the state 7.5 instead of 6.7 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	542,828	100.0
4.0 to 4.9 feet.....	16,380	3.0
5.0 to 5.9 feet.....	41,092	7.6
6.0 to 6.9 feet.....	101,094	18.6
7.0 to 7.9 feet.....	104,795	19.3
8.0 to 8.9 feet.....	44,940	8.3
9.0 to 9.9 feet.....	47,929	8.8
10 feet and more.....	105,300	19.4
Not reporting branches.....	81,298	15.0

Maintenance of works.—The law of 1909, as amended, requires that in each drainage district the original assessment for cost of construction shall include an amount estimated to be sufficient for keeping the works in repair for three years. The drainage commissioners are authorized also to levy special assessments for maintenance purposes, apportioned like the cost of construction, whenever deemed necessary by the commissioners. For maintenance of works constructed by the Mecklenburg County drainage commission, under the act of 1911, that commission may levy assessments apportioned like those for construction.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	542,828	100.0	\$3,623,518	100.0	\$902,500
By district forces.....	9,408	1.7	147,471	4.1	.....
By contract.....	160,101	29.5	1,080,054	30.1	13,500
By landowners.....	28,810	5.3	299,995	8.3	.....
Method not stated.....	8,350	1.5	79,000	2.2	.....
No maintenance provided.....	295,421	54.4	1,827,998	50.4	514,000
Not reporting.....	40,740	7.5	179,000	4.9	375,000

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the court or other designated officials, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

DRAINAGE—NORTH CAROLINA.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	542,828	100.0	552,428	100.0
Before 1880.....	1,650	0.3	1,650	0.3
1880 to 1889.....	2,507	0.5	2,507	0.5
1905 to 1909.....	51,553	9.5	51,553	9.3
1910 to 1914.....	347,661	64.0	357,261	64.7
1915 to 1919.....	139,457	25.7	139,457	25.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$3,623,518	100.0	\$902,500
Before 1880.....	10,000	0.3	.....
1880 to 1889.....	10,000	0.3	.....
1905 to 1909.....	327,500	9.0	.....
1910 to 1914.....	2,329,797	49.0	6,000
1915 to 1919.....	946,251	41.4	896,500

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	1,539.1	100.0	33.5	100.0
Before 1880.....	6.0	0.4	.....	.....
1880 to 1889.....	5.0	0.3	.....	.....
1905 to 1909.....	111.7	7.3	2.8	7.5
1910 to 1914.....	758.6	49.3	31.0	92.5
1915 to 1919.....	657.8	42.7	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and cotton. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Ala- manca.	Alle- ghany.	Anson.	Ashe.	Beaufort.	Bertie.	Bladen.												
									Brunswick.	Buncombe.	Burke.	Cabarrus.	Caldwell.	Camden.	Carteret.	Catawba.	Chowan.			
1	Number of all farms in the state or county.....	269,763	2,705	1,409	3,706	3,407	3,228	3,340	2,452											
2	Farms reporting land having drainage.....	45,246	65	90	187	515	2,250	1,341	1,223											
3	Farms reporting land needing drainage.....	42,247	242	99	502	989	1,739	1,000	1,040											
4	Farms in drainage and levee districts.....	1,881	3	.....	9	1	261	2	49											
<b>LAND AND FARM AREA.</b>																				
5	Approximate land area of the state or county.....acres..	31,193,600	314,830	149,780	355,840	273,280	537,600	449,920	624,640											
6	All land in farms.....acres..	20,021,738	239,175	138,908	251,975	260,765	218,828	233,242	249,918											
7	Improved land in farms.....acres..	8,198,409	100,776	91,789	112,352	158,051	79,403	87,284	68,177											
8	Woodland in farms.....acres..	10,289,547	119,583	45,286	121,717	87,744	134,311	137,446	163,196											
9	Other unimproved land in farms.....acres..	1,523,780	18,816	1,633	17,906	14,970	5,114	8,512	18,543											
10	Farm land reported as provided with drainage.....acres..	1,066,933	707	715	2,152	3,877	57,455	22,698	30,434											
11	Farm land reported as needing drainage.....acres..	1,925,343	1,613	1,114	24,142	23,123	100,164	28,855	71,506											
12	Drainage only.....acres..	189,401	89	332	1,408	1,345	1,039	1,779	6,238											
13	Drainage and clearing.....acres..	1,735,942	1,524	732	22,734	21,778	99,125	27,076	65,268											
<b>LAND AND FARM AREA.</b>																				
1	Number of all farms in the county.....	1,417	3,701	2,194	2,427	1,972	875	858	2,916	1,028										
2	Farms reporting land having drainage.....	592	138	184	113	88	659	102	188	610										
3	Farms reporting land needing drainage.....	861	160	197	84	110	206	80	118	386										
4	Farms in drainage and levee districts.....	.....	.....	7	3	19	20	.....	28	1										
<b>LAND AND FARM AREA.</b>																				
5	Approximate land area of the county.....acres..	505,600	408,960	341,760	249,600	301,440	140,300	366,720	261,120	105,600										
6	All land in farms.....acres..	206,959	260,134	195,202	206,903	183,639	52,845	69,494	217,463	77,253										
7	Improved land in farms.....acres..	28,854	129,467	58,461	101,873	61,294	35,384	17,304	113,685	33,973										
8	Woodland in farms.....acres..	164,810	126,615	117,774	73,906	113,783	17,206	42,159	80,192	41,288										
9	Other unimproved land in farms.....acres..	16,595	10,062	18,967	31,124	8,584	255	9,971	23,586	1,992										
10	Farm land reported as provided with drainage.....acres..	18,309	2,749	1,652	1,895	893	25,826	4,691	1,554	15,966										
11	Farm land reported as needing drainage.....acres..	66,138	3,454	5,474	1,214	2,511	5,674	16,085	627	16,810										
12	Drainage only.....acres..	13,878	231	313	786	656	90	4,015	265	681										
13	Drainage and clearing.....acres..	52,260	3,223	5,161	428	1,955	5,584	12,070	363	16,129										

# DRAINAGE—NORTH CAROLINA

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Clay.	Cleveland.	Columbus.	Craven.	Cumberland.	Currituck.	Davidson.	DeWitt.	Duplin.
1	Number of all farms in the county.....	808	4,016	3,580	2,598	3,100	994	3,770	1,768	4,686
2	Farms reporting land having drainage.....	125	142	2,695	1,134	708	266	504	130	2,538
3	Farms reporting land needing drainage.....	61	112	2,428	582	604	212	660	144	1,453
4	Farms in drainage and levee districts.....		77	37	1	5	13	6		2
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	140,800	317,440	597,120	422,400	428,800	186,880	364,160	165,120	505,800
6	All land in farms..... acres..	71,130	252,539	284,184	149,899	233,840	88,843	311,746	151,713	314,600
7	Improved land in farms..... acres..	24,876	132,425	78,693	50,701	92,196	50,589	128,542	67,690	98,638
8	Woodland in farms..... acres..	40,871	89,431	180,640	72,587	130,864	29,875	130,699	56,856	195,236
9	Other unimproved land in farms..... acres..	5,383	30,683	24,851	17,611	10,780	8,379	52,515	27,167	20,726
10	Farm land reported as provided with drainage..... acres..	987	4,735	58,397	21,782	18,620	15,957	3,873	1,426	54,984
11	Farm land reported as needing drainage..... acres..	386	1,455	130,123	37,428	42,262	7,034	21,191	1,686	86,421
12	Drainage only..... acres..	307	341	10,479	6,424	3,609	185	1,277	755	3,424
13	Drainage and clearing..... acres..	79	1,114	119,644	31,004	38,653	6,849	19,914	931	82,497

		Edgecombe.	Forsyth.	Franklin.	Gaston.	Gates.	Graham.	Granville.	Greene.	Gulford.
1	Number of all farms in the county.....	3,840	2,849	4,226	3,339	1,583	746	3,503	2,740	4,021
2	Farms reporting land having drainage.....	1,765	155	8	148	589	48	37	229	63
3	Farms reporting land needing drainage.....	643	186	429	121	370	75	123	10	172
4	Farms in drainage and levee districts.....	1	23	3	28	4			79	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	325,760	240,640	299,520	232,320	229,760	190,720	321,620	161,280	442,240
6	All land in farms..... acres..	256,842	209,604	223,615	178,346	125,075	63,112	293,604	126,754	350,669
7	Improved land in farms..... acres..	138,733	94,389	105,608	87,300	49,140	17,457	112,556	67,447	145,795
8	Woodland in farms..... acres..	108,749	95,255	102,428	63,656	65,778	43,191	151,469	56,056	165,551
9	Other unimproved land in farms..... acres..	9,360	10,960	15,579	27,390	10,157	2,464	34,579	3,251	39,313
10	Farm land reported as provided with drainage..... acres..	61,838	1,437	5,006	1,939	15,488	705	3,598	4,516	837
11	Farm land reported as needing drainage..... acres..	39,539	2,131	18,124	1,901	18,033	924	5,892	208	3,773
12	Drainage only..... acres..	3,488	1,234	592	705	2,079	248	818	140	1,283
13	Drainage and clearing..... acres..	36,051	897	17,532	1,196	10,954	676	5,074	68	2,490

		Halifax.	Harnett.	Haywood.	Henderson.	Hertford.	Hoke.	Hyde.	Iredell.	Jackson.
1	Number of all farms in the county.....	4,671	3,378	2,074	1,973	2,084	1,496	1,148	4,115	1,853
2	Farms reporting land having drainage.....	463	525	89	148	954	237	491	217	108
3	Farms reporting land needing drainage.....	833	1,046	238	93	649	153	201	234	157
4	Farms in drainage and levee districts.....	9	5			1		38	166	
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	432,640	376,320	349,440	229,120	218,240	266,880	394,880	376,320	316,160
6	All land in farms..... acres..	334,803	239,746	172,268	148,741	185,516	99,543	80,675	347,747	148,568
7	Improved land in farms..... acres..	152,328	90,947	81,796	53,150	60,289	52,655	37,060	160,738	49,777
8	Woodland in farms..... acres..	155,880	142,809	88,086	67,434	114,475	36,402	32,270	151,888	85,525
9	Other unimproved land in farms..... acres..	26,595	5,990	7,386	28,157	4,752	10,486	11,345	35,121	13,266
10	Farm land reported as provided with drainage..... acres..	17,634	6,221	781	3,297	18,633	4,117	15,697	2,461	832
11	Farm land reported as needing drainage..... acres..	46,832	46,646	8,108	1,948	24,235	5,937	75,265	2,564	5,446
12	Drainage only..... acres..	4,490	1,409	273	573	387	337	50,117	1,246	267
13	Drainage and clearing..... acres..	42,342	45,237	7,835	1,375	23,898	5,600	25,148	1,318	5,149

		Johnston.	Jones.	Lee.	Lenoir.	Madison.	Martin.	Mecklenburg.	Moore.	Nash.
1	Number of all farms in the county.....	7,026	1,540	1,465	3,162	2,935	2,515	4,344	2,176	4,451
2	Farms reporting land having drainage.....	1,267	62	85	1,502	107	274	183	97	322
3	Farms reporting land needing drainage.....	1,315	67	260	546	82	293	600	158	485
4	Farms in drainage and levee districts.....	2			11		1	24		13
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	516,480	266,880	167,040	249,600	279,040	230,320	332,080	408,960	375,040
6	All land in farms..... acres..	396,438	156,634	121,006	189,153	213,290	191,404	283,105	229,597	241,948
7	Improved land in farms..... acres..	177,433	52,868	37,077	90,322	106,249	79,360	151,447	67,320	108,272
8	Woodland in farms..... acres..	212,552	97,692	80,793	93,247	97,260	106,055	90,898	161,799	126,119
9	Other unimproved land in farms..... acres..	6,453	6,074	3,136	5,584	9,781	5,989	45,760	9,978	7,557
10	Farm land reported as provided with drainage..... acres..	16,649	1,648	745	47,556	685	14,076	2,115	779	8,797
11	Farm land reported as needing drainage..... acres..	43,718	6,949	16,891	28,804	1,266	18,892	10,036	10,052	17,094
12	Drainage only..... acres..	2,968	241	533	8,663	55	4,655	2,015	888	694
13	Drainage and clearing..... acres..	40,750	6,708	16,368	20,141	1,211	14,237	8,021	9,664	16,400

## DRAINAGE—NORTH CAROLINA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	New Hanover.	Northampton.	Onslow.	Pamlico.	Pasquotank.	Pender.	Perquimans.	Pitt.	Randolph.
1	323	3,501	2,179	1,316	1,360	1,886	1,462	5,937	3,871
2	60	1,128	740	811	730	349	778	2,022	63
3	84	358	412	450	188	705	289	1,124	394
4	1	5		344		10	8	27	
<b>LAND AND FARM AREA.</b>									
5	138,240	322,560	475,520	224,000	142,720	521,600	161,280	401,280	513,920
6	17,928	222,418	193,176	85,382	84,469	178,981	86,360	293,062	405,320
7	6,137	104,841	54,196	35,170	51,065	44,003	48,463	146,327	132,242
8	9,864	105,156	133,804	42,169	29,878	128,585	37,222	137,350	242,732
9	1,925	12,421	5,176	8,043	3,526	6,393	675	9,385	30,346
10	1,244	21,526	15,650	20,213	26,709	10,240	24,847	52,706	773
11	2,966	11,479	26,463	22,936	9,147	54,311	8,972	63,627	20,498
12	216	1,591	413	111	156	1,452	88	3,057	488
13	2,780	9,888	26,050	22,825	8,991	52,859	8,884	60,570	20,010
	Richmond.	Robeson.	Rowan.	Sampson.	Scotland.	Stanly.	Transylvania.	Tyrrell.	Union.
1	1,797	6,564	3,474	5,771	1,830	2,519	799	643	4,820
2	25	2,980	268	1,809	659	211	184	257	564
3	215	1,841	219	2,264	191	83	65	152	1,093
4	1	97	103	1		2		164	
<b>LAND AND FARM AREA.</b>									
5	333,440	633,600	312,060	567,040	223,360	266,240	242,560	249,600	361,600
6	164,521	400,228	296,408	427,493	114,942	207,205	69,984	54,440	347,939
7	77,593	209,367	145,063	148,867	75,822	87,549	19,383	18,610	156,443
8	76,519	161,363	118,042	257,246	35,112	103,191	43,283	34,910	160,533
9	10,409	29,498	33,303	21,380	4,008	16,465	7,318	920	80,963
10	589	93,052	2,136	36,346	18,931	10,432	4,893	5,762	9,732
11	11,196	89,045	4,174	123,085	11,810	2,222	1,966	4,516	35,808
12	342	6,570	759	6,437	756	685	843	411	3,451
13	10,854	82,475	3,415	116,648	11,054	1,537	1,143	4,105	32,367
	Warren.	Washing- ton.	Watauga.	Wayne.	Wilkes.	Wilson.	Yadkin.	All other counties. <sup>1</sup>	
1	3,169	1,110	2,020	5,030	4,971	4,439	2,646	55,129	
2	85	321	249	1,689	370	1,271	164	651	
3	502	92	805	689	846	859	40	4,575	
4		3	2	61		26		73	
<b>LAND AND FARM AREA.</b>									
5	272,000	209,280	193,920	365,440	470,400	238,720	207,360	6,299,520	
6	195,381	73,866	171,935	281,591	369,084	185,029	202,321	4,344,300	
7	81,031	35,422	84,138	140,009	109,865	98,641	78,920	1,574,082	
8	102,572	34,470	82,933	122,696	211,939	82,750	95,544	2,407,237	
9	11,778	3,974	4,864	18,886	47,280	3,608	27,857	362,981	
10	1,075	8,794	1,980	35,765	2,142	28,025	2,390	5,559	
11	26,365	3,415	25,942	19,168	22,974	18,944	792	148,724	
12	715	53	1,073	1,121	822	1,067	233	6,137	
13	27,650	3,362	24,869	18,047	22,152	17,877	559	142,587	

<sup>1</sup> No drainage on farms reported in Orange and Person Counties.

DRAINAGE—NORTH CAROLINA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Beaufort.	Bladen.	Camden.	Carteret.	Cleveland.	Columbus.	
<b>LAND AREA.</b>								
1	Approximate land area of the state or county.....acres.	31,193,600	537,600	624,640	140,800	366,720	317,440	597,120
2	All land in operating drainage enterprises.....acres.	542,828	59,629	7,533	11,914	33,000	14,622	34,000
3	Improved land.....acres.	204,928	24,803	6,731	2,979	150	10,967	5,300
4	Per cent of all improved land in farms.....	2.5	31.2	9.9	8.4	0.9	8.3	6.7
5	Timber and out-over land.....acres.	244,576	34,826	802	8,935	4,950		28,700
6	Other unimproved land.....acres.	93,324				27,900	3,655	
7	Swampy or subject to overflow, in enterprises.....acres.	77,494	3,000			32,850	2,193	
8	Suffering a loss of crops from defective drainage.....acres.	12,771					2,193	
9	Assessed acreage.....	552,428	59,629	7,533	11,914	33,000	14,622	34,000
10	Excess over all land in operating enterprises.....acres.	9,600						
<b>DRAINAGE WORKS.</b>								
11	Open ditches:							
12	Completed.....miles.	1,171.3	107.6	24.5	8.0	41.2	24.0	61.0
13	Additional under construction.....miles.	367.8	8.0			233.8		
14	Maximum completed in any enterprise.....miles.	110.0	42.5	10.0	8.0	41.2	24.0	42.0
15	Maximum width at bottom of ditch <sup>1</sup> .....feet.	70	46	28	30	8	35	14
16	Maximum of average depths of outlet ditches <sup>1</sup> .....feet.	14.0	10.0	8.0	7.0	8.0	10.0	14.0
17	Mean depth of branch ditches <sup>1</sup> .....feet.	6.7	8.0	4.1	7.0	6.0	8.0	8.2
18	Accessory levees and dikes:							
19	Completed.....miles.	33.5		3.5				
20	Additional under construction.....miles.							
21	Pumping plants:							
22	Engine capacity.....horsepower.	1,000						
23	Pump capacity.....gallons per minute.	1,000,000						
24	Area served by pumps.....acres.	100,000						
25	Area drained by open ditches only <sup>1</sup> .....acres.	435,295	59,629		11,914	33,000	14,622	34,000
26	Length of the ditches.....miles.	1,404.6	115.6		8.0	275.0	24.0	61.0
27	Average length per acre.....feet.	17.0	10.2		3.5	44.0	8.7	9.5
28	Area having open ditches and levees <sup>1</sup> .....acres.	107,533		7,533				
29	Length of the ditches.....miles.	134.5		24.5				
30	Average length per acre.....feet.	6.6		17.2				
31	Length of the accessory levees.....miles.	33.5		3.5				
<b>DEVELOPMENT OF LAND.</b>								
32	Improved land in operating enterprises, 1920.....acres.	204,928	24,803	6,731	2,979	150	10,967	5,300
33	Improved land prior to drainage.....acres.	84,714	5,819	838	2,383			3,000
34	Increase since drainage.....acres.	120,214	18,984	5,893	596	150	10,967	2,300
35	Per cent of increase.....	141.9	326.2	703.2	25.0			76.7
36	Per cent increase is of all improved land in farms, 1920.....	1.5	23.9	8.6	1.7	0.9	8.3	2.9
37	Timber and out-over land, 1920.....acres.	244,576	34,826	802	8,935	4,950		28,700
38	Timber and out-over land prior to drainage.....acres.	311,626	52,010	6,695	9,531	4,950		31,000
39	Decrease since drainage.....acres.	67,050	17,184	5,893	596			2,300
40	Per cent of decrease.....	21.5	33.0	88.0	6.3			7.4
41	Other unimproved land, 1920.....acres.	93,324				27,900	3,655	
42	Other unimproved land prior to drainage.....acres.	146,486	1,800			28,050	14,622	
43	Decrease since drainage.....acres.	53,164	1,800			150	10,967	
44	Per cent of decrease.....	36.3	100.0			0.5	75.0	
45	Swampy or subject to overflow, 1920.....acres.	77,494	3,000			32,850	2,193	
46	Swampy or subject to overflow prior to drainage.....acres.	311,110	33,000	5,700	5,957	33,000	14,622	28,000
47	Decrease since drainage.....acres.	233,616	30,000	5,700	5,957	150	12,429	28,000
48	Per cent of decrease.....	75.1	90.9	100.0	100.0	0.5	85.0	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
49	Total capital invested in and required for completion of operating enterprises.....dollars.	4,526,018	333,250	61,000	30,000	395,000	75,000	232,000
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	3,623,518	304,250	61,000	30,000	65,000	75,000	232,000
51	Additional capital required to complete these enterprises.....dollars.	902,500	29,000			330,000		
52	Average cost per acre when completed.....dollars.	8.34	5.59	8.10	2.52	11.97	6.13	6.82
53	Enterprises constructing open ditches only.....dollars.	3,729,644	333,250		30,000	395,000	75,000	232,000
54	Average cost per acre when completed.....dollars.	8.57	5.59		2.52	11.97	6.13	6.82
55	Enterprises constructing open ditches and levees.....dollars.	796,374		61,000				
56	Average cost per acre when completed.....dollars.	7.41		8.10				
<b>CROPS.</b>								
57	Improved land in enterprises reporting—							
58	Corn as principal crop on drained land.....acres.	163,658	21,803	6,731	2,979	150	10,967	5,300
59	Cotton as principal crop on drained land.....acres.	19,678	3,000					
60	Other crops as principal ones on drained land.....acres.	11,592						

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Includes 242 acres not reporting principal crop.

## DRAINAGE—NORTH CAROLINA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Craven.	Cumber- land.	Currutuck.	Edge- combe.	Harnett.	Hyde.	Iredell.	Lenoir.	
<b>LAND AREA.</b>									
1	Approximate land area of the county..... acres..	422,400	428,800	186,880	325,760	376,320	394,880	376,320	249,600
2	All land in operating drainage enterprises..... acres..	7,800	23,000	25,915	4,857	6,730	128,529	8,679	4,833
3	Improved land..... acres..	2,190	13,800	8,579	4,857	5,048	33,728	7,509	2,376
4	Per cent of all improved land in farms.....	3.7	15.0	17.0	3.5	5.6	91.0	4.7	2.6
5	Timber and cut-over land..... acres..	5,610	9,200	17,336			42,671	591	2,457
6	Other unimproved land..... acres..					1,682	52,130	579	
7	Swampy or subject to overflow, in enterprises..... acres..	380			251		28,636	1,874	
8	Suffering a loss of crops from defective drainage..... acres..	19			251			1,831	
9	Assessed acreage.....	7,800	23,000	25,915	4,857	6,730	131,329	8,679	4,833
10	Excess over all land in operating enterprises..... acres..						2,800		
<b>DRAINAGE WORKS.</b>									
Open ditches:									
11	Completed..... miles..	18.5	37.0	30.0	14.0	15.0	125.6	90.0	11.7
12	Additional under construction..... miles..						95.3	4.2	
13	Maximum completed in any enterprise..... miles..	10.5	37.0	22.0	6.0	15.0	110.0	15.5	8.0
14	Maximum width at bottom of ditch <sup>1</sup> ..... feet..	30	16	30	20	14	70	35	30
15	Maximum of average depths of outlet ditches <sup>1</sup> ..... feet..	8.0	6.0	7.0	12.0	10.0	10.0	9.0	8.0
16	Mean depth of branch ditches <sup>1</sup> ..... feet..	5.9	6.0	5.9		4.0	7.7	7.2	5.0
Accessory levees and dikes:									
17	Completed..... miles..						30.0		
18	Additional under construction..... miles..								
Pumping plants:									
19	Engine capacity..... horsepower..						1,000		
20	Pump capacity..... gallons per minute..						1,000,000		
21	Area served by pumps..... acres..						100,000		
22	Area drained by open ditches only <sup>1</sup> ..... acres..	7,800	23,000	25,915	4,857	6,730	28,529	8,679	4,833
23	Length of the ditches..... miles..	18.5	37.0	30.0	14.0	15.0	110.9	94.2	11.7
24	Average length per acre..... feet..	12.5	8.5	6.1	15.2	11.8	20.5	57.3	12.8
25	Area having open ditches and levees <sup>1</sup> ..... acres..						100,000		
26	Length of the ditches..... miles..						110.0		
27	Average length per acre..... feet..						5.8		
28	Length of the accessory levees..... miles..						30.0		
<b>DEVELOPMENT OF LAND.</b>									
29	Improved land in operating enterprises, 1920..... acres..	2,190	13,800	8,579	4,857	5,048	33,728	7,509	2,376
30	Improved land prior to drainage..... acres..	1,600	9,200	7,283	1,525	4,038	25,185	2,895	1,642
31	Increase since drainage..... acres..	590	4,600	1,296	3,332	1,010	8,543	4,614	734
32	Per cent of increase.....	36.8	50.0	17.8	218.5	25.0	33.9	159.4	44.7
33	Per cent increase is of all improved land in farms, 1920.....	1.0	5.0	2.6	2.4	1.1	23.1	2.9	0.8
34	Timber and cut-over land, 1920..... acres..	5,610	9,200	17,336			42,671	591	2,457
35	Timber and cut-over land prior to drainage..... acres..	6,200	13,800	18,632			51,214	1,680	3,191
36	Decrease since drainage..... acres..	590	4,600	1,296			8,543	1,069	734
37	Per cent of decrease.....	9.5	33.3	7.0			16.7	64.4	23.0
38	Other unimproved land, 1920..... acres..					1,682	52,130	579	
39	Other unimproved land prior to drainage..... acres..				3,332	2,692	52,130	4,124	
40	Decrease since drainage..... acres..				3,332	1,010		3,545	
41	Per cent of decrease.....				100.0	37.5		86.0	
42	Swampy or subject to overflow, 1920..... acres..	380			251		28,636	1,874	
43	Swampy or subject to overflow prior to drainage..... acres..	7,800			4,332	3,365	75,622	3,935	4,000
44	Decrease since drainage..... acres..	7,420			4,081	3,365	46,986	2,061	4,000
45	Per cent of decrease.....	95.1			94.2	100.0	62.1	52.4	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
46	Total capital invested in and required for completion of operating enterprises..... dollars..	89,000	76,500	73,000	30,000	30,000	1,215,272	197,225	32,500
47	Capital invested in these enterprises to Dec. 31, 1919..... dollars..	89,000	76,500	73,000	30,000	30,000	800,372	133,725	32,500
48	Additional capital required to complete these enterprises..... dollars..						415,000	13,500	
49	Average cost per acre when completed..... dollars..	11.41	3.33	2.82	6.18	4.46	9.46	22.72	6.72
50	Enterprises constructing open ditches only..... dollars..	89,000	76,500	73,000	30,000	30,000	479,898	197,225	32,500
51	Average cost per acre when completed..... dollars..	11.41	3.33	2.82	6.18	4.46	16.82	22.72	6.72
52	Enterprises constructing open ditches and levees..... dollars..						735,374		
53	Average cost per acre when completed..... dollars..						7.35		
<b>CROPS.</b>									
Improved land in enterprises reporting—									
54	Corn as principal crop on drained land..... acres..	2,190	13,800	8,579	4,157		33,728	7,509	2,376
55	Cotton as principal crop on drained land..... acres..				700	5,048			
56	Other crops as principal ones on drained land..... acres..								

<sup>1</sup> When works under construction have been completed.

# DRAINAGE—NORTH CAROLINA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Mecklenburg.	Famlico.	Perquimans.	Pitt.	Robeson.	Rowan.	Washington.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres..	382,080	224,000	161,280	401,280	633,600	212,960	206,280	23,523,840
2	All land in operating drainage enterprises.....	acres..	17,224	19,875	8,300	6,200	32,600	7,027	38,444	42,117
3	Improved land.....	acres..	14,358	867	8,300	1,760	9,780	5,151	5,617	30,078
4	Per cent of all improved land in farms.....		9.5	2.5	17.1	1.2	4.7	3.6	15.9	2.3
5	Timber and cut-over land.....	acres..	484	19,008		4,440	22,820	960	32,827	7,959
6	Other unimproved land.....	acres..	2,382					916		4,080
7	Swampy or subject to overflow, in enterprises.....	acres..	1,133			250		1,200	1,251	4,476
8	Suffering a loss of crops from defective drainage.....	acres..	1,247		1,500	171			251	4,134
9	Assessed acreage.....	acres..	17,224	19,875	8,300	6,200	32,600	7,027	45,244	42,117
10	Excess over all land in operating enterprises.....	acres..							6,800	
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....	miles..	50.0	25.0	14.0	20.0	55.0	63.0	88.6	247.6
12	Additional under construction.....	miles..							25.4	1.1
13	Maximum completed in any enterprise.....	miles..	14.0	20.0	10.0	11.5	55.0	12.0	58.0	14.0
14	Maximum width at bottom of ditch.....	feet..	36	20	30	30	22	60	48	40
15	Maximum of average depths of outlet ditches.....	feet..	9.0	9.0	11.0	8.0	8.0	11.0	8.5	14.0
16	Mean depth of branch ditches.....	feet..	8.0	6.8		7.0	6.0	6.5	9.1	5.5
Accessory levees and dikes:										
17	Completed.....	miles..								
18	Additional under construction.....	miles..								
Pumping plants:										
19	Engine capacity.....	horsepower..								
20	Pump capacity.....	gallons per minute..								
21	Area served by pumps.....	acres..								
22	Area drained by open ditches only.....	acres..	17,224	19,875	8,300	6,200	32,600	7,027	38,444	42,117
23	Length of the ditches.....	miles..	50.0	25.0	14.0	20.0	55.0	63.0	114.0	248.7
24	Average length per acre.....	feet..	15.3	6.6	8.9	17.0	8.9	47.3	15.7	31.2
25	Area having open ditches and levees.....	acres..								
26	Length of the ditches.....	miles..								
27	Average length per acre.....	feet..								
28	Length of the accessory levees.....	miles..								
<b>DEVELOPMENT OF LAND.</b>										
29	Improved land in operating enterprises, 1920.....	acres..	14,358	867	8,300	1,760	9,780	5,151	5,617	30,078
30	Improved land prior to drainage.....	acres..	1,470		3,530	150	6,520	681	1,130	5,819
31	Increase since drainage.....	acres..	12,888	867	4,770	1,610	3,260	4,470	4,481	24,259
32	Per cent of increase.....		876.7		135.1		50.0	666.4	384.5	416.9
33	Per cent increase is of all improved land in farms, 1920.....		8.5	2.5	9.8	1.1	1.6	3.1	12.7	1.9
34	Timber and cut-over land, 1920.....	acres..	484	19,008		4,440	22,820	960	32,827	7,959
35	Timber and cut-over land prior to drainage.....	acres..	3,043	19,875	4,770	6,050	26,080	1,593	37,308	14,024
36	Decrease since drainage.....	acres..	2,559	867	4,770	1,610	3,260	633	4,481	6,065
37	Per cent of decrease.....		84.1	4.4	100.0	26.6	12.5	39.7	12.0	43.2
38	Other unimproved land, 1920.....	acres..	2,382					916		4,080
39	Other unimproved land prior to drainage.....	acres..	12,711					4,753		22,274
40	Decrease since drainage.....	acres..	10,329					3,837		18,194
41	Per cent of decrease.....		81.3					80.7		81.7
42	Swampy or subject to overflow, 1920.....	acres..	1,133			250		1,200	1,251	4,476
43	Swampy or subject to overflow prior to drainage.....	acres..	16,308	16,000		5,200		3,210	24,151	26,908
44	Decrease since drainage.....	acres..	15,175	16,000		4,950		2,010	22,900	22,432
45	Per cent of decrease.....		93.1	100.0		95.2		62.6	94.8	83.4
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
46	Total capital invested in and required for completion of operating enterprises.....	dollars..	115,101	96,000	45,625	77,600	165,000	129,026	440,352	587,567
47	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	115,101	96,000	45,625	77,600	165,000	129,026	334,352	578,567
48	Additional capital required to complete these enterprises.....	dollars..							106,000	9,000
49	Average cost per acre when completed.....	dollars..	6.68	4.83	5.50	12.52	5.06	18.36	11.45	13.95
50	Enterprises constructing open ditches only.....	dollars..	115,101	96,000	45,625	77,600	165,000	129,026	440,352	587,567
51	Average cost per acre when completed.....	dollars..	6.68	4.83	5.50	12.52	5.06	18.36	11.45	13.95
52	Enterprises constructing open ditches and levees.....	dollars..								
53	Average cost per acre when completed.....	dollars..								
<b>CROPS.</b>										
Improved land in enterprises reporting—										
54	Corn as principal crop on drained land.....	acres..	14,358	867	8,300	960		5,151	5,617	28,136
55	Cotton as principal crop on drained land.....	acres..				800	9,780			3.0
56	Other crops as principal ones on drained land.....	acres..								41,592

<sup>1</sup> Includes Alexander, Burke, Cabarrus, Caldwell, Catawba, Chowan, Davidson, Forsyth, Gaston, Greene, Jones, Lincoln, McDowell, New Hanover, Pender, Tyrrell, Wayne, and Wilson Counties.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Per cent not shown when more than 1,000.

<sup>4</sup> Includes 242 acres not reporting principal crop.



## NORTH DAKOTA.

The following pages present the statistics of drainage for North Dakota collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of unimproved land

not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

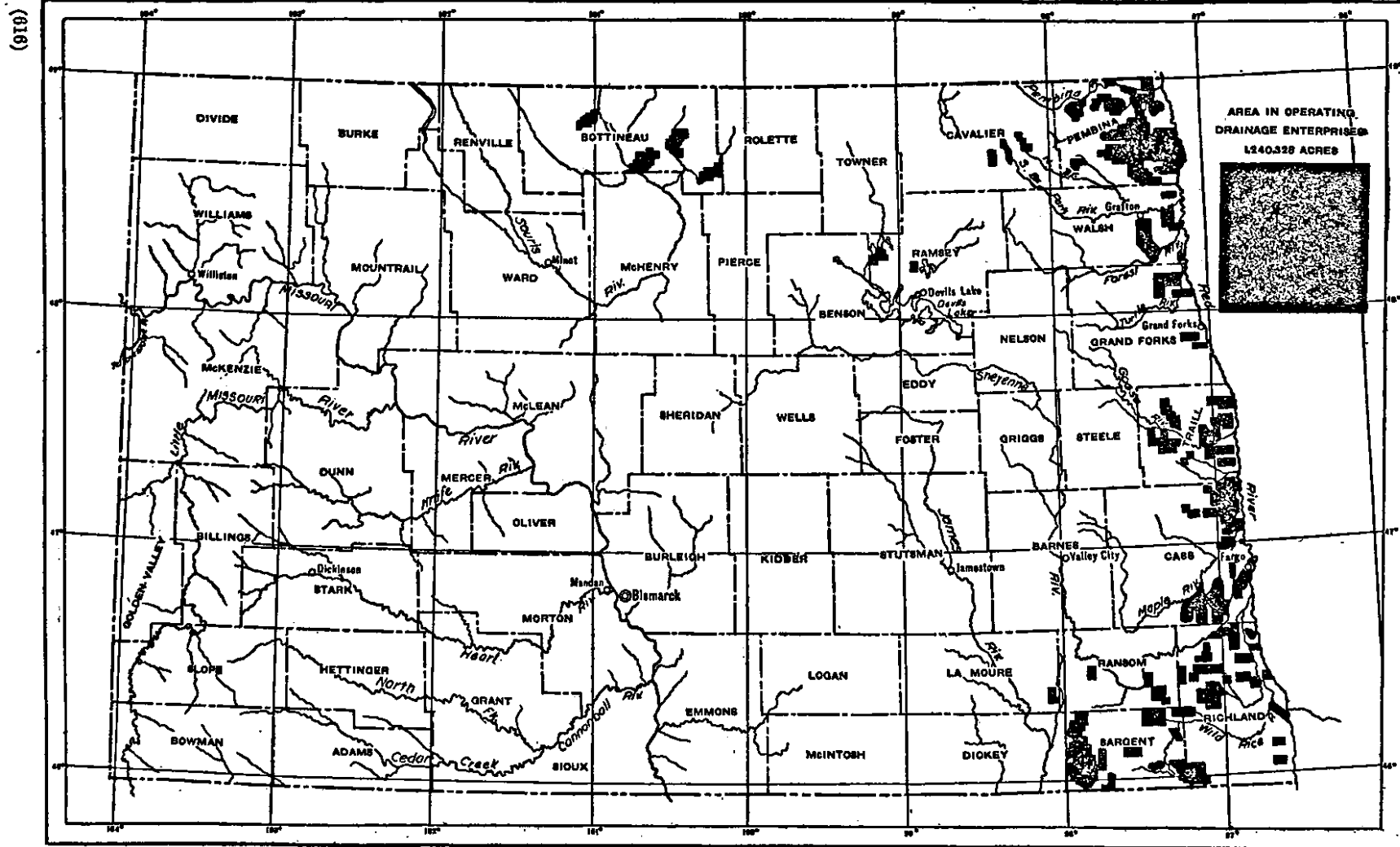
ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	77, 690	100. 0
Farms reporting land having drainage.....	682	0. 9
Farms reporting land needing drainage.....	2, 669	3. 4
All land in farms..... acres..	36, 214, 751	100. 0
Improved land in farms..... acres..	24, 563, 178	67. 8
Farm land reported as provided with drainage..... acres..	89, 054	0. 2
Farm land reported as needing drainage..... acres..	211, 305	0. 6
Needing drainage only..... acres..	53, 161	0. 1
Needing drainage and clearing..... acres..	158, 144	0. 4
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	44, 917, 120	100. 0
All land in operating drainage enterprises..... acres..	1, 240, 328	2. 8
Improved land..... acres..	1, 026, 574	2. 3
Per cent of all improved land in farms.....	4. 2	-----
Unimproved land <sup>1</sup> ..... acres..	213, 754	0. 5
Swampy, subject to overflow, seeped, or alkali..... acres..	12, 332	(2)
Suffering a loss of crops from defective drainage..... acres..	4, 819	(2)
Improved land prior to drainage..... acres..	691, 005	1. 5
Increase since drainage began..... acres..	335, 569	0. 7
Land in nonoperating enterprises..... acres..	8, 000	(2)
Open ditches in operating enterprises..... miles..	712. 3	100. 0
Completed..... miles..	708. 3	99. 4
Additional under construction..... miles..	4. 0	0. 6
Tile drains in operating enterprises..... miles..	9. 3	100. 0
Completed..... miles..	9. 3	100. 0
Additional under construction..... miles..	-----	-----
Total capital invested in and required for completion of operating enterprises.....	\$2, 261, 449	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	2, 208, 049	97. 6
Additional capital required to complete these enterprises.....	53, 400	2. 4
Average cost per acre when completed.....	1. 82	-----

<sup>1</sup> No timber or cut-over land reported.

<sup>2</sup> Less than one-tenth of 1 per cent.

# NORTH DAKOTA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



(919)

**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by the drain commissioners and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	1,248,328	100.0	\$2,208,049	100.0	\$77,723
Operating enterprises.....	1,240,328	99.4	2,208,049	100.0	53,400
With works completed.....	1,100,044	88.1	1,863,788	84.4	.....
With works under construction.....	140,284	11.2	344,261	15.6	53,400
Nonoperating enterprises.....	8,000	0.6	.....	.....	24,323

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an estimate of additional investment to complete."

**Location of enterprises.**—All but a small part of the area in drainage enterprises in North Dakota is in the extreme eastern part of the state, in the broad belt of comparatively level land which borders Red River. A small area in La Moure County is drained through James River to the Missouri, and the enterprises in Bottineau County are drained through Souris River.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	1,248,328	100.0	\$2,208,049	100.0	\$77,723
Operating enterprises.....	1,240,328	99.4	2,208,049	100.0	53,400
Missouri River.....	8,300	0.3	22,500	1.0	.....
Red River.....	1,187,233	95.1	2,014,453	91.2	53,400
Souris River.....	49,795	4.0	171,096	7.8	.....
Nonoperating enterprises.....	8,000	0.6	.....	.....	24,323
Red River.....	8,000	0.6	.....	.....	24,323

**Condition of land in enterprises.**—The purpose of the drainage enterprises in this state has been the reclamation and improvement of swampy land or

land subject to overflow. None of the enterprises is for the drainage of irrigated land. The natural channels of the streams tributary to Red River where they cross the level bottom land are not adequate to carry the run-off from storms and from melting snow on the hills to the west. Many of the well-defined channels of small and moderate size practically disappear at short distances below the foot of the hills, so the waters are spread over considerable areas until artificial channels are provided. The drainage of this valley as a whole is rendered specially difficult by the northward course of Red River, which may be ice-bound north of the Canadian boundary while higher temperatures in Minnesota and the Dakotas are melting the snow and causing that stream to overflow.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	1,240,328	100.0	1,100,044	140,284	8,000
Improved land.....	1,026,574	82.8	920,304	108,270	5,334
Unimproved land <sup>1</sup> .....	213,754	17.2	179,740	34,014	2,666
Swampy or subject to overflow.....	12,332	1.0	12,332	.....	2,000
Suffering a loss of crops.....	4,819	0.4	4,819	.....	.....

<sup>1</sup> No timber or cut-over land reported.

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 137 operating drainage enterprises are counted in North Dakota, with an average area of 9,053 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	1,240,328	1,240,328	100.0
500 to 999 acres.....	640	640	0.1
1,000 to 4,999 acres.....	148,680	148,680	12.0
5,000 to 9,999 acres.....	358,390	358,390	28.9
10,000 to 49,999 acres.....	501,377	501,377	40.4
50,000 to 99,999 acres.....	231,241	231,241	18.6

**Character of enterprises.**—All the drainage enterprises in North Dakota are county drains under the control of the county board of drain commissioners. This board of three freeholders is appointed by the board of county commissioners upon their own volition or upon petition from interested landowners.

The board of drain commissioners may establish drains for wet land whenever such drains will be conducive to public health, convenience, and welfare. If the chief object sought is to drain land to be used for agricultural purposes, a petition for the drain must be signed by six or more freeholders whose property will be affected. Plans, specifications, and estimates are prepared by a surveyor employed by the drain commissioners, who hold a public hearing upon the surveyor's report. The drain is established if sufficient cause for the petition is shown and if the cost of the proposed drain will not exceed the benefits to be derived, provided two-thirds of the landowners who would be subject to assessment do not petition against establishment. Appeal from the decision establishing a drain may be taken to the district court for trial without jury. The cost of the enterprise is assessed against the tracts of land in proportion to the benefits they will receive. Counties, cities, towns, and railroads are assessed if they will be benefited.

Damages for rights of way are determined by jury in the district court, or by the court or a referee if jury trial is waived. Assessments of benefits are made by the board of drain commissioners and reviewed by them at a public hearing. An appeal from these assessments, or for review of the location and design of any drain, may be made to the state engineer by two-thirds of the landowners affected by the drain. Contracts for construction are let by the drain commissioners. Bonds to finance the enterprise may be issued by the board of county commissioners, to run not more than 15 years and to be paid only from the assessments levied for the drain. When a drain is to be located in more than one county, the petition is presented to the board of drain commissioners in each county affected, and all those boards act jointly.

The present county drainage law of North Dakota was enacted March 8, 1895 (ch. 51), but has been amended many times. The principal amendments relate to the number of signatures on the petition (1903), to appeals from decisions of the drain commissioners (1911 and 1915), and to the time of payment of bonds (1901 and 1907). The first general drainage law of the state was enacted March 18, 1893 (ch. 55). It provided for the appointment of a county board of drain commissioners and for a method of establishing county drains generally similar to that provided in the law of 1895, which repealed the earlier statute. Only one enterprise, of 3,520 acres, was reported as organized under the law of 1893.

Township drains may be established by the board of supervisors of any township under a law of March 12, 1915 (ch. 124), as amended March 3, 1919 (ch. 114). These are under the control of the township supervisors. The cost is paid from the township funds if the cost does not exceed \$3,000 and if the enterprise is approved by a majority vote of the people of the township; otherwise the cost is assessed in proportion to benefits. No enterprises were reported as organized under this law.

An act of March 13, 1919 (ch. 115), created a flood-control commission, consisting of the dean of the state agricultural college, the dean of the state school of mines, the state engineer, and two citizens appointed by the governor, to make surveys and plans for controlling floods.

Laws authorizing the establishment of public drains by boards of county commissioners and by boards of township supervisors, upon petition of one or more owners of land to be affected, were enacted by the legislature of Dakota territory in 1883. Viewers were appointed to locate the drains and to assess damages and benefits, the costs being assessed against the lands in proportion to the benefits.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 708.3 miles of open ditches, 9.3 miles of tile drains, and 2.1 miles of accessory levees; the additional works under construction were 4.0 miles of open ditches. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts in the state.

TABLE 6.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	1,240,328	100.0	\$2,208,049	100.0	\$53,400
Open ditches only.....	1,217,028	98.1	2,146,758	97.2	53,400
Open ditches and levees.....	9,600	0.8	12,368	0.6	.....
Tile drains only.....	10,820	0.9	42,908	1.9	.....
Open ditches and tile drains.....	2,880	0.2	5,015	0.2	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would not change the mean depth for the state, 3.7 feet.

TABLE 7.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	1,240,328	100.0
Less than 3 feet.....	15,600	1.2
3.0 to 3.9 feet.....	96,200	7.8
4.0 to 4.9 feet.....	227,124	18.3
Not reporting branches.....	901,404	72.7

**Maintenance of works.**—The drainage law of 1895 provided that all drains constructed under that act should be kept in good repair by the board of county commissioners, and the existing statutes have made that provision applicable to the improvements established under any drainage law of the state. In the case of a drain that is situated in more than one county, the board of county commissioners of each county affected is required to keep in good condition the portion of the drain that is situated in that county. However, systematic maintenance was reported for enterprises embracing a total of only 82,080 acres, representing an investment of \$82,459, the work being done by contract.

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the drain commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, including extensions made after the original plan of reclamation was completed.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	1,240,328	100.0	1,240,328	100.0
1890 to 1899.....	87,340	7.0	87,340	7.0
1900 to 1904.....	176,055	14.2	176,055	14.2
1905 to 1909.....	611,659	49.3	611,659	49.3
1910 to 1914.....	61,380	5.0	61,380	5.0
1915 to 1919.....	303,894	24.5	303,894	24.5

TABLE 9.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$2,208,049	100.0	\$53,400
1890 to 1899.....	154,061	7.0	.....
1900 to 1904.....	183,657	8.3	.....
1905 to 1909.....	965,459	43.7	.....
1910 to 1914.....	70,940	3.2	.....
1915 to 1919.....	833,932	37.8	53,400

TABLE 10.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total. <sup>1</sup>	Miles.	Per cent of total. <sup>1</sup>
All drains and levees..	712.3	100.0	9.3	100.0	2.1	100.0
1890 to 1899.....	63.3	8.9	.....	.....	0.1	.....
1900 to 1904.....	90.5	12.7	.....	.....	2.0	.....
1905 to 1909.....	334.8	47.0	0.3	.....	.....	.....
1910 to 1914.....	32.7	4.6	.....	.....	.....	.....
1915 to 1919.....	191.0	26.8	9.0	.....	.....	.....

<sup>1</sup> Per cent not shown when base is less than 100.

**Crops.**—The principal crop grown upon the drained land was reported as wheat for most of the drainage enterprises, though hay was so reported for a small part of them. Statistics were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. Information was not obtained at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

## DRAINAGE—NORTH DAKOTA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Botti- neau.	Cass.	Emmons.	Grand Forks.	Griggs.	Moun- trail.	Pem- bina.	
1	Number of all farms in the state or county .....	77,690	2,203	2,374	1,449	2,007	963	2,000	1,795	
2	Farms reporting land having drainage.....	682	148	77	67	10	7	5	44	
3	Farms reporting land needing drainage.....	2,669	165	141	75	145	50	107	225	
4	Farms in drainage and levee districts.....	341	61	65	.....	3	5	3	41	
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county.....acres..	44,917,120	1,075,840	1,128,320	1,000,320	917,120	453,880	1,224,960	714,880	
6	All land in farms.....acres..	36,214,751	939,149	1,000,011	837,636	819,400	427,025	826,026	640,390	
7	Improved land in farms.....acres..	24,563,178	794,709	944,239	487,208	719,576	336,038	414,843	567,404	
8	Woodland in farms.....acres..	679,836	36,745	18,399	11,247	23,838	4,130	8,521	51,811	
9	Other unimproved land in farms.....acres..	10,971,737	107,695	37,373	339,181	75,986	86,857	402,662	21,175	
10	Farm land reported as provided with drainage.....acres..	89,054	11,674	19,908	9,337	1,532	950	605	10,598	
11	Farm land reported as needing drainage.....acres..	211,305	16,266	4,394	7,848	7,524	2,483	16,407	15,638	
12	Drainage only.....acres..	53,161	1,284	2,077	7,848	2,494	1,132	97	168	
13	Drainage and clearing.....acres..	158,144	14,982	2,317	.....	5,030	1,351	16,310	15,470	
		Ramsey.	Ransom.	Rich- land.	Rolette.	Sargent.	Steele.	Stuts- man.	Trall.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,401	1,343	2,298	1,267	1,321	987	2,487	1,263	52,532
2	Farms reporting land having drainage.....	6	17	44	45	79	7	6	53	66
3	Farms reporting land needing drainage.....	14	4	119	80	206	3	258	23	1,054
4	Farms in drainage and levee districts.....	4	1	26	1	75	2	.....	38	15
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	771,200	550,400	919,680	587,520	547,200	453,880	1,460,480	553,600	32,547,840
6	All land in farms.....acres..	715,903	474,077	829,295	498,443	494,179	432,116	1,200,738	517,311	25,563,052
7	Improved land in farms.....acres..	627,766	405,315	736,962	348,320	430,758	380,954	836,901	466,032	16,066,153
8	Woodland in farms.....acres..	4,972	14,385	15,525	53,411	2,906	8,351	12,141	13,116	400,338
9	Other unimproved land in farms.....acres..	83,165	54,377	76,808	96,712	60,515	42,511	351,696	38,163	9,096,561
10	Farm land reported as provided with drainage.....acres..	525	1,599	5,478	961	8,048	525	627	13,131	3,588
11	Farm land reported as needing drainage.....acres..	992	210	4,702	5,882	7,471	192	11,490	1,774	108,042
12	Drainage only.....acres..	992	210	2,605	1,375	7,318	170	7,519	1,429	16,441
13	Drainage and clearing.....acres..	.....	.....	2,096	4,506	153	22	3,961	345	91,601

<sup>1</sup> No drainage on farms reported in Billings, Bowman, Burleigh, Dunn, Foster, Golden Valley, Grant, Kidder, Logan, McHenry, Mercer, and Oliver Counties.

DRAINAGE—NORTH DAKOTA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Bottineau.	Cass.	Cavaller.	Grand Forks.	La Moure.	
<b>LAND AREA.</b>							
1	Approximate land area of the state or county.....acres..	44,917,120	1,076,840	1,128,320	956,160	917,120	784,080
2	All land in operating drainage enterprises.....acres..	1,240,328	49,795	201,580	12,700	47,000	3,300
3	Improved land.....acres..	1,026,574	32,000	155,135	4,019	40,586	2,640
4	Per cent of all improved land in farms.....	4.2	4.0	16.4	0.5	5.6	0.5
5	Unimproved land <sup>1</sup> .....acres..	213,754	17,795	46,445	8,681	6,414	660
6	Swampy or subject to overflow, in enterprises.....acres..	12,332		960			
7	Suffering a loss of crops from defective drainage.....acres..	4,819					
8	Assessed acreage.....	1,240,328	49,795	201,580	12,700	47,000	3,300
9	Excess over all land in operating enterprises.....acres..						
<b>DRAINAGE WORKS.</b>							
<b>Open ditches:</b>							
10	Completed.....miles.....	708.3	44.0	177.3	12.0	25.8	
11	Additional under construction.....miles.....	4.0		1.5			
12	Maximum completed in any enterprise.....miles.....	45.1	20.0	15.6	5.0	10.2	
13	Maximum width at bottom of ditch <sup>2</sup> .....feet.....	80	80	29	8	12	
14	Maximum of average depths of outlet ditches <sup>2</sup> .....feet.....	14.0	6.0	14.0	5.0	6.0	
15	Mean depth of branch ditches <sup>2</sup> .....feet.....	3.7					
<b>Tile drains:</b>							
16	Completed.....miles.....	9.3					4.5
17	Additional under construction.....miles.....						
18	Maximum completed in any enterprise.....miles.....	4.5					4.5
19	Maximum size of tile <sup>2</sup> .....inches.....	22					22
<b>Accessory levees and dikes:</b>							
20	Completed.....miles.....	2.1					
21	Additional under construction.....miles.....						
22	Area drained by open ditches only <sup>3</sup> .....acres.....	1,217,028	49,795	201,580	12,700	47,000	
23	Length of these ditches.....miles.....	708.0	44.0	178.3	12.0	25.8	
24	Average length per acre.....feet.....	8.1	4.7	4.7	5.0	2.9	
25	Area having both open ditches and levees <sup>3</sup> .....acres.....	9,600					
26	Length of these ditches.....miles.....	4.0					
27	Average length per acre.....feet.....	2.2					
28	Length of the accessory levees.....miles.....	2.1					
29	Area drained by tile only <sup>3</sup> .....acres.....	10,820					3,300
30	Length of these tile.....miles.....	9.0					4.5
31	Average length per acre.....feet.....	4.4					7.2
32	Area drained by open ditches and tile <sup>3</sup> .....acres.....	2,880					
33	Length of these drains.....miles.....	2.6					
34	Average length per acre.....feet.....	4.8					
<b>DEVELOPMENT OF LAND.</b>							
35	Improved land in operating enterprises, 1920.....acres.....	1,026,574	32,000	155,135	4,019	40,586	2,640
36	Improved land prior to drainage.....acres.....	691,005	26,000	115,784	3,473	28,548	2,475
37	Increase since drainage.....acres.....	335,569	6,000	39,371	546	12,038	165
38	Per cent of increase.....	48.6	23.1	34.0	15.7	42.2	6.7
39	Per cent increase is of all improved land in farms, 1920.....	1.4	0.8	4.2	0.1	1.7	( <sup>4</sup> )
40	Unimproved land, 1920.....acres.....	213,754	17,795	46,445	8,681	6,414	660
41	Unimproved land prior to drainage.....acres.....	549,323	23,795	85,816	9,227	18,452	825
42	Decrease since drainage.....acres.....	335,569	6,000	39,371	546	12,038	165
43	Per cent of decrease.....	61.1	25.2	45.9	5.9	65.2	20.0
44	Swampy or subject to overflow, 1920.....acres.....	12,332		960			
45	Swampy or subject to overflow prior to drainage.....acres.....	619,159	26,659	120,056	9,653	21,660	1,650
46	Decrease since drainage.....acres.....	606,827	26,659	119,126	9,653	21,660	1,650
47	Per cent of decrease.....	98.0	100.0	69.2	100.0	100.0	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>							
48	Total capital invested in and required for completion of operating enterprises.....dollars.....	2,261,449	171,096	837,690	15,785	49,894	22,500
49	Capital invested in these enterprises to Dec. 31, 1919.....dollars.....	2,208,049	171,096	808,690	15,785	49,894	22,500
50	Additional capital required to complete these enterprises.....dollars.....	53,400		31,000			
51	Average cost per acre, when completed.....dollars.....	1.82	3.44	4.16	1.24	1.06	6.82
52	Enterprises constructing open ditches only.....dollars.....	2,200,158	171,096	837,690	15,785	49,894	
53	Average cost per acre, when completed.....dollars.....	1.81	3.44	4.16	1.24	1.06	
54	Enterprises constructing open ditches and levees.....dollars.....	12,368					
55	Average cost per acre, when completed.....dollars.....	1.29					
56	Enterprises constructing tile drains only.....dollars.....	42,908					22,500
57	Average cost per acre, when completed.....dollars.....	3.97					6.82
58	Enterprises constructing open ditches and tile drains.....dollars.....	6,015					
59	Average cost per acre, when completed.....dollars.....	2.09					
<b>CROPS.</b>							
60	Improved land in enterprises reporting— Wheat as principal crop on drained land.....acres.....	1,000,359	24,000	155,135		40,586	2,640
61	Hay and forage as principal crop on drained land.....acres.....	26,135	8,000		4,019		

<sup>1</sup> No timber or out-over land reported.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> Less than one-tenth of 1 per cent.

## DRAINAGE—NORTH DAKOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pembina.	Ramsey.	Ransom.	Richland.	Sargent.	Traill.	Walsh.
<b>LAND AREA.</b>								
1	Approximate land area of the county.....	714,880	771,200	550,400	919,680	547,200	553,600	820,480
2	All land in operating drainage enterprises.....	280,800	12,715	23,640	204,063	205,655	145,460	53,620
3	Improved land.....	256,778	11,443	14,120	171,911	162,151	126,527	49,264
4	Per cent of all improved land in farms.....	45.3	1.8	3.5	23.3	37.6	27.1	7.6
5	Unimproved land <sup>1</sup> .....	24,022	1,272	9,520	32,152	43,604	18,933	4,356
6	Swampy or subject to overflow, in enterprises.....	512			5,980		4,880	
7	Suffering a loss of crops from defective drainage.....				4,179		640	
8	Assessed acreage.....	280,800	12,715	23,640	204,063	205,655	145,460	53,620
9	Excess over all land in operating enterprises.....							
<b>DRAINAGE WORKS.</b>								
Open ditches:								
10	Completed.....	145.8	4.0	14.5	102.2	78.6	87.1	18.0
11	Additional under construction.....					2.5		
12	Maximum completed in any enterprise.....	24.0	2.5	6.5	12.5	45.1	8.5	7.0
13	Maximum width at bottom of ditch <sup>2</sup> .....	24	9	12	17	16	10	14
14	Maximum of average depths of outlet ditches <sup>2</sup> .....	7.0	4.0	5.0	10.0	8.0	8.0	4.7
15	Mean depth of branch ditches <sup>2</sup> .....	3.6		3.0	3.5	4.0		3.0
Tile drains:								
16	Completed.....					4.8		
17	Additional under construction.....							
18	Maximum completed in any enterprise.....					4.5		
19	Maximum size of tile <sup>2</sup> .....					18		
Accessory levees and dikes:								
20	Completed.....	2.1						
21	Additional under construction.....							
22	Area drained by open ditches only <sup>2</sup> .....	271,200	12,715	23,640	204,063	195,255	145,460	53,620
23	Length of these ditches.....	141.8	4.0	14.5	102.2	78.8	87.1	19.0
24	Average length per acre.....	2.8	1.7	3.2	2.6	2.1	3.2	1.9
25	Area having both open ditches and levees <sup>2</sup> .....	9,600						
26	Length of these ditches.....	4.0						
27	Average length per acre.....	2.2						
28	Length of the accessory levees.....	2.1						
29	Area drained by tile only <sup>2</sup> .....					7,520		
30	Length of these tile.....					4.5		
31	Average length per acre.....					3.2		
32	Area drained by open ditches and tile <sup>2</sup> .....					2,880		
33	Length of these drains.....					2.6		
34	Average length per acre.....					4.8		
<b>DEVELOPMENT OF LAND.</b>								
35	Improved land in operating enterprises, 1920.....	256,778	11,443	14,120	171,911	162,151	126,527	49,264
36	Improved land prior to drainage.....	179,720	3,075	9,550	124,962	57,412	100,406	39,620
37	Increase since drainage.....	77,058	8,368	4,570	46,949	104,739	26,121	9,644
38	Per cent of increase.....	42.9	272.1	47.9	37.6	182.4	26.0	24.3
39	Per cent increase is of all improved land in farms, 1920.....	13.6	1.8	1.1	6.4	24.3	5.6	1.5
40	Unimproved land, 1920 <sup>1</sup> .....	24,022	1,272	9,520	32,152	43,604	18,933	4,356
41	Unimproved land prior to drainage <sup>1</sup> .....	101,080	9,640	14,090	79,101	148,243	45,054	14,000
42	Decrease since drainage.....	77,058	8,368	4,570	46,949	104,739	26,121	9,644
43	Per cent of decrease.....	76.2	86.8	32.4	59.4	70.7	58.0	68.9
44	Swampy or subject to overflow, 1920.....	512			5,980		4,880	
45	Swampy or subject to overflow prior to drainage.....	95,031	9,640	20,000	126,308	102,906	63,326	22,249
46	Decrease since drainage.....	94,519	9,640	20,000	120,328	102,906	58,446	22,249
47	Per cent of decrease.....	99.5	100.0	100.0	95.3	100.0	92.3	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
48	Total capital invested in and required for completion of operating enterprises.....	297,282	6,553	45,930	265,608	285,839	224,671	38,601
49	Capital invested in these enterprises to Dec. 31, 1919.....	297,282	6,553	45,930	265,608	263,439	224,671	38,601
50	Additional capital required to complete these enterprises.....					22,400		
51	Average cost per acre, when completed.....	1.06	0.52	1.94	1.30	1.39	1.54	0.72
52	Enterprises constructing open ditches only.....	284,914	6,553	45,930	265,608	259,416	224,671	38,601
53	Average cost per acre, when completed.....	1.05	0.52	1.94	1.30	1.33	1.54	0.72
54	Enterprises constructing open ditches and levees.....	12,368						
55	Average cost per acre, when completed.....	1.29						
56	Enterprises constructing tile drains only.....					20,408		
57	Average cost per acre, when completed.....					2.71		
58	Enterprises constructing open ditches and tile drains.....					6,015		
59	Average cost per acre, when completed.....					2.09		
<b>CROPS.</b>								
60	Improved land in enterprises reporting— Wheat as principal crop on drained land.....	256,778	11,443	6,900	166,911	160,205	126,527	49,264
61	Hay and forage as principal crop on drained land.....			7,220	5,000	1,946		

<sup>1</sup> No timber or cut-over land reported.<sup>2</sup> When works under construction have been completed.



## OHIO.

The following pages present the statistics of drainage for Ohio collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises might include areas of unimproved land not yet in farms. The statistics

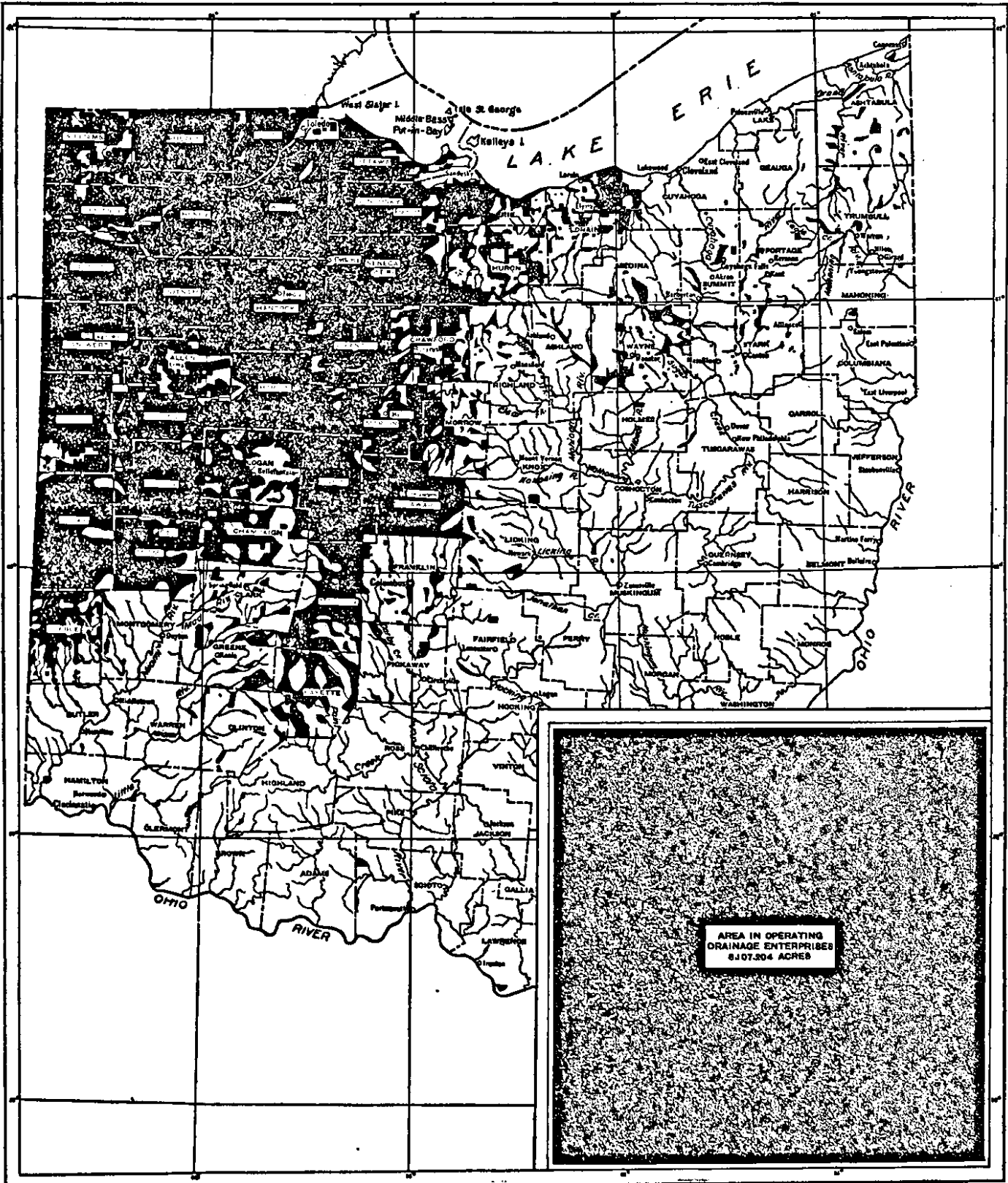
for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	256, 695	100. 0
Farms reporting land having drainage.....	130, 117	50. 7
Farms reporting land needing drainage.....	85, 326	33. 2
All land in farms..... acres..	23, 515, 888	100. 0
Improved land in farms..... acres..	18, 542, 353	78. 9
Farm land reported as provided with drainage..... acres..	7, 365, 532	31. 3
Farm land reported as needing drainage..... acres..	2, 014, 889	8. 6
Needing drainage only..... acres..	886, 557	3. 8
Needing drainage and clearing..... acres..	1, 128, 332	4. 8
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	26, 073, 600	100. 0
All land in operating drainage enterprises..... acres..	8, 107, 204	31. 1
Improved land..... acres..	6, 707, 328	25. 7
Per cent of all improved land in farms.....	36. 2	
Timber and cut-over land..... acres..	956, 894	3. 7
Other unimproved land..... acres..	442, 982	1. 7
Swampy, subject to overflow, seeped, or alkali..... acres..	247, 273	0. 9
Suffering a loss of crops from defective drainage..... acres..	141, 481	0. 5
Improved land prior to drainage..... acres..	3, 955, 220	15. 2
Increase since drainage began..... acres..	2, 752, 108	10. 6
Land in nonoperating enterprises..... acres..	40, 342	0. 2
Open ditches in operating enterprises..... miles..	24, 997. 4	100. 0
Completed..... miles..	24, 984. 0	99. 9
Additional under construction..... miles..	13. 4	0. 1
Tile drains in operating enterprises..... miles..	9, 213. 6	100. 0
Completed..... miles..	9, 205. 3	99. 9
Additional under construction..... miles..	8. 3	0. 1
Total capital invested in and required for completion of operating enterprises..	\$30, 771, 620	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	30, 680, 145	99. 7
Additional capital required to complete these enterprises.....	91, 475	0. 3
Average cost per acre when completed.....	3. 80	

# OHIO

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include some that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for construction work, and also others for which orders of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	8, 147, 546	100. 0	\$30, 707, 863	100. 0	\$397, 396
Operating enterprises.....	8, 107, 204	99. 5	30, 680, 145	99. 9	91, 475
With works completed.....	8, 093, 994	99. 3	30, 638, 857	99. 8	.....
With works under construction.....	13, 210	0. 2	43, 288	0. 1	91, 475
Nonoperating enterprises.....	40, 342	0. 5	27, 718	0. 1	305, 921

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—A very large part of the northwest quarter of Ohio has been included in organized drainage enterprises. A large acreage in the southwest quarter also has been included in such enterprises, and a considerable amount in the northeast section, but almost none in the southeast part of the state. The approximate location and extent of the enterprises are shown by the map on page 2.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	8, 147, 546	100. 0	\$30, 707, 863	100. 0	\$397, 396
Operating enterprises.....	8, 107, 204	99. 5	30, 680, 145	99. 9	91, 475
Wabash River.....	122, 660	1. 5	621, 830	2. 0	.....
Miami River.....	1, 304, 841	16. 0	5, 838, 833	19. 0	39, 570
Scioto River.....	1, 530, 510	18. 1	4, 451, 241	14. 5	1, 630
Ohio River.....	277, 350	3. 4	1, 335, 843	4. 5	9, 908
Lake Erie.....	4, 345, 943	59. 5	18, 372, 548	59. 8	40, 367
Nonoperating enterprises.....	40, 342	0. 5	27, 718	0. 1	305, 921
Miami River.....	3, 456	( <sup>1</sup> )	2, 297	( <sup>1</sup> )	5, 951
Scioto River.....	4, 804	0. 1	3, 494	( <sup>1</sup> )	40, 639
Ohio River.....	272	( <sup>1</sup> )	3, 316	( <sup>1</sup> )	2, 843
Lake Erie.....	31, 810	0. 4	18, 611	0. 1	256, 483

<sup>1</sup> Less than one-tenth of 1 per cent.

Condition of land in enterprises.—Approximately seven-eighths of the operating drainage enterprises, in number and in acreage, were reported as organized for the reclamation or improvement of land generally swampy or too wet for cultivation with profit; most of the others were reported as organized for securing protection against overflow by stream floods. The estimates of the condition of the land before drainage show 50 per cent of the total area in the enterprises to have been improved, and 37 per cent timbered or cut-over; the area reported as having been swampy, wet, or subject to overflow is 39 per cent of the total area in the enterprises.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	8, 107, 204	100. 0	8, 093, 994	13, 210	40, 342
Improved land.....	6, 707, 328	82. 7	6, 697, 080	10, 248	24, 375
Timber and cut-over land.....	958, 894	11. 8	955, 107	1, 787	4, 363
Other unimproved land.....	442, 982	5. 5	441, 807	1, 175	11, 604
Swampy or subject to overflow.....	247, 273	3. 1	243, 962	3, 311	19, 778
Suffering a loss of crops.....	141, 481	1. 7	140, 059	1, 422	7, 603

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered as a separate enterprise. In this way 24,871 operating drainage enterprises are counted in Ohio, with an average area of 943 acres assessed. Of this number, 191 comprise 10,000 acres or more each; 5,372 others comprise 1,000 acres or more; and 19,308 embrace less than 1,000 acres each, of which 6,231 are smaller than 200 acres.

The assessed acreage exceeds the land in enterprises by 15,357,608 acres, which is the amount of overlapping and probably represents largely reassessments for enlarging, extending, or reconstructing ditches. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises. The amount of overlapping

could be only estimated, however, in a great number of cases, so for many of the northwestern counties the figures for land in enterprises are only rough approximations.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acres.	Per cent of total.
All operating enterprises.....	8,107,204	23,464,812	100.0
Less than 200 acres.....	418,913	658,953	2.8
200 to 499 acres.....	1,274,879	2,495,998	10.6
500 to 999 acres.....	1,625,720	3,928,812	16.7
1,000 to 4,999 acres.....	3,288,121	9,615,229	41.0
5,000 to 9,999 acres.....	823,323	2,850,517	12.1
10,000 to 49,999 acres.....	571,127	3,182,280	13.4
50,000 to 99,999 acres.....	105,121	763,025	3.3

**Character of enterprises.**—Most of the drainage enterprises in Ohio are county ditches established according to an act passed April 12, 1871. There are also considerable numbers of county ditches, joint county ditches, and township ditches established under other drainage laws of the state, and a very few interstate county ditches and large undertakings by individual landowners. These "ditches" include all forms of drains and watercourses constructed or improved under the provisions of the laws. An act passed June 19, 1919, codifies all the ditch laws of the state and repeals the earlier forms without changing the general character of the enterprises.

The law of 1919 provides that ditches or drains may be established by the board of county commissioners of the county in which is situated the land that will be affected by the proposed improvement, upon petition from one or more owners of such land, from the trustees of a township, or from any public corporation, board, or institution. A preliminary survey and estimates are made by the county engineer, and public hearing upon the petition then is held by the county commissioners. The drain is established upon finding that it is necessary or will be advantageous. Claims for damages are determined by the commissioners. Final orders of the board are subject to appeal to the common pleas court. The drainage plan and the apportionment of cost are made by the engineer. The cost is assessed against the land in proportion to benefits; the assessments are equalized and confirmed by the commissioners, and then are appealable to the common pleas court. The assessments are to be paid in 10 semiannual installments. Construction of the drainage works is under the supervision of the county engineer. The commissioners may issue bonds to finance the improvement. If petition for the drain is signed by the county commissioners, the proceedings for establishment are in charge of the court of common pleas. If the land to be affected by a

drain is situated in more than one county, the commissioners of the counties affected act upon the petition jointly. The act provides that right of way for a private drain across the land of an objecting owner may be obtained through petition to the trustees of the township and payment of the damages awarded by them.

An act of March 24, 1859, authorized the establishment of ditches by the county commissioners upon petition from one or more landowners. It provided that damages claimed should be determined by the probate court, and that the construction work should be allotted to the landowners, in proportion to benefits, by an engineer appointed by the commissioners. Contracts for unfinished work were let by the county auditor. An act of March 27, 1861, was substantially similar.

The act of April 12, 1871, superseded all earlier county ditch laws and remained in effect until 1919. The ditches were established by order of the county commissioners of the county in which the ditch was located. Ditches in more than one county were established by joint action of the commissioners of the counties affected. Petition for a ditch had to be made by one or more owners of land to be benefited, and public hearing be held before the enterprise was established. Plans and estimates for the work were made by the county surveyor or by an engineer appointed by the commissioners. Claims for damages were determined by the commissioners, subject to appeal to the probate court. Construction of the drain was apportioned among the landowners in proportion to benefits, by the commissioners; contracts for work not performed by the owners were let by the county auditor. The costs were paid by the county, which was reimbursed by taxes levied against the land benefited. The issue of bonds for drainage was authorized by an act of April 29, 1873, and an act of April 20, 1881, required that the engineer should make assessments of the total cost for consideration with his plans and estimates.

Joint county ditches providing drainage for land in more than one county are specially authorized by an act of June 12, 1911. The petition for establishment under this law must be signed by 50 or more interested persons. Establishment is ordered by the joint action of the commissioners of the counties affected. Plans and estimates for the improvement are made by the county surveyors jointly. The cost is apportioned among the counties by joint action of the county boards, and each county surveyor makes the assessments against the land in his county. Claims for damages are determined and contracts for construction are let by the county boards jointly. Each county may issue joint county ditch bonds to run not longer than 20 years.

Interstate county ditches, which will benefit land in an adjoining state also, are authorized by an act of

March 21, 1887. Upon petition from one or more landowners the county commissioners may meet jointly with the county officials of the adjoining state to consider the petition, to locate the improvement, and to apportion the costs between the states. The ditch then is constructed and the cost apportioned as for a county drain wholly within this state. Damages allowed are paid from the county fund. An act of 1898 authorizes the boards of county commissioners to enter into agreements with county officials in adjoining states to secure drainage outlets in those states or to provide such outlet facilities for land in those states.

Township ditches have been established under several statutes. The act of February 24, 1853, authorized the establishment of public ditches by the township trustees upon petition from one or more owners of land that would be benefited and after investigation of the necessity for the drain, subject to appeal to the probate judge. Damages were determined by the trustees, who also apportioned the work of construction to the landowners benefited. An act of May 1, 1862, also provided for the establishment of public drains by the township trustees upon petition from one or more landowners. Damages claimed were determined by jury in the probate court. The cost was apportioned by the trustees according to benefits, and each landowner might pay his assessment in labor. An act of May 6, 1868, was similar to that of May 1, 1862.

The greater part of the township ditches were established under an act of April 18, 1874, which was in effect until 1919. This law authorized the establishment of ditches by the township trustees upon application from one or more owners of land adjacent to the proposed drain, after public hearing. Plans for the improvement were made and claims for damages were determined by the trustees, who also apportioned the work of construction among the landowners according to benefits. Appeals from decisions of the trustees regarding the utility or location of the ditch and the awards of damages might be taken to the probate court for jury trial. For work not performed within the specified time, contract was let by the trustees and the cost was charged to the delinquent landowners. Ditches in two or more townships might be established by joint action of the trustees of those townships, under an act of April 19, 1898. A great many amendments to the act of 1874 have been made, but the character of the enterprises has not been changed.

The first general drainage law of Ohio was an act of February 8, 1847, authorizing the establishment of drains by the county commissioners upon petition from one or more interested landowners. Viewers were appointed to locate the ditch and assess damages. By an amendment in 1851, the viewers also assessed benefits against the land. When the petitioners had paid the damages and constructed the ditch, they might collect the benefits as confirmed by the commissioners. A township ditch law of

May 1, 1854, was similar to that of February 24, 1853. Both of these laws were repealed by the county ditch law of March 24, 1859. An act of March 2, 1853, authorized the county commissioners to drain the swamp land granted to the state by Congress, payment to be made from funds realized from the sale of that land. This act was repealed April 13, 1894. No drainage enterprises were reported as organized under these and other acts relating to drainage, including the conservancy act of February 17, 1914. Conservancy districts are established by courts of common pleas upon petition from 500 freeholders in the proposed district, or from a majority of all in number, acreage, or value. The officers are three directors appointed by the court.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	8,147,546	100.0	\$30,707,863	100.0	\$397,396
Operating enterprises.....	8,107,204	99.5	30,680,145	99.9	91,475
County ditches.....	7,719,283	94.7	29,283,427	95.4	85,099
Act of Mar. 24, 1859.....	257,382	3.2	358,710	1.2	.....
Act of Mar. 27, 1861.....	804,999	9.9	1,565,324	5.1	.....
Act of Apr. 12, 1871.....	6,658,012	81.7	27,359,393	89.1	83,099
Joint county ditches.....	78,803	1.0	442,018	1.4	8,376
Interstate county ditches.....	5,474	0.1	44,459	0.1	.....
Township ditches.....	192,993	2.4	504,433	1.6	.....
Act of Feb. 24, 1853.....	2,895	( <sup>1</sup> )	8,768	( <sup>1</sup> )	.....
Act of May 1, 1862.....	11,344	0.1	25,627	0.1	.....
Act of May 6, 1868.....	177,794	2.2	528,208	1.7	.....
Act of Apr. 18, 1874.....	7,736	0.1	138,876	0.5	.....
Individual ownership.....	102,905	1.3	206,908	0.7	.....
Not identified.....	100,990	1.2	182,926	0.6	.....
Act of 1881.....	1,915	( <sup>1</sup> )	23,982	0.1	.....
Not reporting.....	.....	.....	.....	.....	.....
Nonoperating enterprises.....	40,342	0.5	27,718	0.1	305,921
County ditches.....	40,342	0.5	27,718	0.1	305,921
Act of Apr. 12, 1871.....	16,275	0.2	19,497	0.1	195,588
Act of June 12, 1911.....	24,067	0.3	8,221	( <sup>1</sup> )	109,333

<sup>1</sup> Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 24,984.0 miles of open ditches, 9,205.3 miles of tile drains, and 9.6 miles of accessory levees; the additional lengths under construction were 13.4 miles of open ditches, 8.3 miles of tile drains, and 4.0 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of open ditches or tile drains. It is possible that some duplication of open ditches is included, by reason of reconstruction work being reported as new work, though every effort was made to avoid or eliminate such duplication.

There are four small pumping districts among the operating drainage enterprises in this state. The total acreage served by pumps, wholly or partly, is 1,755 acres; the total capacities of the pumps and engines are 3,600 gallons per minute and 125 horsepower, respectively.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	8,107,204	100.0	\$30,680,145	100.0	\$91,475
Open ditches only.....	4,738,114	58.4	15,357,021	50.1	3,610
Open ditches and levees.....	7,078	0.1	25,080	0.1	25,000
The drains only.....	1,139,856	14.1	5,993,113	19.5	4,585
Open ditches and tile drains.....	2,219,770	27.4	9,226,931	30.1	58,280
Open ditches, tile drains, and levees.....	2,388	( <sup>1</sup> )	78,000	0.3	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include this group, computed as 3 feet, would show the mean depth for the state 3.8 instead of 3.9 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	8,107,204	100.0
Less than 3 feet.....	342,631	4.2
3.0 to 3.9 feet.....	792,424	9.8
4.0 to 4.9 feet.....	569,745	7.0
5.0 to 5.9 feet.....	291,340	3.6
6.0 to 6.9 feet.....	150,733	1.9
7.0 to 7.9 feet.....	1,692	( <sup>1</sup> )
8.0 to 8.9 feet.....	9,535	0.1
Not reporting branches.....	5,949,054	73.4

<sup>1</sup> Less than one-tenth of 1 per cent.

**Maintenance of works.**—The act of June 19, 1919, provides that county ditches constructed under that and earlier acts are to be maintained by the county commissioners of the respective counties. The cost is to be assessed against the land in the same ratio as

the cost for original construction. If there be no record of the original apportionment, however, a new assessment of benefits shall be made the same as for constructing a new improvement, such assessment being subject to appeal as for a new drain. Joint county ditches are to be maintained by joint action of the county commissioners concerned.

The county drain law of 1871 authorized the election of a township ditch supervisor by the electors of each township, to keep the ditches in repair, and the township ditch law of 1874 authorized the township trustees to keep the ditches in repair. An act of April 2, 1906, required that the township ditch supervisor divide the county and township ditches into sections which he should allot to the various landowners, corporate roads, railroads, townships, and counties according to benefits. If any person or corporation failed to keep his allotted section in good repair, the supervisor was authorized to let contract for the work and the cost would be placed upon the tax roll. Provision also was made in the statutes for undertaking repair of ditches by proceedings like those for constructing new ditches, and the information secured in the canvass indicates that this method was generally followed.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	8,107,204	100.0	\$30,680,145	100.0	\$91,475
By district forces.....	30,172	0.4	85,599	0.3	9,908
By contract.....	1,990,206	24.5	7,780,408	25.4	810
By method not specified.....	28,956	0.4	73,215	0.2	.....
By landowners.....	23,216	0.3	122,245	0.4	.....
No maintenance provided.....	5,912,990	72.9	22,232,863	72.5	80,157
Not reported.....	121,664	1.5	385,815	1.3	600

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the ditches were established by the county commissioners or township trustees, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	8,107,204	100.0	23,464,812	100.0
Before 1860.....	89,203	1.1	90,003	0.4
1860 to 1869.....	721,132	8.9	864,879	3.7
1870 to 1879.....	1,411,044	17.4	2,665,032	11.4
1880 to 1889.....	2,219,818	27.4	5,008,785	21.3
1890 to 1899.....	1,405,162	17.3	5,710,988	24.3
1900 to 1904.....	563,795	7.0	2,956,124	12.6
1905 to 1909.....	751,494	9.3	2,971,538	12.7
1910 to 1914.....	463,418	5.7	1,802,952	7.7
1915 to 1919.....	449,782	5.5	1,377,048	5.9
Not reported.....	2,356	( <sup>1</sup> )	17,470	0.1

<sup>1</sup> Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$30,680,145	100.0	\$91,475
Before 1860.....	154,702	0.5	.....
1860 to 1869.....	1,278,392	4.2	.....
1870 to 1879.....	4,218,515	13.7	.....
1880 to 1889.....	6,624,473	21.6	.....
1890 to 1899.....	5,609,118	18.3	810
1900 to 1904.....	2,941,011	9.6	.....
1905 to 1909.....	4,158,050	13.6	.....
1910 to 1914.....	2,920,876	9.5	.....
1915 to 1919.....	2,749,993	9.0	90,665
Not reported.....	27,015	0.1	.....

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	24,997.4	100.0	9,213.6	100.0	13.6	100.0
Before 1860.....	160.2	0.6	4.2	( <sup>1</sup> )	.....	.....
1860 to 1869.....	2,202.7	8.8	46.5	0.5	.....	.....
1870 to 1879.....	4,778.0	19.1	316.4	3.4	.....	.....
1880 to 1889.....	7,188.0	28.7	1,285.9	14.0	0.5	3.7
1890 to 1899.....	5,067.5	20.3	2,056.0	22.3	.....	.....
1900 to 1904.....	1,890.2	7.6	1,413.5	15.3	6.5	47.8
1905 to 1909.....	1,903.1	7.6	1,850.2	20.1	0.3	2.2
1910 to 1914.....	1,068.0	4.3	1,263.7	13.7	1.5	11.0
1915 to 1919.....	736.9	2.9	967.5	10.5	4.8	35.3
Not reported.....	22.8	0.1	7.7	0.1	.....	.....

<sup>1</sup> Less than one-tenth of 1 per cent.

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, wheat, and hay. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Adams.	Allen.	Ashland.	Ash-	Athens.	Auglaize.	Belmont.	
		tabula.							
1 Number of all farms in the state or county.....	256,695	3,650	2,909	2,512	4,801	2,503	2,626	3,566	
2 Farms reporting land having drainage.....	130,117	48	2,721	1,403	1,100	162	2,341	142	
3 Farms reporting land needing drainage.....	85,326	212	1,687	934	1,027	195	1,734	349	
4 Farms in drainage and levee districts.....	7,315	.....	14	40	92	.....	70	.....	
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the state or county..... acres..	26,073,600	349,440	259,840	269,440	462,720	811,680	254,080	839,200	
6 All land in farms..... acres..	23,515,888	321,892	241,488	252,142	381,320	256,974	240,568	807,934	
7 Improved land in farms..... acres..	18,542,353	214,375	205,577	190,956	252,635	187,906	203,146	235,708	
8 Woodland in farms..... acres..	3,198,929	89,942	31,357	35,579	68,750	42,792	30,837	37,345	
9 Other unimproved land in farms..... acres..	1,774,606	29,575	4,654	24,607	59,936	26,276	6,585	34,881	
10 Farm land reported as provided with drainage..... acres..	7,365,532	1,121	173,347	48,699	22,374	2,240	162,293	1,617	
11 Farm land reported as needing drainage..... acres..	2,014,889	2,771	42,715	22,082	30,348	4,631	42,672	6,135	
12 Drainage only..... acres..	886,557	605	17,333	13,338	7,361	1,281	13,253	1,397	
13 Drainage and clearing..... acres..	1,128,332	2,166	25,382	8,744	22,987	3,350	29,419	2,738	
	Brown.	Butler.	Carroll.	Cham-	Clark.	Cler-	Clinton.	Colum-	Cosho-
				paign.		mont.		biana.	ton.
1 Number of all farms in the county.....	3,890	2,534	1,990	2,481	2,487	3,803	2,411	3,586	2,951
2 Farms reporting land having drainage.....	626	1,178	247	1,543	1,548	168	1,619	1,411	591
3 Farms reporting land needing drainage.....	429	729	470	766	790	208	804	1,204	624
4 Farms in drainage and levee districts.....	14	18	.....	218	46	76	26	18	11
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county..... acres..	307,840	289,280	247,680	269,440	260,490	297,600	263,040	341,760	357,120
6 All land in farms..... acres..	302,391	272,243	229,597	258,168	241,540	276,070	256,686	288,847	337,542
7 Improved land in farms..... acres..	263,652	216,656	171,631	221,010	204,277	230,319	231,732	213,517	259,156
8 Woodland in farms..... acres..	29,860	26,562	32,484	24,349	19,083	24,118	19,896	40,256	46,481
9 Other unimproved land in farms..... acres..	14,879	29,080	25,482	12,809	18,180	21,633	5,068	35,435	31,905
10 Farm land reported as provided with drainage..... acres..	26,956	52,676	2,867	117,490	100,562	8,253	129,658	39,900	8,452
11 Farm land reported as needing drainage..... acres..	5,067	18,998	8,853	20,894	18,668	2,229	14,668	22,504	9,376
12 Drainage only..... acres..	519	13,074	5,546	6,537	7,778	323	4,891	11,216	5,752
13 Drainage and clearing..... acres..	4,548	5,924	3,307	14,357	10,890	1,906	9,777	11,288	3,634



DRAINAGE—OHIO.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Crawford.	Cuyahoga.	Darke.	Defiance.	Delaware.	Erie.	Fairfield.	Fayette.	Franklin.
1	Number of all farms in the county.....	2,415	3,375	5,456	2,522	2,922	1,883	3,437	1,787	3,778
2	Farms reporting land having drainage.....	2,275	1,196	4,870	2,002	2,445	1,363	2,391	1,623	3,033
3	Farms reporting land needing drainage.....	1,487	568	2,396	1,304	1,569	568	1,180	675	1,095
4	Farms in drainage and levee districts.....	78	139	84	203	474	73	136	129	61
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	281,760	296,320	375,040	259,200	284,800	163,840	316,800	264,320	330,880
6	All land in farms.....acres..	241,832	173,742	370,661	243,593	275,734	140,771	307,007	249,700	296,733
7	Improved land in farms.....acres..	201,748	113,700	330,473	195,583	229,560	117,102	263,868	235,262	265,116
8	Woodland in farms.....acres..	32,107	28,969	33,256	37,708	39,588	12,395	28,208	11,661	19,363
9	Other unimproved land in farms.....acres..	7,477	31,073	6,932	10,302	6,586	11,274	14,831	2,777	12,254
10	Farm land reported as provided with drainage.....acres..	148,022	22,627	280,280	114,728	126,563	65,773	120,930	176,246	189,062
11	Farm land reported as needing drainage.....acres..	40,814	9,568	33,583	20,818	51,807	13,721	21,943	18,866	26,107
12	Drainage only.....acres..	14,508	3,280	7,050	8,941	28,419	9,951	11,345	9,767	13,243
13	Drainage and clearing.....acres..	26,306	6,288	26,533	21,877	23,388	3,770	10,598	9,099	12,864
		Fulton.	Gallia.	Geauga.	Greene.	Guernsey.	Hamilton.	Hancock.	Hardin.	Harrison.
1	Number of all farms in the county.....	3,156	2,968	2,576	2,373	3,079	3,741	3,214	2,052	2,039
2	Farms reporting land having drainage.....	2,929	275	739	1,454	300	270	3,024	2,887	341
3	Farms reporting land needing drainage.....	1,726	490	914	529	434	161	1,986	1,672	466
4	Farms in drainage and levee districts.....	478	2	44	58	.....	5	1	301	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	259,200	287,360	266,240	265,600	331,520	260,480	342,400	302,720	256,640
6	All land in farms.....acres..	248,052	265,636	232,818	247,759	308,943	183,776	317,894	289,727	238,867
7	Improved land in farms.....acres..	210,611	196,936	119,586	213,797	248,804	140,431	272,711	245,764	186,517
8	Woodland in farms.....acres..	29,794	42,854	47,524	22,901	42,230	17,784	37,678	34,143	29,893
9	Other unimproved land in farms.....acres..	7,647	25,746	65,708	11,061	16,909	25,561	7,507	9,820	22,477
10	Farm land reported as provided with drainage.....acres..	168,120	4,713	10,967	103,728	6,122	5,897	225,267	218,802	6,378
11	Farm land reported as needing drainage.....acres..	42,603	10,708	27,854	11,256	11,405	2,746	54,423	49,527	8,956
12	Drainage only.....acres..	19,133	4,729	8,723	4,726	5,797	1,694	21,609	16,696	4,539
13	Drainage and clearing.....acres..	23,470	5,979	19,131	6,530	6,608	1,052	32,814	32,831	4,417
		Henry.	Highland.	Hocking.	Holmes.	Huron.	Jackson.	Jefferson.	Knox.	Lake.
1	Number of all farms in the county.....	2,891	3,338	1,753	2,546	2,728	2,054	1,866	3,108	1,771
2	Farms reporting land having drainage.....	2,623	1,163	228	770	1,798	264	38	1,217	767
3	Farms reporting land needing drainage.....	1,534	516	428	610	708	244	131	1,148	478
4	Farms in drainage and levee districts.....	14	45	1	4	82	6	.....	7	100
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	264,960	351,360	263,040	267,520	316,160	258,560	260,480	328,320	154,240
6	All land in farms.....acres..	253,063	346,283	208,674	258,743	283,224	229,203	214,930	322,509	115,819
7	Improved land in farms.....acres..	222,839	296,186	135,754	194,824	221,146	161,413	142,094	257,974	77,721
8	Woodland in farms.....acres..	23,159	39,138	50,298	44,116	34,318	45,669	40,784	40,210	21,326
9	Other unimproved land in farms.....acres..	7,395	10,959	22,622	19,603	27,700	22,121	32,053	24,325	16,773
10	Farm land reported as provided with drainage.....acres..	191,095	53,118	5,774	10,978	96,483	6,755	355	41,993	18,543
11	Farm land reported as needing drainage.....acres..	31,580	10,702	8,192	9,515	17,603	16,919	2,240	23,538	10,498
12	Drainage only.....acres..	13,274	3,111	1,603	7,011	7,203	6,668	697	13,407	4,752
13	Drainage and clearing.....acres..	18,306	7,591	6,689	2,504	10,400	10,251	1,543	10,131	5,746
		Lawrence.	Licking.	Logan.	Lorain.	Lucas.	Madison.	Mahoning.	Marion.	Medina.
1	Number of all farms in the county.....	2,430	4,138	2,825	3,425	2,744	1,769	2,555	1,997	3,018
2	Farms reporting land having drainage.....	129	2,423	2,212	1,942	1,214	1,432	1,043	1,896	1,829
3	Farms reporting land needing drainage.....	590	1,885	1,212	987	508	694	863	959	1,543
4	Farms in drainage and levee districts.....	18	49	225	228	192	140	17	15	83
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	283,520	428,160	288,640	318,080	218,880	318,080	273,280	261,760	278,400
6	All land in farms.....acres..	194,910	405,111	274,008	278,195	152,759	289,550	309,066	243,373	249,572
7	Improved land in farms.....acres..	128,241	336,594	221,877	209,119	126,991	261,094	135,712	216,995	178,097
8	Woodland in farms.....acres..	45,017	43,965	33,977	34,950	16,354	21,937	35,427	21,223	43,400
9	Other unimproved land in farms.....acres..	21,652	24,552	18,154	34,126	9,414	6,519	37,917	5,155	28,075
10	Farm land reported as provided with drainage.....acres..	2,516	116,315	142,831	61,687	54,262	203,352	21,867	194,221	55,164
11	Farm land reported as needing drainage.....acres..	14,228	49,622	34,615	22,747	10,261	33,252	26,224	25,168	32,492
12	Drainage only.....acres..	1,948	28,019	14,960	8,773	4,602	15,442	12,892	11,864	11,954
13	Drainage and clearing.....acres..	12,280	21,508	19,866	13,969	6,659	14,810	13,332	13,304	20,542



DRAINAGE—OHIO.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Meigs.	Mercer.	Miami.	Monroe.	Montgomery.	Morgan.	Morrow.	Muskingum.	Noble.
1	2,833	3,040	3,260	3,062	4,460	2,378	2,570	3,688	2,576
2	258	2,871	2,568	23	3,072	213	2,362	527	84
3	426	1,741	925	279	1,276	350	1,898	803	182
4		70	231		94	1	87	6	3
<b>LAND AND FARM AREA.</b>									
5	263,680	288,000	261,120	286,720	291,200	257,280	257,920	424,960	255,860
6	247,377	276,716	247,273	267,944	260,307	249,034	239,345	392,152	241,906
7	170,185	230,650	217,956	190,589	221,331	198,213	187,461	324,151	204,370
8	49,056	34,223	16,785	52,798	21,903	33,783	44,213	51,906	27,235
9	28,136	5,843	12,632	24,567	17,073	17,038	7,671	16,065	10,301
10	3,144	193,128	155,869	367	119,301	2,733	106,770	8,529	1,152
11	5,523	39,976	15,307	3,877	25,237	5,874	53,858	14,066	3,043
12	2,449	17,985	6,401	179	13,466	2,782	24,708	5,015	1,042
13	3,074	21,991	8,906	3,698	11,771	3,092	29,150	9,061	2,001

	Ottawa.	Paulding.	Perry.	Pickaway.	Plk.	Portage.	Preble.	Putnam.	Richland.
1	2,010	2,414	2,355	2,151	1,940	3,408	3,095	3,232	3,125
2	1,494	2,224	527	1,748	104	1,809	2,666	3,114	2,008
3	925	1,217	398	833	163	1,742	1,462	2,091	1,338
4	74	21	32	53	9	126	649	249	25
<b>LAND AND FARM AREA.</b>									
5	172,800	204,320	255,360	313,600	273,920	333,440	266,240	308,480	321,920
6	138,750	246,265	218,578	308,497	229,343	286,070	263,918	292,620	299,138
7	117,214	220,913	162,267	285,124	123,165	181,419	217,971	259,691	232,453
8	11,966	19,751	28,967	15,013	82,728	48,329	28,681	28,114	46,056
9	9,570	5,601	27,324	8,360	23,450	56,322	17,266	4,815	20,629
10	77,111	184,356	18,528	179,660	2,775	33,946	162,170	233,253	90,489
11	16,915	35,398	8,211	19,680	6,749	39,856	30,863	46,697	24,108
12	7,988	18,837	4,903	9,884	3,245	14,821	14,045	22,437	9,800
13	8,927	16,561	3,308	9,796	3,504	25,035	16,818	24,260	14,306

	Ross.	Sandusky.	Scioto.	Seneca.	Shelby.	Stark.	Summit.	Trumbull.	Tuscarawas.
1	2,949	2,713	2,762	3,113	2,624	4,628	2,529	3,911	3,264
2	855	2,270	180	2,210	2,356	2,164	1,136	1,220	900
3	862	1,428	330	1,357	1,432	1,831	1,126	1,138	859
4	14	4	9	223	68	161	15	28	29
<b>LAND AND FARM AREA.</b>									
5	427,520	264,320	398,720	352,000	264,320	362,240	261,120	405,120	355,200
6	384,328	240,257	283,237	332,132	245,769	328,911	204,210	330,510	312,604
7	272,680	202,451	127,250	279,747	210,359	264,306	147,856	207,909	247,849
8	82,479	20,829	122,059	38,136	24,983	33,465	32,718	61,776	41,442
9	29,169	16,977	38,928	14,250	10,427	31,140	23,636	60,825	23,313
10	57,962	140,076	6,598	136,688	172,283	55,086	26,534	27,202	15,533
11	23,701	42,132	14,974	32,339	34,165	30,858	23,569	37,687	14,648
12	6,698	26,978	1,217	11,796	15,044	16,192	9,726	16,366	8,531
13	17,003	15,154	13,757	20,543	19,121	14,666	13,843	21,321	6,117

	Union.	Van Wert.	Vinton.	Warren.	Washington.	Wayne.	Williams.	Wood.	Wyandot.
1	2,736	2,879	1,598	2,584	4,204	3,944	2,810	4,164	2,264
2	2,400	2,802	144	948	154	2,502	2,601	2,361	2,088
3	1,448	1,809	181	403	209	1,703	1,959	1,363	1,421
4	130	11	1	15	1	126	283	242	95
<b>LAND AND FARM AREA.</b>									
5	285,440	259,840	263,680	264,320	403,200	356,480	263,040	391,680	259,840
6	263,830	252,450	193,108	250,348	368,064	333,949	257,685	356,882	245,297
7	227,016	224,192	118,874	196,258	242,079	268,129	207,475	316,979	211,971
8	27,844	24,704	50,216	30,203	67,333	46,371	28,314	30,266	21,674
9	8,970	3,554	24,019	20,890	58,652	19,449	31,296	9,637	11,632
10	176,124	206,702	3,823	40,361	1,795	75,237	144,642	166,778	159,790
11	47,715	38,357	2,915	6,152	2,791	38,629	42,420	38,723	33,064
12	26,382	15,774	1,934	2,409	1,119	18,561	16,919	22,981	12,418
13	21,333	22,583	981	3,743	1,672	20,068	25,501	13,742	20,646

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Allen.	Ashtabula.	Ash-tabula.	Anglaiza.	Cham-paign.	Clark.	Clinton.	Craw-ford.
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres.	26,073,600	259,840	269,440	462,720	254,080	269,440	263,040	261,760
2	All land in operating drainage enterprises.....acres.	8,107,204	225,015	9,189	18,092	240,934	156,191	19,505	20,040
3	Improved land.....acres.	6,707,328	175,350	7,887	9,081	201,399	145,464	13,949	20,040
4	Per cent of all improved land in farms.....	38.2	85.3	4.1	3.6	99.1	65.8	8.6	8.6
5	Timber and cut-over land.....acres.	956,894	35,833	264	3,269	32,595	8,113	297	10,543
6	Other unimproved land.....acres.	442,982	13,832	1,058	6,612	6,940	2,614	5,259	10,801
7	Swampy or subject to overflow, in enterprises.....acres.	247,273	24,724	1,192	1,442	27,753	2,555	784	895
8	Suffering a loss of crops from defective drainage.....acres.	141,481	7,857	1,192	394	23,634	2,363	783	186
9	Assessed acreage.....acres.	23,464,812	468,980	13,190	18,962	515,318	210,953	29,754	20,040
10	Excess over all land in operating enterprises.....acres.	15,357,608	243,965	4,001	274,384	54,762	10,249	152,998	7,901
<b>DRAINAGE WORKS.</b>									
Open ditches:									
11	Completed.....miles.	24,984.0	527.3	49.1	48.4	437.6	150.8	65.2	18.4
12	Additional under construction.....miles.	13.4	2.9	.....	.....	.....	1.2	.....	399.9
13	Maximum completed in any enterprise.....miles.	44.1	10.0	12.6	4.1	23.2	13.2	7.0	6.6
14	Maximum width at bottom of ditch <sup>2</sup> .....feet.	125	12	6	6	12	36	35	4
15	Maximum of average depths of outlet ditches <sup>2</sup> .....feet.	18.0	8.5	10.0	5.5	12.0	17.0	8.0	7.0
16	Mean depth of branch ditches <sup>2</sup> .....feet.	3.9	3.9	6.2	3.0	4.9	4.7	3.4	5.9
Tile drains:									
17	Completed.....miles.	9,205.8	161.3	1.4	1.2	846.7	147.4	47.7	27.5
18	Additional under construction.....miles.	8.3	0.6	.....	.....	1.6	1.1	.....	.....
19	Maximum completed in any enterprise.....miles.	50.0	4.8	0.5	0.8	16.6	3.9	2.5	3.3
20	Maximum size of tile <sup>2</sup> .....inches.	60	27	9	18	48	32	24	27
Accessory levees and dikes:									
21	Completed.....miles.	9.6	.....	.....	.....	.....	1.2	.....	.....
22	Additional under construction.....miles.	4.0	.....	.....	.....	.....	.....	.....	.....
Pumping plants:									
23	Engine capacity.....horsepower.	125	.....	.....	.....	.....	.....	.....	.....
24	Pump capacity.....gallons per minute.	3,600	.....	.....	.....	.....	.....	.....	.....
25	Area served by pumps.....acres.	1,755	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only <sup>2</sup> .....acres.	4,738,114	132,171	8,280	18,779	92,987	70,004	6,800	48,389
27	Length of these ditches.....miles.	19,924.4	354.8	48.2	48.2	231.1	96.1	41.6	222.6
28	Average length per acre.....feet.	22.2	14.2	30.7	13.6	13.1	7.2	32.0	24.3
29	Area having open ditches and levees <sup>2</sup> .....acres.	7,078	.....	.....	.....	.....	1,000	.....	.....
30	Length of these ditches.....miles.	11.1	.....	.....	.....	.....	1.5	.....	.....
31	Average length per acre.....feet.	8.3	.....	.....	.....	.....	7.9	.....	.....
32	Length of the accessory levees.....miles.	6.8	.....	.....	.....	.....	1.2	.....	.....
33	Area drained by tile only <sup>2</sup> .....acres.	1,139,856	13,092	209	57	26,825	26,911	4,404	5,871
34	Length of these tile.....miles.	5,274.7	65.9	1.2	0.4	205.7	72.6	23.9	14.4
35	Average length per acre.....feet.	24.4	26.6	30.3	37.1	40.5	14.2	28.7	13.0
36	Area drained by open ditches and tile <sup>2</sup> .....acres.	2,219,770	79,752	700	126	121,122	59,278	7,241	14,169
37	Length of these drains.....miles.	8,933.4	271.4	1.1	1.0	349.1	131.8	45.9	28.4
38	Average length per acre.....feet.	21.2	18.0	8.3	41.9	15.2	11.7	33.5	10.6
39	Area having open ditches, tile drains, and levees <sup>2</sup> .....acres.	2,386	.....	.....	.....	.....	.....	.....	.....
40	Length of these drains.....miles.	67.4	.....	.....	.....	.....	.....	.....	.....
41	Average length per acre.....feet.	149.2	.....	.....	.....	.....	.....	.....	.....
42	Length of the accessory levees.....miles.	6.8	.....	.....	.....	.....	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>									
43	Improved land in operating enterprises, 1920.....acres.	6,707,328	175,350	7,887	9,081	201,399	145,464	13,949	20,040
44	Improved land prior to drainage.....acres.	3,955,220	70,648	4,633	8,121	159,105	110,542	10,360	18,329
45	Increase since drainage.....acres.	2,752,108	104,702	3,214	960	42,294	34,922	3,589	1,711
46	Per cent of increase.....	69.6	148.2	69.1	11.8	26.6	31.6	34.6	9.3
47	Per cent increase is of all improved land in farms, 1920.....	14.8	50.9	1.7	0.4	20.8	15.8	1.8	0.7
48	Timber and cut-over land, 1920.....acres.	956,894	35,833	264	3,269	32,595	8,113	297	10,543
49	Timber and cut-over land prior to drainage.....acres.	3,079,180	133,933	1,594	3,319	69,581	13,381	1,829	695
50	Decrease since drainage.....acres.	2,122,286	98,100	1,330	50	36,986	5,268	1,632	695
51	Per cent of decrease.....	68.9	73.2	83.4	1.5	53.2	39.4	84.6	100.0
52	Other unimproved land, 1920.....acres.	442,982	13,832	1,058	6,612	6,940	2,614	5,259	10,801
53	Other unimproved land prior to drainage.....acres.	1,072,804	20,434	2,942	7,522	12,248	32,268	7,216	1,016
54	Decrease since drainage.....acres.	629,822	6,602	1,884	910	5,308	29,654	1,957	65,949
55	Per cent of decrease.....	58.7	32.3	64.0	12.1	43.3	91.9	27.1	100.0
56	Swampy or subject to overflow, 1920.....acres.	247,273	24,724	1,192	1,442	27,753	2,555	784	895
57	Swampy or subject to overflow prior to drainage.....acres.	3,126,835	158,960	4,483	16,610	105,070	54,253	2,663	9,882
58	Decrease since drainage.....acres.	2,879,612	134,236	3,271	15,168	77,317	51,698	1,879	9,882
59	Per cent of decrease.....	92.1	84.4	73.3	91.3	73.6	95.3	70.6	100.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
60	Total capital invested in and required for completion of operating enterprises.....dollars.	30,771,620	900,915	58,700	71,989	1,012,994	533,092	133,225	39,251
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	30,430,145	581,915	58,700	71,989	1,009,034	521,301	133,225	39,251
62	Additional capital required to complete these enterprises.....dollars.	91,475	19,000	.....	.....	3,960	11,791	.....	.....
63	Average cost per acre when completed.....dollars.	\$ 80	2.67	6.39	3.80	4.20	3.41	6.83	1.98
64	Enterprises constructing open ditches only.....dollars.	15,360,631	214,464	56,316	66,544	215,828	235,820	41,344	89,657
65	Average cost per acre when completed.....dollars.	\$ 24	1.62	6.80	3.64	2.30	3.37	6.03	1.85
66	Enterprises constructing open ditches and levees.....dollars.	50,080	.....	.....	.....	.....	.....	9,267	.....
67	Average cost per acre when completed.....dollars.	7.08	.....	.....	.....	.....	.....	9.27	.....
68	Enterprises constructing tile drains only.....dollars.	5,997,698	78,062	897	298	273,796	90,697	28,239	16,073
69	Average cost per acre when completed.....dollars.	5.26	5.96	4.29	5.23	10.21	3.37	6.41	2.74
70	Enterprises constructing open ditches and tile drains.....dollars.	9,285,211	308,389	1,487	5,147	525,370	206,575	54,375	23,178
71	Average cost per acre when completed.....dollars.	4.18	3.87	2.12	40.85	4.34	3.48	7.51	1.64
72	Enterprises constructing open ditches, tile drains, and levees.....dollars.	73,000	.....	.....	.....	.....	.....	.....	.....
73	Average cost per acre when completed.....dollars.	32.69	.....	.....	.....	.....	.....	.....	.....
<b>CROPS.</b>									
74	Improved land in enterprises reporting—								
75	Corn as principal crop on drained land.....acres.	6,309,143	168,810	.....	.....	201,399	138,719	13,915	20,040
76	Wheat as principal crop on drained land.....acres.	248,186	6,351	.....	.....	.....	1,621	.....	.....
77	Hay as principal crop on drained land.....acres.	126,815	.....	7,887	9,081	.....	.....	.....	.....
78	Vegetables as principal crop on drained land.....acres.	14,833	.....	.....	.....	.....	417	34	.....
79	Oats as principal crop on drained land.....acres.	4,741	.....	.....	.....	.....	4,707	.....	.....
80	Other crops as principal ones on drained land.....acres.	201	.....	.....	.....	.....	.....	.....	.....
81	Not reporting principal crop on drained land.....acres.	3,359	189	.....	.....	.....	.....	.....	770

<sup>1</sup> Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The figures reported have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—OHIO.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Cuya-hoga.	Darke.	Defiance.	Delaware.	Erie.	Fairfield.	Fayette.	Franklin.	Fulton.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres	296,320	375,040	259,200	284,800	163,840	316,800	264,320	330,880	259,200
2	All land in operating drainage enterprises.....acres	8,519	348,125	250,267	272,530	102,251	5,655	96,478	83,045	257,047
3	Improved land.....acres	6,284	314,643	194,430	227,865	99,804	5,405	89,195	25,121	208,640
4	Per cent of all improved land in farms.....	5.5	95.2	99.4	99.3	85.2	2.0	37.9	9.5	99.1
5	Timber and cut-over land.....acres	496	31,482	47,301	40,597	644	250	7,283	1,329	47,594
6	Other unimproved land.....acres	1,739		8,536	4,068	1,803			6,595	813
7	Swampy or subject to overflow, in enterprises.....acres	240	4,353	2,433	2,591	1,696		1,777	512	3,191
8	Suffering a loss of crops from defective drainage.....acres	90	4,365	2,405	2,567			1,590	452	3,191
9	Assessed acreage.....acres	12,234	842,868	843,361	428,090	149,381	5,655	96,478	45,051	1,513,486
10	Excess over all land in operating enterprises.....acres	3,715	496,743	593,094	153,560	47,130			12,006	1,256,439
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....miles	54.4	534.0	1,075.2	249.3	274.2	14.7	48.4	67.3	1,616.7
12	Additional under construction.....miles	1.1							0.3	
13	Maximum completed in any enterprise.....miles	11.0	15.0	28.1	14.5	11.0	8.0	9.7	5.0	20.2
14	Maximum width at bottom of ditch.....feet	18	60	16	10	20	65	6	50	25
15	Maximum of average depths of outlet ditches.....feet	4.5	10.0	7.4	6.0	12.0	9.0	8.0	5.5	8.5
16	Mean depth of branch ditches.....feet	3.0	4.6	3.3	3.0	3.3	6.0		3.0	4.0
Tile drains:										
17	Completed.....miles		559.5	104.5	371.7	38.6	1.4	220.1	39.9	244.6
18	Additional under construction.....miles				0.8					
19	Maximum completed in any enterprise.....miles		5.3	10.0	6.8	2.4	1.0	7.2	2.3	7.1
20	Maximum size of tile.....inches		24	30	30	18	15	24	48	20
Accessory levees and dikes:										
21	Completed.....miles									
22	Additional under construction.....miles									
Pumping plants:										
23	Engine capacity.....horsepower									
24	Pump capacity.....gallons per minute									
25	Area served by pumps.....acres									
26	Area drained by open ditches only.....acres	8,219	113,654	235,135	62,131	80,487	4,560	8,615	21,284	194,713
27	Length of these ditches.....miles	53.8	338.6	867.7	137.3	245.5	14.7	20.5	64.2	1,248.1
28	Average length per acre.....feet	84.6	15.7	19.5	11.7	15.0	17.0	12.6	15.9	33.8
29	Area having open ditches and levees.....acres									
30	Length of these ditches.....miles									
31	Average length per acre.....feet									
32	Length of the accessory levees.....miles									
33	Area drained by tile only.....acres		56,860	(*)	70,358	5,481	1,095	58,822	9,394	7,893
34	Length of these tile.....miles		277.3	19.9	180.4	20.7	1.4	178.9	32.2	104.7
35	Average length per acre.....feet		26.7		13.5	19.9	6.8	16.1	18.1	70.0
36	Area drained by open ditches and tile.....acres	800	175,611	415,132	140,041	10,283		29,041	2,367	54,441
37	Length of these drains.....miles	3.0	477.6	292.1	304.1	44.6		69.1	11.1	508.5
38	Average length per acre.....feet	52.8	14.4		11.5	22.9		12.6	24.6	49.3
39	Area having open ditches, tile drains, and levees.....acres									
40	Length of these drains.....miles									
41	Average length per acre.....feet									
42	Length of the accessory levees.....miles									
<b>DEVELOPMENT OF LAND.</b>										
43	Improved land in operating enterprises, 1920.....acres	6,284	314,643	194,430	227,865	99,804	5,405	89,195	25,121	208,640
44	Improved land prior to drainage.....acres	4,170	221,459	63,402	140,154	80,939	2,901	52,502	19,968	118,380
45	Increase since drainage.....acres	2,114	93,184	128,028	87,711	18,865	2,504	36,693	5,153	90,260
46	Per cent of increase.....	50.7	42.1	184.2	62.6	23.3	88.3	8.1	25.8	76.2
47	Per cent increase is of all improved land in farms, 1920.....	1.9	28.2	64.4	38.2	16.1	0.9	2.8	1.9	42.9
48	Timber and cut-over land, 1920.....acres	496	31,482	47,301	40,597	644	250	7,283	1,329	47,594
49	Timber and cut-over land prior to drainage.....acres	969	124,666	157,437	119,939	7,597	675	11,801	4,661	124,336
50	Decrease since drainage.....acres	473	93,184	110,136	79,342	6,953	425	4,518	3,332	76,742
51	Per cent of decrease.....	48.8	74.7	70.0	66.2	91.5	63.0	38.3	71.5	61.7
52	Other unimproved land, 1920.....acres	1,739		8,536	4,068	1,803			6,595	813
53	Other unimproved land prior to drainage.....acres	3,380		24,428	12,437	13,715	2,079	2,176	8,416	14,331
54	Decrease since drainage.....acres	1,641		15,892	8,369	11,912	2,079	2,176	1,821	13,518
55	Per cent of decrease.....	48.6		65.1	67.3	86.9	100.0	100.0	21.6	94.3
56	Swampy or subject to overflow, 1920.....acres	240	4,353	2,433	2,591	1,696		1,777	512	3,191
57	Swampy or subject to overflow prior to drainage.....acres	6,135	108,196	42,810	41,220	52,289	2,029	94,303	2,510	55,851
58	Decrease since drainage.....acres	5,895	103,833	40,377	38,629	50,593	2,029	92,526	1,998	52,660
59	Per cent of decrease.....	96.1	96.0	94.3	93.7	93.8	100.0	98.1	79.6	94.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
60	Total capital invested in and required for completion of operating enterprises.....dollars	64,872	2,000,095	651,468	617,685	250,199	99,364	274,691	120,982	1,012,672
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars	53,872	2,000,095	651,468	616,455	250,199	99,364	274,691	120,532	1,012,672
62	Additional capital required to complete these enterprises.....dollars	11,000			1,230				450	
63	Average cost per acre when completed.....dollars	7.61	5.78	2.60	2.27	2.45	17.57	2.85	3.66	3.94
64	Enterprises constructing open ditches only.....dollars	50,872	551,942	437,309	100,887	104,438	97,083	7,428	61,668	576,044
65	Average cost per acre when completed.....dollars	6.19	4.96	1.88	1.62	2.25	21.29	0.86	2.90	2.96
66	Enterprises constructing open ditches and levees.....dollars									
67	Average cost per acre when completed.....dollars									
68	Enterprises constructing tile drains only.....dollars		450,495	19,457	167,703	21,283	2,281	167,405	44,990	102,030
69	Average cost per acre when completed.....dollars		7.92		3.38	3.88	2.08	2.85	4.79	12.93
70	Enterprises constructing open ditches and tile drains.....dollars	14,000	997,658	194,702	349,095	34,478		99,858	14,294	234,598
71	Average cost per acre when completed.....dollars	46.67	5.68		2.49	3.35		3.44	6.04	6.15
72	Enterprises constructing open ditches, tile drains, and levees.....dollars									
73	Average cost per acre when completed.....dollars									
<b>CROPS.</b>										
74	Improved land in enterprises reporting—									
75	Wheat as principal crop on drained land.....acres		314,643	194,430	227,865	99,783	5,405	89,195	24,679	208,640
76	Hay as principal crop on drained land.....acres					21				
77	Vegetables as principal crop on drained land.....acres	6,284							67	
78	Oats as principal crop on drained land.....acres								375	
79	Other crops as principal ones on drained land.....acres									
80	Not reporting principal crop on drained land.....acres									

1 Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 Area reported under "open ditches and tile."  
 4 Additional area reported under "open ditches only."  
 5 The figures reported have been reduced by the same acreage as the improved land, 1920.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Greens.	Hancock.	Hardin.	Henry.	Huron.	Licking.	Logan.	Lorain.	Lucas.
<b>LAND AREA.</b>										
1	Approximate land area of the county.....acres.	265,600	342,400	302,720	264,960	316,160	428,160	288,640	318,080	218,880
2	All land in operating drainage enterprises.....acres.	46,685	341,627	299,610	262,707	92,411	19,305	175,061	113,761	205,244
3	Improved land.....acres.	43,680	270,205	245,442	220,591	90,575	16,987	172,258	64,001	124,644
4	Per cent of all improved land in farms.....	20.4	99.1	99.9	99.1	41.0	5.0	77.6	80.6	98.2
5	Timber and cut-over land.....acres.	2,232	35,919	36,839	42,116	839	1,050	2,539	14,443	61,776
6	Other unimproved land.....acres.	793	35,503	17,529	.....	997	1,268	264	35,317	18,824
7	Swampy or subject to overflow, in enterprises.....acres.	832	26,906	5,311	32	316	2,162	1,246	4,281	13,877
8	Suffering a loss of crops from defective drainage.....acres.	772	18	244	.....	111	2,162	1,175	133	13,863
9	Assessed acreage.....	97,825	2,060,025	891,290	1,963,587	92,471	23,809	268,271	180,827	589,405
10	Excess over all land in operating enterprises.....acres.	51,140	1,718,398	591,680	1,700,880	60	4,504	93,210	47,066	284,161
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed.....miles.	76.4	969.1	537.9	2,109.1	249.3	17.2	393.8	731.0	569.1
13	Additional under construction.....miles.	.....	.....	.....	1.0	.....	.....	0.5	.....	.....
14	Maximum completed in any enterprise.....miles.	7.7	12.9	19.4	30.0	10.6	2.9	10.8	44.1	30.0
15	Maximum width at bottom of ditch <sup>1</sup> .....feet.	18	12	35	20	30	5	20	20	40
16	Maximum of average depths of outlet ditches <sup>2</sup> .....feet.	8.0	8.3	14.0	8.0	10.0	4.0	15.0	6.0	10.0
17	Mean depth of branch ditches <sup>3</sup> .....feet.	.....	4.3	4.2	3.9	3.5	.....	4.1	3.1	5.3
18	Tile drains:									
19	Completed.....miles.	39.1	627.2	588.1	22.5	107.9	40.4	470.8	22.0	68.7
20	Additional under construction.....miles.	.....	.....	.....	.....	.....	.....	0.7	.....	.....
21	Maximum completed in any enterprise.....miles.	3.7	5.3	9.0	3.0	3.0	3.0	7.0	2.6	50.0
22	Maximum size of tile <sup>4</sup> .....inches.	24	27	24	42	24	28	30	24	60
23	Accessory levees and dikes:									
24	Completed.....miles.	.....	.....	.....	.....	.....	.....	0.8	.....	6.8
25	Additional under construction.....miles.	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Pumping plants:									
27	Engine capacity.....horsepower.	.....	.....	.....	.....	.....	.....	.....	.....	100
28	Pump capacity.....gallons per minute.	.....	.....	.....	.....	.....	.....	.....	.....	3,100
29	Area served by pumps.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	1,500
30	Area drained by open ditches only <sup>5</sup> .....acres.	23,121	195,310	191,531	260,187	40,595	7,702	72,675	108,999	200,823
31	Length of these ditches.....miles.	69.1	567.5	326.5	2,074.7	155.9	11.7	229.8	703.6	554.5
32	Average length per acre.....feet.	15.8	15.3	9.0	42.1	20.3	8.0	16.7	34.1	14.6
33	Area having open ditches and levees <sup>6</sup> .....acres.	.....	.....	.....	.....	.....	.....	1,612	.....	.....
34	Length of these ditches.....miles.	.....	.....	.....	.....	.....	.....	4.3	.....	.....
35	Average length per acre.....feet.	.....	.....	.....	.....	.....	.....	14.1	.....	.....
36	Length of the accessory levees.....miles.	.....	.....	.....	.....	.....	.....	0.8	.....	.....
37	Area drained by tile only <sup>7</sup> .....acres.	12,768	10,003	24,812	1,490	11,733	6,942	47,677	1,244	512
38	Length of these tile.....miles.	24.2	362.2	333.6	10.7	45.4	32.4	275.0	11.3	3.1
39	Average length per acre.....feet.	10.0	.....	71.0	.....	20.4	24.6	30.5	48.0	32.0
40	Area drained by open ditches and tile <sup>8</sup> .....acres.	10,796	136,314	83,267	2,030	40,083	4,661	53,097	3,518	1,523
41	Length of these drains.....miles.	22.2	668.6	465.9	47.2	155.9	13.5	356.7	38.1	12.5
42	Average length per acre.....feet.	10.9	25.8	29.5	.....	20.5	15.3	35.5	57.2	43.3
43	Area having open ditches, tile drains, and levees <sup>9</sup> .....acres.	.....	.....	.....	.....	.....	.....	.....	.....	2,386
44	Length of these drains.....miles.	.....	.....	.....	.....	.....	.....	.....	.....	67.4
45	Average length per acre.....feet.	.....	.....	.....	.....	.....	.....	.....	.....	149.2
46	Length of the accessory levees.....miles.	.....	.....	.....	.....	.....	.....	.....	.....	6.8
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920.....acres.	43,680	270,205	245,442	220,591	90,575	16,987	172,258	64,001	124,644
48	Improved land prior to drainage.....acres.	43,577	226,157	167,419	192,153	67,597	9,198	67,831	28,483	51,933
49	Increase since drainage.....acres.	1,083	244,048	78,023	128,438	22,978	7,789	104,927	35,518	72,651
50	Per cent of increase.....	2.5	933.0	46.6	139.4	34.0	84.7	156.8	124.7	139.7
51	Per cent increase in all improved land in farms, 1920.....	0.5	89.5	31.7	57.7	10.4	2.3	47.3	17.0	57.2
52	Timber and cut-over land, 1920.....acres.	2,232	35,919	36,839	42,116	839	1,050	2,539	14,443	61,776
53	Timber and cut-over land prior to drainage.....acres.	2,881	276,776	102,937	169,599	9,835	4,804	107,155	26,100	122,902
54	Decrease since drainage.....acres.	649	240,857	66,298	127,483	8,996	3,754	104,616	11,657	61,126
55	Per cent of decrease.....	22.5	87.0	64.4	75.2	91.5	78.1	97.6	44.7	49.7
56	Other unimproved land, 1920.....acres.	793	35,503	17,529	.....	997	1,268	264	35,317	18,824
57	Other unimproved land prior to drainage.....acres.	1,227	38,694	29,254	955	14,979	5,303	575	59,178	30,349
58	Decrease since drainage.....acres.	434	3,191	11,725	955	13,982	4,035	311	23,861	11,525
59	Per cent of decrease.....	35.4	8.2	40.1	100.0	93.8	76.1	54.1	40.3	38.0
60	Swampy or subject to overflow, 1920.....acres.	832	26,906	5,311	32	316	2,162	1,246	4,281	13,877
61	Swampy or subject to overflow prior to drainage.....acres.	3,286	289,937	103,239	44,000	36,469	9,712	35,739	113,217	46,249
62	Decrease since drainage.....acres.	2,454	263,031	97,928	43,968	36,153	7,550	34,493	108,936	32,372
63	Per cent of decrease.....	74.7	90.7	94.9	99.9	99.1	77.7	96.5	96.2	70.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises.....dollars.	114,190	1,527,173	1,128,506	1,799,959	335,825	75,749	874,267	456,376	565,851
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	114,190	1,527,173	1,128,506	1,799,149	335,825	75,749	873,048	456,376	565,851
66	Additional capital required to complete these enterprises.....dollars.	.....	.....	.....	810	.....	.....	1,219	.....	.....
67	Average cost per acre when completed.....dollars.	2.45	4.47	3.77	6.85	3.63	3.92	4.99	4.01	2.76
68	Enterprises constructing open ditches only.....dollars.	51,998	494,269	411,310	1,736,764	149,516	8,226	270,219	393,914	467,714
69	Average cost per acre when completed.....dollars.	2.25	2.53	2.15	6.68	3.68	1.07	3.72	3.61	2.33
70	Enterprises constructing open ditches and levees.....dollars.	.....	.....	.....	.....	.....	.....	3,195	.....	.....
71	Average cost per acre when completed.....dollars.	.....	.....	.....	.....	.....	.....	1.98	.....	.....
72	Enterprises constructing tile drains only.....dollars.	35,674	402,999	298,113	14,736	39,392	46,899	285,785	22,627	4,387
73	Average cost per acre when completed.....dollars.	2.79	.....	12.01	.....	3.36	6.76	5.99	18.19	8.57
74	Enterprises constructing open ditches and tile drains.....dollars.	26,518	629,885	419,083	48,459	146,917	20,624	315,068	39,835	15,750
75	Average cost per acre when completed.....dollars.	2.46	4.62	5.03	.....	3.67	4.42	5.93	11.32	10.34
76	Enterprises constructing open ditches, tile drains, and levees.....dollars.	.....	.....	.....	.....	.....	.....	.....	.....	75,000
77	Average cost per acre when completed.....dollars.	.....	.....	.....	.....	.....	.....	.....	.....	32.69
<b>CROPS.</b>										
78	Improved land in enterprises reporting—									
79	Corn as principal crop on drained land.....acres.	43,660	269,708	242,003	220,591	89,647	16,987	172,258	1,670	122,068
80	Wheat as principal crop on drained land.....acres.	.....	.....	2,963	.....	82	.....	.....	3,600	.....
81	Hay as principal crop on drained land.....acres.	.....	.....	.....	.....	846	.....	.....	58,731	.....
82	Vegetables as principal crop on drained land.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	2,586
83	Oats as principal crop on drained land.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Other crops as principal ones on drained land.....acres.	.....	.....	.....	.....	.....	.....	.....	.....	.....
85	Not reporting principal crop on drained land.....acres.	.....	497	477	.....	.....	.....	.....	.....	.....

<sup>1</sup> Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> A additional area reported under "open ditches only."  
<sup>4</sup> The figures reported have been reduced by the same acreage as the improved land, 1920.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Madison.	Marion.	Medina.	Mercer.	Miami.	Montgomery.	Morrow.	Ottawa.	Faulding.	
<b>LAND AREA.</b>											
1	Approximate land area of the county.....	acres	218,080	281,760	278,400	288,000	261,120	291,200	257,920	172,800	264,320
2	All land in operating drainage enterprises.....	acres	236,431	237,580	17,859	250,853	225,720	10,482	111,111	154,402	262,911
3	Improved land.....	acres	214,306	174,142	10,753	222,988	202,613	9,308	97,763	110,177	219,885
4	Per cent of all improved land in farms.....		82.1	80.3	6.0	94.2	83.0	4.2	52.2	84.0	93.5
5	Timber and cut-over land.....	acres	14,528	24,142	1,729	27,865	668	776	5,913	40,240	41,012
6	Other unimproved land.....	acres	7,597	39,296	5,377		22,439	398	7,435	3,985	2,014
7	Swampy or subject to overflow, in enterprises.....	acres	15	5,057	130	5,619	536	152	7,454	690	8,230
8	Suffering a loss of crops from defective drainage.....	acres	64	4,828	109	5,359	28	84	5,520		4,923
9	Assessed acreage.....		252,359	465,385	19,644	515,191	281,021	11,003	325,012	441,699	1,131,331
10	Excess over all land in operating enterprises.....	acres	16,928	227,806	1,685	264,338	55,301	526	213,901	287,297	868,420
<b>DRAINAGE WORKS.</b>											
<b>Open ditches:</b>											
11	Completed.....	miles	201.8	407.7	44.5	569.6	153.3	10.5	104.6	652.8	1,551.8
12	Additional under construction.....	miles									
13	Maximum completed in any enterprise.....	miles	10.0	10.7	4.6	33.3	8.5	3.8	9.2	19.6	21.0
14	Maximum width at bottom of ditch.....	feet	12	12	24	125	18	13	9	40	15
15	Maximum of average depths of outlet ditches.....	feet	7.0	12.0	10.0	13.9	7.0	7.0	8.0	8.1	11.0
16	Mean depth of branch ditches.....	feet	3.6	3.0	3.0	4.3	3.9		3.3	4.4	4.1
<b>Tile drains:</b>											
17	Completed.....	miles	515.5	488.3	0.8	190.4	490.3	27.3	138.1	4.0	78.7
18	Additional under construction.....	miles									
19	Maximum completed in any enterprise.....	miles	16.5	11.2	0.3	4.0	6.3	2.4	4.4	1.4	3.4
20	Maximum size of tile.....	inches	24	27	8	42	42	27	24	12	30
<b>Accessory levees and dikes:</b>											
21	Completed.....	miles								0.3	
22	Additional under construction.....	miles									
<b>Pumping plants:</b>											
23	Engine capacity.....	horsepower								25	
24	Pump capacity.....	gallons per minute								500	
25	Area served by pumps.....	acres								255	
26	Area drained by open ditches only.....	acres	37,532	58,752	17,648	148,960	79,100	4,359	26,349	153,256	248,130
27	Length of these ditches.....	miles	101.7	141.4	42.8	431.7	86.0	10.5	42.7	650.6	1,466.4
28	Average length per acre.....	feet	14.3	12.7	12.8	15.8	5.7	12.7	8.6	22.4	31.2
29	Area having open ditches and levees.....	acres								350	
30	Length of these ditches.....	miles								0.5	
31	Average length per acre.....	feet								7.5	
32	Length of the accessory levees.....	miles								0.3	
33	Area drained by tile only.....	acres	74,759	60,405	20	36,608	78,368	6,123	25,079	227	330
34	Length of these tile.....	miles	250.9	288.0	0.3	123.0	337.8	27.3	68.8	1.9	39.3
35	Average length per acre.....	feet	17.7	26.2	79.2	17.7	22.8	23.5	14.1	44.2	
36	Area drained by open ditches and tile.....	acres	124,140	118,423	191	65,287	63,252		59,683	570	14,451
37	Length of these drains.....	miles	424.7	466.6	2.2	205.3	219.8		133.2	3.8	125.5
38	Average length per acre.....	feet	18.1	20.8	60.8	16.6	17.0		11.8	35.2	45.0
39	Area having open ditches, tile drains, and levees.....	acres									
40	Length of these drains.....	miles									
41	Average length per acre.....	feet									
42	Length of the accessory levees.....	miles									
<b>DEVELOPMENT OF LAND.</b>											
43	Improved land in operating enterprises, 1920.....	acres	214,306	174,142	10,753	222,988	202,613	9,308	97,763	110,177	219,885
44	Improved land prior to drainage.....	acres	120,773	98,609	7,173	159,035	200,834	8,820	66,263	70,297	75,811
45	Increase since drainage.....	acres	93,533	75,533	3,580	63,953	1,779	479	31,500	39,880	144,074
46	Per cent of increase.....		77.4	76.6	49.9	40.2	0.9	5.4	47.5	56.7	190.0
47	Per cent increase is of all improved land in farms, 1920.....		35.8	34.8	2.0	27.0	0.8	0.2	16.8	34.0	65.2
48	Timber and cut-over land, 1920.....	acres	14,528	24,142	1,729	27,865	668	776	5,913	40,240	41,012
49	Timber and cut-over land prior to drainage.....	acres	63,515	87,721	2,273	91,818	2,015	1,165	18,578	41,025	184,142
50	Decrease since drainage.....	acres	53,987	63,579	544	63,953	1,347	389	12,665	785	143,130
51	Per cent of decrease.....		78.8	72.5	23.9	69.7	66.3	33.4	68.2	1.9	77.7
52	Other unimproved land, 1920.....	acres	7,597	39,296	5,377		22,439	398	7,435	3,985	2,014
53	Other unimproved land prior to drainage.....	acres	47,143	51,250	8,413		22,871	488	26,270	43,080	2,958
54	Decrease since drainage.....	acres	39,546	11,954	3,036		432	90	18,835	39,095	944
55	Per cent of decrease.....		83.9	23.3	35.1		1.9	18.4	71.7	90.7	31.9
56	Swampy or subject to overflow, 1920.....	acres	15	5,057	130	5,619	536	152	7,454	690	8,230
57	Swampy or subject to overflow prior to drainage.....	acres	94,970	45,730	18,819	65,502	8,994	793	29,205	69,491	94,289
58	Decrease since drainage.....	acres	94,955	40,673	15,689	59,883	8,458	641	21,751	68,801	86,059
59	Per cent of decrease.....		100.0	88.9	89.2	91.4	94.0	80.8	74.5	99.0	91.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>											
60	Total capital invested in and required for completion of operating enterprises.....	dollars	686,563	706,490	65,430	898,792	884,625	54,686	224,268	441,719	1,037,071
61	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	686,563	706,490	65,430	898,792	884,625	54,686	224,268	441,719	1,037,071
62	Additional capital required to complete these enterprises.....	dollars									
63	Average cost per acre when completed.....	dollars	2.90	2.97	3.66	3.58	3.92	5.22	2.02	2.86	3.94
64	Enterprises constructing open ditches only.....	dollars	62,355	87,765	63,580	601,465	128,729	9,535	24,304	433,240	910,892
65	Average cost per acre when completed.....	dollars	1.66	1.49	3.60	3.37	1.63	2.19	0.92	2.83	3.67
66	Enterprises constructing open ditches and levees.....	dollars								5,600	
67	Average cost per acre when completed.....	dollars								16.00	
68	Enterprises constructing tile drains only.....	dollars	248,930	263,894	392	161,235	480,957	45,150	70,389	771	48,844
69	Average cost per acre when completed.....	dollars	3.33	4.19	19.60	4.40	5.88	7.37	2.81	3.40	
70	Enterprises constructing open ditches and tile drains.....	dollars	376,278	305,821	1,478	236,102	294,939		129,575	2,108	82,635
71	Average cost per acre when completed.....	dollars	3.02	3.09	7.74	3.62	4.32		2.17	3.70	5.72
72	Enterprises constructing open ditches, tile drains, and levees.....	dollars									
73	Average cost per acre when completed.....	dollars									
<b>CROPS.</b>											
74	Improved land in enterprises reporting—										
75	Corn as principal crop on drained land.....	acres	210,722	174,142		222,988	202,399	9,308	97,763	14,877	219,187
76	Wheat as principal crop on drained land.....	acres	3,584		435					95,117	
77	Hay as principal crop on drained land.....	acres			10,318					171	
78	Vegetables as principal crop on drained land.....	acres									
79	Oats as principal crop on drained land.....	acres					34			19	
80	Other crops as principal ones on drained land.....	acres									
81	Not reporting principal crop on drained land.....	acres					180				698

1 Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 Additional area reported under "open ditches only."  
 4 The figures reported have been reduced by the same acreage as the improved land, 1920.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Pick- away.	Portage.	Preble.	Putnam.	Richland.	San- dusky.	Seneca.	Shelby.	Stark.	
<b>LAND AREA.</b>										
1	Approximate land area of the county..... acres	312,600	333,440	266,240	308,480	321,920	264,320	352,000	264,320	362,240
2	All land in operating drainage enterprises..... acres	24,101	10,274	110,615	308,374	22,783	250,307	327,618	247,498	14,639
3	Improved land..... acres	20,680	2,508	106,806	253,803	18,411	186,005	273,028	207,043	8,631
4	Per cent of all improved land in farms.....	7.3	1.4	48.9	97.7	7.9	91.9	97.6	68.4	3.3
5	Timber and cut-over land..... acres	1,534	1,317	4,009	39,510	2,555	25,976	37,759	28,987	39
6	Other unimproved land..... acres	1,887	6,449	.....	15,061	1,797	38,326	16,831	11,468	5,979
7	Swampy or subject to overflow, in enterprises..... acres	2,049	2,381	4,105	34,614	1,620	1,126	1,940	5,208	667
8	Suffering a loss of crops from defective drainage..... acres	1,240	.....	4,068	4,520	1,175	150	700	4,327	578
9	Assessed acreage.....	32,095	11,836	119,570	1,598,583	35,190	608,883	423,775	369,776	18,966
10	Excess over all land in operating enterprises..... acres	7,994	1,562	8,956	1,290,209	12,427	258,576	96,157	122,278	4,327
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed..... miles	32.1	84.8	48.4	1,239.9	53.9	851.2	775.3	357.3	167.9
13	Additional under construction..... miles	.....	.....	.....	.....	1.9	.....	.....	2.7	.....
14	Maximum completed in any enterprise..... miles	12.4	9.6	5.2	13.8	5.1	17.2	12.0	13.2	14.9
15	Maximum width at bottom of ditch <sup>1</sup> ..... feet	18	12	10	30	30	40	30	18	12
16	Maximum of average depths of outlet ditches <sup>2</sup> ..... feet	5.0	8.0	6.5	10.0	8.0	8.5	8.1	10.0	8.0
17	Mean depth of branch ditches <sup>3</sup> ..... feet	.....	4.0	3.7	3.9	3.3	3.3	3.5	.....	4.0
18	Tile drains:									
19	Completed..... miles	37.5	0.2	464.0	229.3	24.5	81.8	148.9	312.5	11.3
20	Additional under construction..... miles	.....	.....	.....	.....	1.6	.....	.....	.....	.....
21	Maximum completed in any enterprise..... miles	6.1	0.2	4.1	4.0	3.4	1.6	6.0	6.1	1.9
22	Maximum size of tile <sup>4</sup> ..... inches	20	8	27	27	30	30	24	34	30
23	Accessory levees and dikes:									
24	Completed..... miles	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Additional under construction..... miles	.....	.....	.....	.....	.....	.....	.....	4.0	.....
26	Pumping plants:									
27	Engine capacity..... horsepower	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	Pump capacity..... gallons per minute	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	Area served by pumps..... acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	Area drained by open ditches only <sup>5</sup> ..... acres	13,299	9,725	10,256	245,239	11,955	230,389	203,074	84,351	9,800
31	Length of these ditches..... miles	28.5	79.7	12.1	1,169.2	49.6	806.4	629.4	235.5	108.8
32	Average length per acre..... feet	11.3	43.3	6.2	25.2	21.9	18.5	18.4	14.7	58.6
33	Area having open ditches and levees <sup>6</sup> ..... acres	.....	.....	.....	.....	.....	.....	.....	2,500	.....
34	Length of these ditches..... miles	.....	.....	.....	.....	.....	.....	.....	4.0	.....
35	Average length per acre..... feet	.....	.....	.....	.....	.....	.....	.....	8.4	.....
36	Length of the accessory levees..... miles	.....	.....	.....	.....	.....	.....	.....	4.0	.....
37	Area drained by tile only <sup>7</sup> ..... acres	9,254	.....	72,020	17,185	5,547	3,322	44,047	63,100	274
38	Length of these tile..... miles	33.4	.....	362.6	120.6	13.4	18.0	85.3	194.6	2.4
39	Average length per acre..... feet	19.1	.....	28.8	37.1	12.8	28.6	10.2	16.3	46.2
40	Area drained by open ditches and tile <sup>8</sup> ..... acres	1,548	549	28,339	45,950	5,261	16,596	80,497	97,547	4,565
41	Length of these drains..... miles	7.7	5.3	107.7	279.4	13.9	58.6	209.5	238.4	88.0
42	Average length per acre..... feet	26.3	51.0	20.1	32.1	19.0	18.6	13.7	12.9	78.7
43	Area having open ditches, tile drains, and levees <sup>9</sup> ..... acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
44	Length of these drains..... miles	.....	.....	.....	.....	.....	.....	.....	.....	.....
45	Average length per acre..... feet	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	Length of the accessory levees..... miles	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920..... acres	20,680	2,508	106,806	253,803	18,411	186,005	273,028	207,043	8,631
48	Improved land prior to drainage..... acres	14,873	2,255	62,481	53,477	12,371	121,434	216,228	180,704	315
49	Increase since drainage..... acres	5,807	2,253	24,125	200,326	6,040	64,571	56,800	26,339	8,306
50	Per cent of increase <sup>10</sup> .....	39.0	883.5	39.2	374.6	48.8	53.2	26.3	14.6	.....
51	Per cent increase is of all improved land in farms, 1920.....	2.0	1.2	11.1	77.1	2.6	31.9	20.3	12.5	3.1
52	Timber and cut-over land, 1920..... acres	1,534	1,317	4,009	39,510	2,555	25,976	37,759	28,987	39
53	Timber and cut-over land prior to drainage..... acres	4,037	1,539	28,134	236,623	4,290	50,358	42,009	47,516	1,252
54	Decrease since drainage..... acres	2,503	222	24,125	197,113	1,735	24,382	4,250	18,529	1,213
55	Per cent of decrease.....	62.0	14.4	85.8	63.3	40.4	48.4	10.1	39.0	96.9
56	Other unimproved land, 1920..... acres	1,887	6,449	.....	15,061	1,797	38,326	16,831	11,468	5,979
57	Other unimproved land prior to drainage..... acres	5,191	8,480	.....	18,274	6,102	78,515	69,381	19,278	13,072
58	Decrease since drainage..... acres	3,304	2,031	.....	3,213	4,305	40,189	52,550	7,810	7,093
59	Per cent of decrease.....	63.6	24.0	.....	17.6	70.6	51.2	75.7	40.5	54.3
60	Swampy or subject to overflow, 1920..... acres	2,049	2,381	4,105	34,614	1,620	1,126	1,940	5,208	667
61	Swampy or subject to overflow prior to drainage..... acres	8,695	3,781	44,377	245,587	6,690	220,912	145,734	9,574	13,986
62	Decrease since drainage..... acres	6,646	6,400	40,272	210,973	5,070	219,788	143,794	4,666	13,319
63	Per cent of decrease.....	76.4	72.9	90.7	85.9	76.8	99.5	98.7	47.3	85.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises..... dollars	69,721	80,474	541,954	1,756,335	127,259	620,742	704,352	853,252	168,044
65	Capital invested in those enterprises to Dec. 31, 1919..... dollars	69,721	80,474	541,954	1,756,335	117,351	620,742	704,352	828,252	168,044
66	Additional capital required to complete these enterprises..... dollars	.....	.....	.....	.....	9,908	.....	.....	25,000	.....
67	Average cost per acre when completed..... dollars	2.89	8.71	4.90	5.70	5.59	2.48	2.15	3.45	11.48
68	Enterprises constructing open ditches only..... dollars	26,311	83,622	21,383	1,161,773	70,037	540,038	422,385	223,140	83,172
69	Average cost per acre when completed..... dollars	1.98	8.60	2.08	4.74	5.86	2.34	2.08	2.65	8.49
70	Enterprises constructing open ditches and levees..... dollars	.....	.....	.....	.....	.....	.....	.....	30,000	.....
71	Average cost per acre when completed..... dollars	.....	.....	.....	.....	.....	.....	.....	12.00	.....
72	Enterprises constructing tile drains only..... dollars	35,698	.....	375,937	145,204	22,608	20,694	117,781	275,078	8,312
73	Average cost per acre when completed..... dollars	8.86	.....	5.22	8.45	4.08	6.23	2.67	4.36	30.34
74	Enterprises constructing open ditches and tile drains..... dollars	7,712	5,852	144,634	449,359	34,614	60,010	164,186	325,064	78,560
75	Average cost per acre when completed..... dollars	4.98	10.66	5.10	9.78	6.58	3.62	2.04	3.33	16.77
76	Enterprises constructing open ditches, tile drains, and levees..... dollars	.....	.....	.....	.....	.....	.....	.....	.....	.....
77	Average cost per acre when completed..... dollars	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>CROPS.</b>										
78	Improved land in enterprises reporting—									
79	Corn as principal crop on drained land..... acres	20,680	1,239	106,442	253,624	1,509	160,157	222,671	207,043	3,045
80	Wheat as principal crop on drained land..... acres	.....	.....	164	.....	16,902	18,524	49,959	.....	225
81	Hay as principal crop on drained land..... acres	.....	.....	.....	.....	.....	7,324	398	.....	.....
82	Vegetables as principal crop on drained land..... acres	.....	1,260	.....	.....	.....	.....	.....	.....	5,348
83	Oats as principal crop on drained land..... acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Other crops as principal ones on drained land..... acres	.....	.....	.....	.....	.....	.....	.....	.....	.....
85	Not reporting principal crop on drained land..... acres	.....	.....	.....	179	.....	.....	.....	.....	.....

1 Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
 2 When works under construction have been completed.  
 3 The figures reported have been reduced by the same acreage as the improved land, 1920.  
 4 Per cent not shown when more than 1,000.



DRAINAGE—OHIO.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Summit.	Trumbull.	Union.	Van Wert.	Wayne.	Williams.	Wood.	Wyandot.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county..... acres..	281,120	405,120	285,440	259,840	356,480	263,040	391,680	259,840	5,584,000
2	All land in operating drainage enterprises..... acres..	17,126	15,331	269,139	257,527	61,661	236,911	389,390	244,500	28,820
3	Improved land..... acres..	11,988	6,478	219,286	*220,721	51,054	*198,444	*314,841	*205,752	23,471
4	Per cent of all improved land in farms.....	8.1	3.1	66.6	98.5	19.0	65.6	99.3	97.1	0.7
5	Timber and cut-over land..... acres..	1,184	2,352	25,567	36,806	2,843	31,353	74,391	17,282	1,114
6	Other unimproved land..... acres..	3,954	6,501	24,286	.....	7,764	7,114	158	21,466	4,235
7	Swampy or subject to overflow, in enterprises..... acres..	107	2,159	56	8,951	11,128	2,383	7,773	229	1,793
8	Suffering a loss of crops from defective drainage..... acres..	.....	490	48	8,567	10,059	2,203	7,773	4,102	724
9	Assessed acreage.....	34,661	21,947	607,580	1,531,134	101,476	311,670	2,373,332	380,564	28,915
10	Excess over all land in operating enterprises..... acres..	17,535	6,616	338,441	1,273,607	39,815	74,769	1,983,942	136,064	95
<b>DRAINAGE WORKS.</b>										
11	Open ditches:									
12	Completed..... miles.....	70.7	86.8	310.1	1,252.0	275.0	678.5	3,072.5	882.5	107.7
13	Additional under construction..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	Maximum completed in any enterprise..... miles.....	24.9	4.6	15.0	41.6	16.9	38.4	25.3	8.1	9.0
15	Maximum width at bottom of ditch..... feet.....	35	12	20	15	40	35	40	16	70
16	Maximum of average depths of outlet ditches..... feet.....	6.0	6.0	18.0	9.8	12.0	11.0	11.0	10.0	9.0
17	Mean depth of branch ditches..... feet.....	3.8	3.4	3.1	3.6	5.2	3.3	4.5	3.5	4.6
18	Tile drains:									
19	Completed..... miles.....	.....	4.9	587.8	209.7	6.1	179.1	81.5	254.0	10.3
20	Additional under construction..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	Maximum completed in any enterprise..... miles.....	.....	1.6	4.3	6.0	1.1	8.2	5.0	5.4	1.5
22	Maximum size of tile..... inches.....	.....	24	28	48	18	30	42	27	22
23	Accessory levees and dikes:									
24	Completed..... miles.....	.....	.....	0.5	.....	.....	.....	.....	.....	.....
25	Additional under construction..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Pumping plants:									
27	Engine capacity..... horsepower.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	Pump capacity..... gallons per minute.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	Area served by pumps..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	Area drained by open ditches only..... acres.....	17,126	13,447	23,380	180,083	57,403	127,492	380,332	107,106	26,362
31	Length of these ditches..... miles.....	70.7	75.1	58.1	947.5	266.8	445.4	2,894.0	243.0	105.2
32	Average length per acre..... feet.....	21.8	29.5	13.1	27.8	24.5	18.4	40.2	12.0	21.1
33	Area having open ditches and levees..... acres.....	.....	.....	1,616	.....	.....	.....	.....	.....	.....
34	Length of these ditches..... miles.....	.....	.....	0.8	.....	.....	.....	.....	.....	.....
35	Average length per acre..... feet.....	.....	.....	2.6	.....	.....	.....	.....	.....	.....
36	Length of the accessory levees..... miles.....	.....	.....	0.5	.....	.....	.....	.....	.....	.....
37	Area drained by tile only..... acres.....	.....	.....	79,060	28,260	*20	33,634	(*)	50,568	1,826
38	Length of these tiles..... miles.....	.....	.....	329.4	115.7	2.7	99.8	37.6	157.6	7.6
39	Average length per acre..... feet.....	.....	.....	22.0	21.6	.....	11.0	.....	16.5	22.0
40	Area drained by open ditches and tile..... acres.....	.....	1,884	165,083	49,184	4,238	75,785	*9,058	86,827	632
41	Length of these drains..... miles.....	.....	16.6	509.6	398.5	11.6	342.4	222.4	238.3	5.2
42	Average length per acre..... feet.....	.....	46.5	16.3	42.8	14.5	23.9	.....	14.5	43.4
43	Area having open ditches, tile drains, and levees..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
44	Length of these drains..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
45	Average length per acre..... feet.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	Length of the accessory levees..... miles.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>DEVELOPMENT OF LAND.</b>										
47	Improved land in operating enterprises, 1920..... acres.....	11,988	6,478	219,286	*220,721	51,054	*198,444	*314,841	*205,752	23,471
48	Improved land prior to drainage..... acres.....	6,712	3,151	170,201	*122,965	32,311	*145,854	*129,836	*116,049	14,350
49	Increase since drainage..... acres.....	5,276	3,327	49,085	97,756	18,743	52,590	185,005	89,703	9,121
50	Per cent of increase.....	78.6	105.6	28.8	79.5	58.0	36.1	142.5	77.3	63.6
51	Per cent increase is of all improved land in farms, 1920.....	3.6	1.6	21.6	43.6	7.0	25.3	58.4	42.3	0.8
52	Timber and cut-over land, 1920..... acres.....	1,184	2,352	25,567	36,806	2,843	31,353	74,391	17,282	1,114
53	Timber and cut-over land prior to drainage..... acres.....	2,459	3,493	38,393	134,562	8,716	75,827	256,176	24,777	4,406
54	Decrease since drainage..... acres.....	1,275	1,141	12,826	97,756	5,873	44,474	181,785	7,495	3,292
55	Per cent of decrease.....	81.9	32.7	33.4	72.6	67.4	58.7	71.0	30.2	74.7
56	Other unimproved land, 1920..... acres.....	3,954	6,501	24,286	.....	7,764	7,114	158	21,466	4,235
57	Other unimproved land prior to drainage..... acres.....	7,955	6,687	60,545	.....	20,634	15,230	3,378	103,674	10,064
58	Decrease since drainage..... acres.....	4,001	2,186	36,259	.....	12,870	8,116	3,230	82,208	5,829
59	Per cent of decrease.....	50.3	25.2	59.9	.....	62.4	53.3	95.3	79.3	57.9
60	Swampy or subject to overflow, 1920..... acres.....	107	2,159	56	8,951	11,128	2,383	7,773	229	1,793
61	Swampy or subject to overflow prior to drainage..... acres.....	16,049	9,813	96,379	95,419	29,885	17,150	166,151	30,726	15,188
62	Decrease since drainage..... acres.....	15,942	7,654	96,323	86,468	18,757	14,767	158,378	30,497	13,395
63	Per cent of decrease.....	99.3	78.0	99.9	90.6	62.8	86.1	95.3	99.3	88.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
64	Total capital invested in and required for completion of operating enterprises..... dollars.....	99,888	85,196	705,535	1,544,952	319,263	512,940	1,723,397	566,244	231,243
65	Capital invested in these enterprises to Dec. 31, 1919..... dollars.....	99,888	85,196	705,535	1,544,952	319,263	512,940	1,723,397	566,244	231,243
66	Additional capital required to complete these enterprises..... dollars.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
67	Average cost per acre when completed..... dollars.....	5.83	5.56	2.62	6.00	5.18	2.17	4.48	2.32	8.02
68	Enterprises constructing open ditches only..... dollars.....	99,888	63,467	34,312	870,038	297,896	222,318	1,571,201	148,962	219,530
69	Average cost per acre when completed..... dollars.....	5.83	4.73	1.47	4.83	5.19	1.74	4.13	1.39	8.33
70	Enterprises constructing open ditches and levees..... dollars.....	.....	.....	2,018	.....	.....	.....	.....	.....	.....
71	Average cost per acre when completed..... dollars.....	.....	.....	1.25	.....	.....	.....	.....	.....	.....
72	Enterprises constructing tile drains only..... dollars.....	.....	.....	264,331	191,335	5,748	72,492	32,276	186,217	7,865
73	Average cost per acre when completed..... dollars.....	.....	.....	3.34	6.77	.....	2.16	.....	3.68	4.31
74	Enterprises constructing open ditches and tile drains..... dollars.....	.....	21,729	404,874	483,579	15,619	218,130	119,920	231,065	3,848
75	Average cost per acre when completed..... dollars.....	.....	11.63	2.45	9.83	3.69	2.88	.....	2.66	6.09
76	Enterprises constructing open ditches, tile drains, and levees..... dollars.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
77	Average cost per acre when completed..... dollars.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>CROPS.</b>										
78	Improved land in enterprises reporting—									
79	Corn as principal crop on drained land..... acres.....	67	234	219,234	220,721	516	108,201	314,841	205,328	21,508
80	Wheat as principal crop on drained land..... acres.....	.....	.....	52	.....	45,718	.....	.....	424	.....
81	Hay as principal crop on drained land..... acres.....	11,610	6,055	.....	.....	11	243	.....	.....	1,965
82	Vegetables as principal crop on drained land..... acres.....	45	.....	.....	.....	4,809	.....	.....	.....	.....
83	Oats as principal crop on drained land..... acres.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Other crops as principal ones on drained land..... acres.....	.....	159	.....	.....	.....	.....	.....	.....	.....
85	Not reporting principal crop on drained land..... acres.....	366	.....	.....	.....	.....	.....	.....	.....	.....

<sup>1</sup> Includes only Brown, Butler, Clermont, Geauga, Hamilton, Highland, Holmes, Jackson, Knox, Lawrence, Mahoning, Muskingum, Perry, Pike, Ross, Scioto, Tuscarawas, and Warren Counties.  
<sup>2</sup> Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>3</sup> When works under construction have been completed.  
<sup>4</sup> Additional area reported under "open ditches only."  
<sup>5</sup> Area reported under "open ditches and tile."  
<sup>6</sup> The figures reported have been reduced by the same acreage as the improved land, 1920.

## SOUTH CAROLINA.

The following pages present the statistics of drainage for South Carolina collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of unimproved land

not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	192, 693	100. 0
Farms reporting land having drainage.....	26, 993	14. 0
Farms reporting land needing drainage.....	24, 508	12. 7
All land in farms..... acres..	12, 426, 675	100. 0
Improved land in farms..... acres..	6, 184, 159	49. 8
Farm land reported as provided with drainage..... acres..	676, 152	5. 4
Farm land reported as needing drainage..... acres..	1, 341, 903	10. 8
Needing drainage only..... acres..	125, 548	1. 0
Needing drainage and clearing..... acres..	1, 216, 355	9. 8
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	19, 516, 800	100. 0
All land in operating drainage enterprises..... acres..	140, 031	0. 7
Improved land..... acres..	59, 075	0. 3
Per cent of all improved land in farms.....	1. 0	.....
Timber and cut-over land..... acres..	64, 955	0. 3
Other unimproved land..... acres..	16, 001	0. 1
Swampy, subject to overflow, seeped, or alkali..... acres..	18, 206	(1)
Suffering a loss of crops from defective drainage..... acres..	3, 093	(1)
Improved land prior to drainage..... acres..	51, 349	0. 3
Increase since drainage began..... acres..	7, 726	(1)
Land in nonoperating enterprises..... acres..	4, 206	(1)
Open ditches in operating enterprises..... miles..	350. 4	100. 0
Completed..... miles..	262. 7	75. 0
Additional under construction..... miles..	87. 7	25. 0
Tile drains in operating enterprises..... miles..	262. 5	100. 0
Completed..... miles..	101. 5	38. 7
Additional under construction..... miles..	161. 0	61. 3
Total capital invested in and required for completion of operating enterprises...	\$936, 514	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	582, 183	62. 2
Additional capital required to complete these enterprises.....	354, 331	37. 8
Average cost per acre when completed.....	6. 69	.....

<sup>1</sup> Less than one-tenth of 1 per cent.



# SOUTH CAROLINA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

**TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.**

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	144,237	100.0	\$583,083	100.0	\$445,845
Operating enterprises.....	140,031	97.1	582,183	99.8	354,331
With works completed.....	24,304	17.2	198,370	34.0	.....
With works under construction..	115,167	79.8	383,813	65.8	354,331
Nonoperating enterprises.....	4,206	2.9	900	0.2	91,514

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

**Location of enterprises.**—Most of the land in drainage enterprises in South Carolina is in the southeastern quarter of the state, though there are small areas in such enterprises in the northeastern and the northwestern parts.

**TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.**

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	144,237	100.0	\$583,083	100.0	\$445,845
Operating enterprises.....	140,031	97.1	582,183	99.8	354,331
Santee River.....	11,007	7.8	56,937	9.8	42,726
Edisto River.....	43,816	30.4	36,219	6.2	155,000
Savannah River.....	3,408	2.4	74,651	12.8	4,505
Atlantic Ocean.....	81,800	56.7	414,376	71.1	152,100
Nonoperating enterprises.....	4,206	2.9	900	0.2	91,514
Santee River.....	1,436	1.0	300	0.1	40,000
Savannah River.....	500	0.3	600	0.1	32,400
Atlantic Ocean.....	2,270	1.6	.....	.....	19,114

**Condition of land in enterprises.**—The drainage enterprises in the Coastal Plain counties, comprising all

but four of the counties in which operating enterprises are located, are mostly for the purpose of reclaiming swamp land or improving level areas that generally are too wet for farming with profit. In the Piedmont section the drainage enterprises are for the protection or drainage of land subject to overflow by stream floods.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains lands still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

**TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.**

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	140,031	100.0	24,364	115,167	4,206
Improved land.....	59,075	42.2	7,099	51,976	976
Timber and cut-over land.....	64,955	46.4	10,667	54,288	1,548
Other unimproved land.....	16,001	11.4	7,098	8,908	1,682
Swampy or subject to overflow.....	18,206	13.0	704	17,502	4,106
Suffering a loss of crops.....	3,093	2.2	.....	3,093	.....

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 17 operating drainage enterprises are counted in South Carolina, with an average area of 8,237 acres. There is no overlapping of the enterprises in this state.

**TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.**

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	140,031	140,031	100.0
Less than 200 acres.....	40	40	.....
200 to 499 acres.....	2,198	2,198	1.6
500 to 999 acres.....	19,793	19,793	14.1
1,000 to 4,999 acres.....	20,400	20,400	14.6
5,000 to 9,999 acres.....	40,000	40,000	28.6
50,000 to 99,999 acres.....	57,600	57,600	41.1

**Character of enterprises.**—The drainage enterprises in South Carolina comprise districts formed in accordance with the drainage district laws of 1911 and 1912 and the sanitary and drainage district law of 1907, also undertakings by individual farm owners.

Drainage districts under the law of February 18, 1911 (act No. 54), are established by the clerk of the court of common pleas of the county in which all or a part of the proposed district is situated. A petition for establishment must be signed by a majority of the resident landowners or the owners of a major part of the land to be included. A preliminary investigation and report regarding the public utility of the undertaking are made by three viewers appointed by the clerk of the court. Public hearing is held upon the petition; then the boundaries of the district are fixed, or proceedings are dismissed at the cost of the county. The viewers prepare the plan of drainage, make awards of damages, and divide the land into five classes according to the benefits that the various tracts will receive; their report is reviewed by the clerk of the court at public hearing before it is confirmed. The cost of land taken for right of way is determined by jury trial. To secure construction of the drains and otherwise administer the affairs of the district, the clerk of the court appoints three drainage commissioners who previously have been elected by the landowners. The cost of the enterprise is assessed according to the classification of the land, the rates per acre being in the ratio 5:4:3:2:1. The district may issue bonds if the cost will exceed an average of 25 cents per acre on all the land. Originally, 22 counties were excepted from the operation of this law, but later the law was made applicable in all counties.

Each drainage district under act No. 411 of 1912 is established by a board of three disinterested drainage commissioners, who are appointed by the board of county commissioners upon receipt of a petition signed by two-thirds of the owners of land adjacent to the creek, swamp, or branch that those owners desire to open or improve for drainage. The drainage commissioners make a preliminary survey and estimate of cost for the work deemed practicable, and hold hearings upon their report. If they find the project should be undertaken, and two-thirds of the landowners sign a second petition to have the works constructed, the drainage commissioners complete the plans and specifications for the improvements, secure construction of the works, and divide the land in the district into three classes according to the anticipated drainage benefits. The cost is assessed according to the classification of the land, the rates per acre being in the ratio 5:4:3. The drainage commissioners may levy annually not exceeding \$5 per acre until the cost of drainage has been paid. By act No. 120 of 1919, bonds of the district may be issued. Land may be condemned for right of way for the drains.

Sanitary and drainage districts are organized in accordance with act No. 247 approved February 13, 1907. The governor of the state, upon request and with the advice and consent of the senator and representatives from any county, or a majority of them, shall appoint a sanitary and drainage commission for that county

with authority regarding sanitary, agricultural, and public utility drainage. The commission has control over all public drains outside of incorporated cities and towns, with power to make surveys, alterations, and improvements, to require persons to drain their land and to keep their drains in repair, and to do any and all work for drainage purposes. Each commission is required to report annually to the general assembly, and all money appropriated for the commission is required to be paid by the county treasurer from the proceeds of general county or township taxes authorized by the general assembly.

The first general drainage law of South Carolina was an act of December 20, 1856 (ch. 4307), which is still in effect, authorizing the formation of drainage corporations by two-thirds of the owners of the land to be drained, who must hold two-thirds of that acreage, signing articles of agreement to be filed in the office of the clerk of the county in which the land is situated. No enterprises were reported as organized under that law. There are also a number of other statutes providing for land drainage, each of which was made applicable in only one or a few counties, for which no enterprises were reported. A law enacted December 22, 1891, provides for securing a drainage outlet by one landowner across the property of an objecting owner, when necessary, the damages being determined by a board of referees.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	144,237	100.0	\$583,083	100.0	\$445,845
Operating enterprises.....	140,031	97.1	582,183	99.8	354,331
Drainage districts.....	57,231	39.7	155,807	26.7	202,231
Law of 1911, act No. 54.....	45,823	31.8	61,156	10.5	185,726
Law of 1912, act No. 411.....	11,408	7.9	94,651	16.2	18,505
Sanitary and drainage districts.....	57,600	39.9	10,376	1.8	5,100
Individual ownership.....	25,200	17.5	416,000	71.3	147,000
Nonoperating enterprises.....	4,206	2.9	900	0.2	91,514
Drainage districts.....	4,206	2.9	900	0.2	91,514
Law of 1911, act No. 54.....	1,436	1.0	300	0.1	40,000
Law of 1912, act No. 411.....	2,770	1.9	600	0.1	51,514

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 262.7 miles of open ditches, 101.5 miles of tile drains, and 12.0 miles of accessory levees; the additional lengths under construction were 87.7 miles of ditches, 161.0 miles of tile drains, and 30.0 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. However, all the tile drains shown are in drainage enterprises under individual ownership.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	140,031	100.0	\$532,183	100.0	\$354,331
Open ditches only.....	130,631	93.4	319,183	54.8	207,331
Open ditches, tile drains, and levees.....	9,200	6.6	263,000	45.2	147,000

There are two drainage enterprises in South Carolina in which 2,940 acres are drained by pumping part of the time. The pumping plants operate four centrifugal pumps of 44,600 gallons per minute total capacity, the plants being capable of developing 40 horsepower by steam and 115 horsepower by internal-combustion engines.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would show the mean depth for the state 4.3 instead of 5.2 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	140,031	100.0
Less than 3 feet.....	57,600	41.1
3.0 to 3.9 feet.....	17,800	12.7
4.0 to 4.9 feet.....	2,000	1.4
5.0 to 5.9 feet.....	9,388	6.7
6.0 to 6.9 feet.....	45,400	32.4
7.0 to 7.9 feet.....	3,007	2.1
8.0 to 8.9 feet.....	2,020	1.4
Not reporting branches.....	2,816	2.0

Maintenance of works.—The drainage district law of 1911 provides that it shall be the duty of the board of drainage commissioners to keep the works of the district in good repair; and for this purpose they may levy an assessment against the land benefited by the construction of the improvement in the same manner and in the same proportion as the original assessment was made. The drainage district law of 1912 does

not provide for maintenance. Sanitary and drainage districts organized under the statute of 1907 are maintained by the commissioners appointed in accordance with that law, the cost of repairs being paid by taxation authorized by the general assembly the same as for original construction of improvements.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	140,031	100.0	\$532,183	100.0	\$354,331
By district forces.....	58,988	42.1	41,527	7.1	6,949
By contract.....	11,007	7.9	56,937	9.8	42,726
By landowners.....	21,016	15.0	392,219	67.4	147,000
No maintenance provided.....	2,020	1.4	43,500	7.5	2,656
Not reported.....	47,000	33.6	48,000	8.2	165,000

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, the drainage commissioners, or the governor of the state, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	140,031	100.0	140,031	100.0
1910 to 1914 <sup>1</sup> .....	18,473	13.2	18,473	13.2
1915 to 1919.....	121,558	86.8	121,558	86.8

<sup>1</sup> Includes one enterprise organized prior to 1910.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$532,183	100.0	\$354,331
1910 to 1914 <sup>1</sup> .....	411,656	70.7	82,822
1915 to 1919.....	170,527	29.3	271,509

<sup>1</sup> Includes one enterprise organized prior to 1910.

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TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.	350.4	100.0	262.5	100.0	42.0	100.0
1910 to 1914 <sup>1</sup> .....	191.0	54.5	75.0	28.6	30.0	71.4
1915 to 1919.....	159.4	45.5	187.5	71.4	12.0	28.6

<sup>1</sup> Includes one enterprise organized prior to 1910.

Crops.—The principal crops grown upon the drained land in drainage enterprises are cotton and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Abbeville.	Alendale.	Bamberg.	Beaufort.	Berkeley.	Calhoun.	Charleston.	Cherokee.	
1 Number of all farms in the state or county.....	192,693	4,469	1,764	2,543	3,168	2,691	2,901	3,850	3,286	
2 Farms reporting land having drainage.....	26,993	97	255	1,035	798	505	121	1,695	40	
3 Farms reporting land needing drainage.....	24,508	274	164	997	574	759	158	1,118	457	
4 Farms in drainage and levee districts.....	1,071	.....	81	58	176	3	82	15	2	
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the state or county..... acres..	19,516,800	326,400	278,400	240,000	449,280	792,320	250,240	568,320	238,720	
6 All land in farms..... acres..	12,426,675	260,265	151,187	160,929	152,350	237,572	166,172	212,539	193,005	
7 Improved land in farms..... acres..	6,184,159	145,126	97,354	105,645	69,212	67,311	98,873	85,267	99,681	
8 Woodland in farms..... acres..	5,302,575	68,257	52,535	53,531	69,468	162,845	54,182	106,662	78,676	
9 Other unimproved land in farms..... acres..	939,941	46,882	998	10,753	13,670	7,416	13,117	20,610	14,648	
10 Farm land reported as provided with drainage..... acres..	676,152	958	7,855	16,814	18,677	10,572	2,133	47,305	543	
11 Farm land reported as needing drainage..... acres..	1,341,903	6,282	8,043	26,291	44,412	50,859	10,725	79,643	12,576	
12 Drainage only..... acres..	1,255,548	3,302	1,438	7,746	5,588	9,397	1,326	18,361	7,799	
13 Drainage and clearing..... acres..	1,216,355	5,960	6,408	25,545	38,826	41,472	9,399	63,282	11,777	
	Chesterfield.	Clarendon.	Colleton.	Darlington.	Dillon.	Dorchester.	Fairfield.	Florence.	Georgetown.	
1 Number of all farms in the county.....	4,487	5,058	3,976	4,923	3,440	2,260	3,980	5,321	1,834	
2 Farms reporting land having drainage.....	775	760	1,193	1,975	960	828	63	2,465	619	
3 Farms reporting land needing drainage.....	1,355	702	1,252	701	945	499	12	1,210	567	
4 Farms in drainage and levee districts.....	6	2	5	54	2	.....	.....	.....	.....	
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the county..... acres..	535,690	450,560	720,640	387,200	301,440	392,320	451,840	447,360	529,920	
6 All land in farms..... acres..	319,892	235,509	401,190	277,343	177,671	205,798	342,522	300,966	227,632	
7 Improved land in farms..... acres..	148,264	145,045	141,057	167,567	103,414	71,072	167,525	146,810	38,429	
8 Woodland in farms..... acres..	164,758	85,242	231,938	94,831	68,669	125,120	138,016	147,861	150,465	
9 Other unimproved land in farms..... acres..	6,872	5,222	28,195	14,945	5,588	9,606	36,961	6,295	39,738	
10 Farm land reported as provided with drainage..... acres..	7,750	23,636	32,193	51,881	28,041	24,712	1,980	55,525	17,163	
11 Farm land reported as needing drainage..... acres..	72,663	40,066	130,119	17,707	21,900	37,617	352	47,633	85,831	
12 Drainage only..... acres..	5,369	2,125	16,661	2,453	2,024	7,440	70	4,703	6,036	
13 Drainage and clearing..... acres..	67,294	37,941	113,458	15,254	19,876	30,177	282	42,930	79,796	
	Greenville.	Hamp- ton.	Horry.	Jasper.	Ker-shaw.	Lan- caster.	Laurens.	Lee.	Lexing- ton.	
1 Number of all farms in the county.....	6,762	2,003	4,687	1,281	3,664	3,724	6,068	4,217	4,616	
2 Farms reporting land having drainage.....	57	648	3,034	365	30	72	242	349	813	
3 Farms reporting land needing drainage.....	169	596	2,574	222	411	194	352	155	855	
4 Farms in drainage and levee districts.....	.....	4	40	.....	10	.....	.....	248	6	
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the county..... acres..	487,040	323,320	741,120	381,440	430,720	329,600	441,600	260,480	498,560	
6 All land in farms..... acres..	368,288	175,484	443,509	174,573	263,488	255,399	359,895	196,779	375,680	
7 Improved land in farms..... acres..	186,518	83,029	108,771	39,500	125,963	115,631	201,635	126,458	155,141	
8 Woodland in farms..... acres..	137,849	77,316	319,463	117,665	124,784	106,653	107,470	67,224	208,138	
9 Other unimproved land in farms..... acres..	41,924	10,139	15,275	17,408	12,739	33,115	50,890	3,097	15,401	
10 Farm land reported as provided with drainage..... acres..	724	27,635	66,806	28,226	2,537	847	7,197	14,944	15,669	
11 Farm land reported as needing drainage..... acres..	2,144	39,355	162,107	74,952	31,579	3,193	8,368	5,402	53,067	
12 Drainage only..... acres..	843	1,525	6,043	391	2,235	666	674	333	788	
13 Drainage and clearing..... acres..	1,301	37,830	156,069	74,561	26,344	2,527	7,694	5,069	52,279	
	Marion.	Marl- boro.	Oconee.	Orange- burg.	Rich- land.	Saluda.	Spartan- burg.	Sumter.	Williams- burg.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	2,579	4,477	4,183	8,558	3,889	3,917	8,260	4,897	5,964	43,796
2 Farms reporting land having drainage.....	1,357	1,400	44	1,603	325	285	312	892	848	133
3 Farms reporting land needing drainage.....	655	775	318	937	478	455	698	501	845	1,584
4 Farms in drainage and levee districts.....	2	1	.....	23	234	.....	.....	7	4	7
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the county..... acres..	338,560	332,160	416,000	723,840	480,640	278,400	489,600	387,360	593,280	4,237,440
6 All land in farms..... acres..	190,492	214,328	267,890	496,306	277,192	245,631	408,181	265,759	340,488	3,104,773
7 Improved land in farms..... acres..	80,629	140,989	120,258	283,227	130,623	130,394	247,594	167,457	151,533	1,681,260
8 Woodland in farms..... acres..	72,881	70,141	129,886	187,248	131,524	106,200	130,812	86,194	180,082	1,087,741
9 Other unimproved land in farms..... acres..	6,982	3,198	17,796	20,831	15,045	9,037	29,775	12,108	8,873	335,772
10 Farm land reported as provided with drainage..... acres..	32,951	40,512	504	30,857	7,305	9,122	7,191	25,847	7,044	1,496
11 Farm land reported as needing drainage..... acres..	21,952	21,016	19,015	37,009	39,935	10,697	15,001	21,874	36,954	62,574
12 Drainage only..... acres..	1,323	1,489	563	9,468	2,682	447	1,880	3,004	4,713	3,940
13 Drainage and clearing..... acres..	30,629	19,527	11,462	17,541	37,268	10,250	13,121	18,870	32,241	68,634

<sup>1</sup> No drainage on farms reported in Chester County.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Beaufort.	Clarendon.	Orangeburg.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>						
1	Approximate land area of the state or county..... acres..	19,516,800	449,280	450,560	723,840	5,792,640
2	All land in operating drainage enterprises..... acres..	140,031	57,600	4,300	42,816	35,315
3	Improved land..... acres..	59,075	34,560	344	13,408	10,783
4	Per cent of all improved land in farms.....	1.0	49.9	0.2	4.7	0.9
5	Timber and cut-over land..... acres..	64,955	17,280	3,956	28,845	14,874
6	Other unimproved land..... acres..	16,001	5,760		563	9,678
7	Swampy or subject to overflow in enterprises..... acres..	18,206	5,760		8,704	3,742
8	Suffering a loss of crops from defective drainage..... acres..	3,093	2,304		704	85
9	Assessed acreage.....	140,031	57,600	4,300	42,816	35,315
10	Excess over all land in operating enterprises..... acres..					
<b>DRAINAGE WORKS.</b>						
Open ditches:						
11	Completed..... miles..	282.7	20.6	2.4	13.4	226.3
12	Additional under construction..... miles..	87.7	5.1	1.6	68.6	12.4
13	Maximum completed in any enterprise..... miles..	100.0	20.6	2.4	9.4	100.0
14	Maximum width at bottom of ditch <sup>2</sup> ..... feet..	28	2	18	20	28
15	Maximum of average depths of outlet ditches <sup>2</sup> ..... feet..	10.0	3.0	7.0	8.0	10.0
16	Mean depth of branch ditches <sup>2</sup> ..... feet..	5.2		5.0	6.0	4.5
Tile drains:						
17	Completed..... miles..	101.5				101.5
18	Additional under construction..... miles..	161.0				161.0
19	Maximum completed in any enterprise..... miles..	64.0				64.0
20	Maximum size of tile <sup>3</sup> ..... inches..	24				24
Accessory levees and dikes:						
21	Completed..... miles..	12.0				12.0
22	Additional under construction..... miles..	30.0				30.0
Pumping plants:						
23	Engine capacity..... horsepower..	155				155
24	Pump capacity..... gallons per minute..	44,600				44,600
25	Area served by pumps..... acres..	2,940				2,940
26	Area drained by open ditches only <sup>3</sup> ..... acres..	130,831	57,600	4,300	42,816	26,115
27	Length of these ditches..... miles..	235.4	25.7	4.0	32.0	123.7
28	Average length per acre..... feet..	9.5	2.4	4.9	10.1	25.0
29	Area having open ditches, tile drains, and levees <sup>3</sup> ..... acres..	9,200				9,200
30	Length of these drains..... miles..	377.5				377.5
31	Average length per acre..... feet..	216.7				216.7
32	Length of the accessory levees..... miles..	42.0				42.0
<b>DEVELOPMENT OF LAND.</b>						
33	Improved land in operating enterprises, 1920..... acres..	59,075	34,560	344	13,408	10,783
34	Improved land prior to drainage..... acres..	51,349	34,560		12,845	3,944
35	Increase since drainage..... acres..	7,726		344	563	6,810
36	Per cent of increase.....	15.0			4.4	172.9
37	Per cent increase is of all improved land in farms, 1920.....	0.1		0.2	0.2	0.5
38	Timber and cut-over land, 1920..... acres..	64,955	17,280	3,956	28,845	14,874
39	Timber and cut-over land prior to drainage..... acres..	68,691	17,280	4,300	29,126	17,985
40	Decrease since drainage..... acres..	3,736		344	281	3,111
41	Per cent of decrease.....	5.4		8.0	1.0	17.8
42	Other unimproved land, 1920..... acres..	16,001	5,760		563	9,678
43	Other unimproved land prior to drainage..... acres..	19,991	5,760		845	13,386
44	Decrease since drainage..... acres..	3,990			282	3,708
45	Per cent of decrease.....	20.0			33.4	27.7
46	Swampy or subject to overflow, 1920..... acres..	18,206	5,760		8,704	3,742
47	Swampy or subject to overflow prior to drainage..... acres..	91,354	57,600	3,870	9,971	19,613
48	Decrease since drainage..... acres..	73,148	51,840	3,870	1,267	16,171
49	Per cent of decrease.....	80.1	90.0	100.0	12.7	81.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>						
50	Total capital invested in and required for completion of operating enterprises..... dollars..	936,514	15,476	12,000	179,219	729,819
51	Capital invested in these enterprises to Dec. 31, 1919..... dollars..	582,183	10,376	4,000	24,219	543,538
52	Additional capital required to complete these enterprises..... dollars..	354,331	5,100	8,000	155,000	186,231
53	Average cost per acre when completed..... dollars..	6.69	0.27	2.79	4.19	20.67
54	Enterprises constructing open ditches only..... dollars..	526,514	15,476	12,000	179,219	319,819
55	Average cost per acre when completed..... dollars..	4.02	0.27	2.79	4.19	12.25
56	Enterprises constructing open ditches, tile drains, and levees..... dollars..	410,000				410,000
57	Average cost per acre when completed..... dollars..	44.57				44.57
<b>CROPS.</b>						
Improved land in enterprises reporting—						
58	Cotton as principal crop on drained land..... acres..	51,308	34,560		13,408	3,340
59	Corn as principal crop on drained land..... acres..	3,035		344		2,691
60	Vegetables as principal crop on drained land <sup>3</sup> ..... acres..	2,352				2,352
61	Other crops as principal ones on drained land..... acres..	2,380				2,380

<sup>1</sup> Includes only Anderson, Berkeley, Charleston, Colleton, Dorchester, Hampton, Horry, Oconee, Pickens, Williamsburg, and York Counties.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Includes 1,120 acres of potatoes.

## SOUTH DAKOTA.

The following tables present the statistics of drainage for South Dakota collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	74, 637	100. 0
Farms reporting land having drainage.....	4, 077	5. 5
Farms reporting land needing drainage.....	11, 828	15. 8
All land in farms..... acres..	34, 636, 491	100. 0
Improved land in farms..... acres..	18, 199, 250	52. 5
Farm land reported as provided with drainage..... acres..	161, 371	0. 5
Farm land reported as needing drainage..... acres..	446, 915	1. 3
Needing drainage only..... acres..	356, 049	1. 0
Needing drainage and clearing..... acres..	90, 866	0. 3
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	49, 195, 520	100. 0
All land in operating drainage enterprises..... acres..	222, 062	0. 5
Improved land..... acres..	178, 540	0. 4
Per cent of all improved land in farms.....	1. 0	-----
Unimproved land <sup>1</sup> ..... acres..	43, 522	0. 1
Swampy, subject to overflow, seeped, or alkali..... acres..	6, 067	(2)
Suffering a loss of crops from defective drainage..... acres..	481	(2)
Improved land prior to drainage..... acres..	98, 724	0. 2
Increase since drainage began..... acres..	79, 816	0. 2
Land in nonoperating enterprises..... acres..	-----	-----
Open ditches in operating enterprises..... miles..	245. 9	100. 0
Completed..... miles..	237. 8	96. 7
Additional under construction..... miles..	8. 1	3. 3
Tile drains in operating enterprises..... miles..	212. 9	100. 0
Completed..... miles..	179. 3	84. 2
Additional under construction..... miles..	33. 6	15. 8
Total capital invested in and required for completion of operating enterprises....	\$1, 732, 729	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	1, 461, 063	84. 3
Additional capital required to complete these enterprises.....	271, 666	15. 7
Average cost per acre when completed.....	7. 80	-----

<sup>1</sup> Only 4 acres of timber or cut-over land reported.

<sup>2</sup> Less than one-tenth of 1 per cent.





Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in South Dakota. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>2</sup> .....	222,062	100.0	\$1,461,063	100.0	\$271,666
With works completed.....	124,132	55.9	942,757	64.5	.....
With works under construction.....	97,930	44.1	518,306	35.5	271,666

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."  
<sup>2</sup> No nonoperating enterprises in South Dakota.

Location of enterprises.—All the enterprises in South Dakota are situated east of Missouri River, and most of them are in the southeastern part of the state. Nearly all the land in the enterprises is drained through tributaries of the Missouri.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	222,062	100.0	\$1,461,063	100.0	\$271,666
Big Sioux River.....	59,078	26.6	656,961	45.0	192,790
Missouri River.....	163,489	73.2	800,799	54.8	78,906
Minnesota River.....	495	0.2	3,393	0.2	.....

<sup>1</sup> No nonoperating enterprises in South Dakota.

Condition of land in enterprises.—The drainage enterprises in this state generally are reported to have been organized for the improvement of agricultural land that was wet, swampy, or subject to overflow, though a major part of the acreage included in the enterprises was unimproved before drainage was provided. Only 640 acres were reported as timbered or cut-over before drainage, and only 4 acres as timbered on January 1, 1920.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and

to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains lands still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES. <sup>1</sup>			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	222,062	100.0	124,132	97,930
Improved land.....	178,540	80.4	110,374	68,166
Unimproved land <sup>2</sup> .....	43,522	19.6	13,758	29,764
Swampy or subject to overflow.....	6,067	2.7	3,801	2,266
Suffering a loss of crops.....	481	0.2	481	.....

<sup>1</sup> No nonoperating enterprises in South Dakota.  
<sup>2</sup> Only 4 acres of timber or cut-over land reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 90 drainage enterprises are counted in South Dakota, with an average area of 2,602 acres assessed. The assessed acreage exceeds the land in enterprises by 12,139 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	222,062	234,901	100.0
Less than 200 acres.....	519	519	0.2
200 to 499 acres.....	10,027	10,027	4.3
500 to 999 acres.....	13,495	13,495	5.8
1,000 to 4,999 acres.....	66,007	68,146	29.1
5,000 to 9,999 acres.....	17,788	17,788	7.6
10,000 to 49,999 acres.....	124,226	124,226	53.0

Character of enterprises.—All the drainage enterprises in this state are county drains organized under the drainage law of March 7, 1905 (ch. 98), or that of February 21, 1907 (ch. 134). The later act did not specifically repeal the earlier one, but the principal provisions of the two are nearly identical. The state constitution declares that the drainage of agricultural land is a public purpose (art. 21, sec. 6, adopted 1906).

The county drains are established by the board of county commissioners upon petition from one or more owners of land that will be affected, if the proposed drainage will be of public benefit or necessary for draining agricultural land. The county commissioners inspect the route of the proposed improvement, and may have a survey made and determine the location of the drain. Public hearing upon the petition is held by the commissioners, who then dismiss the petition or establish the drain and fix the damages to be paid for any injury to land or property that will be caused by the work. The cost of the drainage is paid by the land, railroads, towns, and townships in proportion to the benefits to be received as determined by the county commissioners. Appeals from the determination of the commissioners may be taken to the circuit court of the county. Construction of the drain is secured by the commissioners, who may issue bonds payable in not more than 20 years from the special assessments against the property benefited. An act of February 26, 1909 (ch. 102), requires that the county commissioners make their examination of the route of a proposed drain in company with the state engineer, who shall have supervision of the survey and of the design and construction of the works.

Drains in two or more counties are under the jurisdiction of the board of commissioners of the county containing the greatest part of drainage area, if not more than one county contains as much as 3,000 acres of that area, according to an act of March 10, 1917 (ch. 208). When two or more counties each embrace more than 3,000 acres of land to be affected by the same drain, the boards of commissioners of all those counties have joint jurisdiction. Before 1917, for drains in more than one county the petition must have been signed by owners of land in each county affected, and the boards of commissioners of those counties acted jointly.

Drains to be established by mutual agreement are authorized by the laws of both 1905 and 1907. The owners of the land to be drained may file with the county auditor a written agreement, duly acknowledged, stating the location for the drain and the apportionment of damages and benefits. The county commissioners then will have the drain constructed in accordance with the agreement if they deem the enterprise will be of advantage to the landowners.

The formation of drainage districts in South Dakota to secure cooperation with similar districts in neighboring states, when such cooperation is desired in obtaining drainage and protection against floods, is authorized by a statute of February 24, 1917 (ch. 209). The districts are to be established by the circuit court of the county, upon petition from 50 or more residents and freeholders in the territory to be embraced in the district, or from the county

commissioners. A board of three members to govern the district is appointed by the commissioners. Provision is made for a district situated in two or more counties. No enterprises were reported as organized under this law.

Laws authorizing the establishment of public drains by the boards of county commissioners and by the boards of township supervisors, upon petition from one or more landowners, were enacted by the legislature of Dakota territory in 1883. Viewers were appointed to assess damages and benefits, the cost being apportioned according to the benefits. The South Dakota statute of March 10, 1897 (ch. 76), enacted a new law similar in its main provisions to the territorial drainage laws, which were repealed. No enterprises were reported under any of these statutes.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	222,062	100.0	\$1,461,063	100.0	\$271,666
County drains.....	222,062	100.0	1,461,063	100.0	271,666
Laws of 1905, ch. 98.....	56,798	25.6	265,113	18.1	.....
Laws of 1907, ch. 134.....	165,266	74.4	1,195,950	81.9	271,666

<sup>1</sup> No nonoperating enterprises in South Dakota.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 237.8 miles of open ditches, 179.3 miles of tile drains, and 2.4 miles of accessory levees; the additional lengths under construction were 8.1 miles of open ditches and 33.6 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts for land drainage in South Dakota.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	222,062	100.0	\$1,461,063	100.0	\$271,666
Open ditches only.....	145,834	65.7	822,864	56.3	68,906
Open ditches and levees.....	4,120	1.9	9,447	0.6	.....
Tile drains only.....	30,764	13.9	312,803	21.4	47,460
Open ditches and tile drains.....	40,664	18.3	313,239	21.4	155,300
Open ditches, tile drains, and levees.....	680	0.3	2,710	0.2	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	LAND.	
	Acreage.	Per cent of total.
All operating enterprises.....	222,062	100.0
3.0 to 3.9 feet.....	23,035	10.4
4.0 to 4.9 feet.....	18,995	8.6
5.0 to 5.9 feet.....	47,520	21.4
6.0 to 6.9 feet.....	1,500	0.7
7.0 to 7.9 feet.....	131,012	59.0
Not reporting branches.....		

Maintenance of works.—The drainage laws of 1905 and 1907 provide that assessments for maintenance of the drainage works may be made by the county commissioners upon petition from an interested landowner, to be apportioned in the same manner as the assessments for construction. The later statute provides also that all drains constructed under any law of the state, except as otherwise may be provided, shall be under control of the county commissioners who must keep the drains in good repair. Each part of a drain situated in more than one county is under the charge of the commissioners of the county in which the part is located. The works of drainage districts under the statute of 1917 are to be maintained by joint agreement in the same manner as prescribed for construction, but in the absence of such agreement are to be maintained like county drains under the law of 1907.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	222,062	100.0	\$1,461,063	100.0	\$271,666
By district forces.....	56,159	25.3	589,324	40.4	192,790
By contract.....	5,663	2.6	60,685	4.2	.....
No maintenance provided.....	160,240	72.2	810,554	55.5	78,906

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the drains were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	222,062	100.0	224,201	100.0
1905 to 1909.....	59,446	26.8	59,446	25.4
1910 to 1914.....	40,365	18.2	52,504	22.4
1915 to 1919.....	122,251	55.1	122,251	52.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,461,063	100.0	\$271,666
1905 to 1909.....	230,376	15.8	.....
1910 to 1914.....	454,928	31.1	35,000
1915 to 1919.....	775,259	53.1	236,666

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1905 to 1909.....	79.4	32.3	16.0	7.5	1.8	75.0
1910 to 1914.....	103.4	42.0	29.8	14.0	0.6	25.0
1915 to 1919.....	63.1	25.7	167.1	78.5	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and wheat. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—SOUTH DAKOTA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		The State.	Beadle.	Bon Homme.	Brookings.	Butte.	Clark.	Clay.	Davison.
1	Number of all farms in the state or county.....	74,637	1,716	1,394	1,891	1,005	1,519	1,237	961
2	Farms reporting land having drainage.....	4,077	12	84	114	16	31	187	98
3	Farms reporting land needing drainage.....	11,828	330	305	415	78	435	106	279
4	Farms in drainage and levee districts.....	1,028	3	5	14	12	3	20	8
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county.....acres..	49,195,520	800,000	866,720	506,240	1,454,960	623,360	257,920	276,480
6	All land in farms.....acres..	34,636,491	705,066	353,250	472,237	722,033	521,769	236,428	261,137
7	Improved land in farms.....acres..	18,199,250	629,398	271,598	415,125	68,367	453,557	219,839	212,470
8	Woodland in farms.....acres..	536,183	3,831	7,059	6,041	32,737	3,339	5,881	3,282
9	Other unimproved land in farms.....acres..	15,901,058	171,837	74,563	51,071	600,926	64,873	10,708	45,385
10	Farm land reported as provided with drainage.....acres..	161,371	577	2,980	3,296	526	560	14,160	4,771
11	Farm land reported as needing drainage.....acres..	446,915	15,595	5,187	13,859	1,712	16,970	7,412	10,629
12	Drainage only.....acres..	356,049	15,376	4,794	12,404	1,664	15,762	7,412	9,403
13	Drainage and clearing.....acres..	90,866	220	393	1,455	48	1,218	.....	1,226

		Day.	Deuel.	Douglas.	Grant.	Hamlin.	Hanson.	Hutchinson.	Jones.	Kingsbury.
1	Number of all farms in the county.....	1,995	1,160	912	1,347	1,054	879	1,553	484	1,597
2	Farms reporting land having drainage.....	205	184	42	151	54	175	182	1	205
3	Farms reporting land needing drainage.....	759	417	239	276	162	411	374	2	490
4	Farms in drainage and levee districts.....	18	26	30	36	26	101	22	.....	44
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	679,040	404,480	278,400	442,240	332,800	276,480	522,880	628,480	520,960
6	All land in farms.....acres..	632,055	343,731	254,178	384,687	303,724	254,745	501,336	499,456	457,685
7	Improved land in farms.....acres..	506,462	284,402	182,129	302,064	270,836	206,080	402,399	177,884	450,258
8	Woodland in farms.....acres..	9,819	3,245	4,000	5,303	1,927	2,591	5,496	13,832	7,089
9	Other unimproved land in farms.....acres..	115,774	56,084	68,049	77,320	30,961	46,074	93,451	307,740	30,338
10	Farm land reported as provided with drainage.....acres..	3,577	7,801	1,198	4,505	3,887	7,326	8,252	1,750	5,910
11	Farm land reported as needing drainage.....acres..	24,790	12,280	5,523	5,616	4,783	15,973	8,628	140	11,127
12	Drainage only.....acres..	23,636	12,050	5,404	5,121	4,705	15,432	8,306	.....	10,779
13	Drainage and clearing.....acres..	1,154	230	119	495	78	541	320	140	348

		Lake.	Lincoln.	McCook.	Marshall.	Meade.	Miner.	Minnehaha.	Moody.	Roberts.
1	Number of all farms in the county.....	1,285	1,755	1,253	1,266	1,722	1,153	2,294	1,245	2,194
2	Farms reporting land having drainage.....	314	188	167	96	3	51	287	145	117
3	Farms reporting land needing drainage.....	644	280	462	368	52	390	555	331	604
4	Farms in drainage and levee districts.....	103	114	15	54	6	2	79	17	30
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	359,690	367,360	366,720	568,960	2,234,240	263,520	521,600	337,280	711,040
6	All land in farms.....acres..	332,597	355,027	321,796	495,059	1,380,497	337,128	488,764	306,781	617,408
7	Improved land in farms.....acres..	291,323	329,760	277,539	415,035	202,562	267,596	431,239	257,003	508,795
8	Woodland in farms.....acres..	3,545	5,816	2,951	20,890	20,547	2,994	9,282	7,727	5,370
9	Other unimproved land in farms.....acres..	87,729	19,451	41,306	59,144	1,157,888	66,538	48,263	42,031	103,243
10	Farm land reported as provided with drainage.....acres..	8,500	8,559	2,868	6,738	580	1,926	7,599	6,186	4,544
11	Farm land reported as needing drainage.....acres..	18,200	10,306	11,362	20,874	5,771	8,992	14,914	11,441	19,562
12	Drainage only.....acres..	17,437	9,800	10,212	8,764	130	8,843	13,001	10,609	16,764
13	Drainage and clearing.....acres..	763	506	1,150	12,110	5,641	149	1,913	832	2,798

		Sanborn.	Spink.	Tripp.	Turner.	Union.	Walworth.	Yankton.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,021	1,874	1,856	1,862	1,421	653	1,520	29,536
2	Farms reporting land having drainage.....	92	25	7	482	79	1	213	89
3	Farms reporting land needing drainage.....	633	78	38	661	280	123	191	1,130
4	Farms in drainage and levee districts.....	20	19	.....	184	5	.....	8	4
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	368,640	967,040	1,042,560	364,880	239,280	474,880	334,720	31,111,660
6	All land in farms.....acres..	327,638	864,006	776,607	382,292	249,833	371,791	314,306	19,781,414
7	Improved land in farms.....acres..	233,905	794,096	388,280	334,230	229,573	222,118	235,707	7,807,643
8	Woodland in farms.....acres..	2,282	7,211	6,385	4,748	7,447	6,710	8,164	298,682
9	Other unimproved land in farms.....acres..	91,451	62,700	381,962	43,314	12,864	142,963	70,435	11,675,089
10	Farm land reported as provided with drainage.....acres..	5,627	2,681	690	20,094	2,640	540	6,959	3,104
11	Farm land reported as needing drainage.....acres..	40,209	2,329	2,194	16,300	10,981	14,353	7,405	71,500
12	Drainage only.....acres..	35,350	2,066	2,194	15,143	6,462	958	5,008	41,071
13	Drainage and clearing.....acres..	4,859	263	.....	1,157	4,519	13,395	2,397	30,429

<sup>1</sup> No drainage on farms reported in Armstrong, Brown, Buffalo, Campbell, Corson, Edmunds, Gregory, Haakon, Harding, Hughes, Hyde, Jackson, Lyman, McPherson, Mellette, Perkins, Shannon, Stanley, Sully, Todd, Washabaugh, and Ziebach Counties.

# DRAINAGE—SOUTH DAKOTA.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Brookings.	Clay.	DeVilson.	Douglas.	Hanson.	Kings-bury.	Lake.
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....	acres.. 49,195,620	506,240	257,920	276,480	278,400	276,480	320,000	359,080
2	All land in operating drainage enterprises.....	acres.. 222,082	1,200	39,829	6,133	7,120	3,640	1,930	28,240
3	Improved land.....	acres.. 173,540	1,080	38,829	5,463	4,984	3,071	1,778	22,451
4	Per cent of all improved land in farms.....	..... 1.0	0.3	17.7	2.6	2.7	1.5	0.4	7.7
5	Unimproved land.....	acres.. 48,542	120	1,000	675	2,136	569	152	5,789
6	Swampy or subject to overflow, in enterprises.....	acres.. 6,067	120	136	125	35	32	45	1,666
7	Suffering a loss of crops from defective drainage.....	acres.. 491			40	25	42		
8	Assessed acreage.....	acres.. 234,201	1,200	51,968	6,138	7,120	3,640	1,930	28,240
9	Excess over all land in operating enterprises.....	acres.. 12,139		12,139					
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
10	Completed.....	miles.. 237.8	4.3	37.0	22.8	11.5	0.8	32.1	9.5
11	Additional under construction.....	miles.. 8.1							
12	Maximum completed in any enterprise.....	miles.. 28.6	4.3	10.5	10.7	6.5	0.8	28.6	5.5
13	Maximum width at bottom of ditch.....	feet.. 100	2	75	6	5	2	10	10
14	Maximum of average depths of outlet ditches.....	feet.. 10.5	6.6	10.5	6.0	5.0	1.8	9.0	8.5
15	Mean depth of branch ditches.....	feet.. 4.8				3.0		6.1	4.0
<b>Tile drains:</b>									
16	Completed.....	miles.. 179.3			19.0	0.2	7.6	3.0	82.8
17	Additional under construction.....	miles.. 33.6							20.7
18	Maximum completed in any enterprise.....	miles.. 25.9			12.1	0.2	5.5	3.0	26.9
19	Maximum size of tile.....	inches.. 36			23	20	24	24	36
<b>Accessory levees and dikes:</b>									
20	Completed.....	miles.. 2.4							
21	Additional under construction.....	miles..							
22	Area drained by open ditches only.....	acres.. * 149,954	1,200	39,829	3,223	3,520		430	
23	Length of these ditches.....	miles.. 177.2	4.3	37.0	17.2	6.5		3.5	
24	Average length per acre.....	feet.. 6.2	18.9	4.9	23.2	9.8		48.0	
25	Area drained by tile only.....	acres.. 30,764			2,155		1,340		9,030
26	Length of these tile.....	miles.. 116.0			6.9		2.1		47.1
27	Average length per acre.....	feet.. 19.9			16.9		8.3		27.5
28	Area drained by open ditches and tile.....	acres.. † 41,344			760	3,600	2,300	1,500	19,210
29	Length of these drains.....	miles.. 165.0			17.7	5.2	6.3	31.6	65.9
30	Average length per acre.....	feet.. 31.1			123.0	7.6	14.5	111.2	18.1
<b>DEVELOPMENT OF LAND.</b>									
31	Improved land in operating enterprises, 1920.....	acres.. 178,540	1,080	38,829	5,463	4,984	3,071	1,778	22,451
32	Improved land prior to drainage.....	acres.. 99,724		3,304		8,912	1,616	825	19,094
33	Increase since drainage.....	acres.. 79,816	1,080	35,525	5,463	1,072	1,455	953	2,757
34	Per cent of increase.....	..... 80.8				27.4	90.0	115.5	14.0
35	Per cent increase is of all improved land in farms, 1920.....	..... 0.4	0.3	16.2	2.6	0.6	0.7	0.2	0.9
36	Unimproved land, 1920.....	acres.. 43,522	120	1,000	675	2,136	569	152	5,789
37	Unimproved land prior to drainage.....	acres.. † 123,338	1,200	36,525	6,138	3,208	2,024	1,105	8,546
38	Decrease since drainage.....	acres.. 79,816	1,080	35,525	5,463	1,072	1,455	953	2,757
39	Per cent of decrease.....	..... 64.7	90.0	97.3	89.0	33.4	71.9	86.2	32.3
40	Swampy or subject to overflow, 1920.....	acres.. 6,067	120	136	125	35	32	45	1,666
41	Swampy or subject to overflow prior to drainage.....	acres.. 141,491	600	34,194	6,138	1,248	952	1,190	21,890
42	Decrease since drainage.....	acres.. 135,424	480	34,058	6,013	1,213	920	1,145	19,724
43	Per cent of decrease.....	..... 95.7	80.0	99.6	98.0	97.2	96.6	96.2	92.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
44	Total capital invested in and required for completion of operating enterprises.....	dollars.. 1,782,729	1,776	333,136	64,420	24,000	27,000	67,058	363,832
45	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 1,481,063	1,776	333,136	64,420	24,000	27,000	67,058	246,072
46	Additional capital required to complete these enterprises.....	dollars.. 271,666							117,760
47	Average cost per acre when completed.....	dollars.. 7.80	1.48	8.36	10.82	3.87	7.42	84.75	12.88
48	Enterprises constructing open ditches only.....	dollars.. * 901,317	1,776	333,136	35,913	19,000		3,550	
49	Average cost per acre when completed.....	dollars.. 6.01	1.48	8.36	11.14	3.69		8.26	
50	Enterprises constructing tile drains only.....	dollars.. 380,263			19,230		7,090		130,345
51	Average cost per acre when completed.....	dollars.. 11.71			8.92		6.22		14.43
52	Enterprises constructing open ditches and tile drains.....	dollars.. † 471,249			11,377	11,000	20,000	63,608	233,487
53	Average cost per acre when completed.....	dollars.. 11.40			14.84	3.06	8.70	42.34	12.15
<b>CROPS.</b>									
<b>Improved land in enterprises reporting—</b>									
54	Corn as principal crop on drained land.....	acres.. 143,804	1,080	38,829	5,463	4,984	3,039		22,451
55	Wheat as principal crop on drained land.....	acres.. 27,925							
56	Barley as principal crop on drained land.....	acres.. 1,310					32	1,778	

\* Only 4 acres of timber or cut-over land reported for 1920, and 640 acres prior to drainage.  
 † When works under construction have been completed.  
 ‡ Includes one enterprise constructing also 1.8 miles of levee.  
 § Includes one enterprise constructing also 0.6 mile of levee.  
 ¶ Per cent not shown when more than 1,000.  
 †† Includes cost of 1.8 miles of levee.  
 ††† Includes cost of 0.6 miles of levee.

## DRAINAGE—SOUTH DAKOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Marshall.	Minne- haha.	Moody.	Sanborn.	Spink.	Turner.	Yankton.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>									
1	Approximate land area of the county.....acres..	568,960	521,600	337,280	368,640	967,040	394,880	334,720	1,587,200
2	All land in operating drainage enterprises.....acres..	47,520	21,444	6,000	9,700	3,197	32,270	12,085	1,749
3	Improved land.....acres..	23,760	20,083	5,400	9,700	3,101	25,347	12,085	1,408
4	Per cent of all improved land in farms.....	5.7	4.7	2.1	4.1	0.4	7.6	5.1	0.1
5	Unimproved land.....acres..	23,760	1,361	600	.....	96	6,923	.....	341
6	Swampy or subject to overflow, in enterprises.....acres..	.....	81	600	.....	.....	2,729	.....	498
7	Suffering a loss of crops from defective drainage.....acres..	.....	.....	.....	.....	.....	53	.....	321
8	Assessed acreage.....	47,520	21,444	6,000	9,700	3,197	32,270	12,085	1,749
9	Excess over all land in operating enterprises.....acres..	.....	.....	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>									
Open ditches:									
10	Completed.....miles..	15.8	14.6	4.0	.....	10.5	60.5	6.7	7.7
11	Additional under construction.....miles..	6.7	1.4	.....	.....	.....	.....	.....	.....
12	Maximum completed in any enterprise.....miles..	15.8	14.6	4.0	.....	10.5	8.3	3.5	3.4
13	Maximum width at bottom of ditch <sup>2</sup> .....feet..	24	100	10	.....	15	18	30	12
14	Maximum of average depths of outlet ditches <sup>3</sup> .....feet..	6.5	9.0	8.5	.....	6.0	7.0	10.5	5.0
15	Mean depth of branch ditches <sup>4</sup> .....feet..	6.0	.....	4.0	.....	.....	3.0	3.0	4.0
Tile drains:									
16	Completed.....miles..	.....	14.9	8.6	11.3	.....	26.2	.....	5.7
17	Additional under construction.....miles..	.....	.....	3.2	9.7	.....	.....	.....	.....
18	Maximum completed in any enterprise.....miles..	.....	4.3	8.6	7.0	.....	3.8	.....	2.9
19	Maximum size of tile <sup>5</sup> .....inches..	.....	26	30	22	.....	24	.....	24
Accessory levees and dikes:									
20	Completed.....miles..	.....	.....	.....	.....	.....	2.4	.....	.....
21	Additional under construction.....miles..	.....	.....	.....	.....	.....	.....	.....	.....
22	Area drained by open ditches only <sup>6</sup> .....acres..	47,520	20,000	.....	9,700	3,197	* 18,950	12,085	.....
23	Length of these ditches.....miles..	22.5	16.0	.....	.....	10.5	53.0	6.7	.....
24	Average length per acre.....feet..	2.5	4.2	.....	.....	17.3	14.8	2.9	.....
25	Area drained by tile only <sup>7</sup> .....acres..	.....	1,444	.....	9,700	.....	6,600	.....	495
26	Length of these tile.....miles..	.....	14.9	.....	21.0	.....	20.0	.....	4.0
27	Average length per acre.....feet..	.....	54.5	.....	11.4	.....	16.0	.....	42.7
28	Area drained by open ditches and tile <sup>8</sup> .....acres..	.....	.....	6,000	.....	.....	* 6,720	.....	1,254
29	Length of these drains.....miles..	.....	.....	15.8	.....	.....	13.7	.....	9.4
30	Average length per acre.....feet..	.....	.....	13.9	.....	.....	10.8	.....	39.6
<b>DEVELOPMENT OF LAND.</b>									
31	Improved land in operating enterprises, 1920.....acres..	23,760	20,083	5,400	9,700	3,101	25,347	12,085	1,408
32	Improved land prior to drainage.....acres..	23,760	18,566	4,500	4,484	.....	17,710	.....	353
33	Increase since drainage.....acres..	.....	1,517	900	5,216	3,101	7,637	12,085	1,055
34	Per cent of increase <sup>9</sup> .....	.....	8.2	20.0	116.3	.....	43.1	.....	298.9
35	Per cent increase is of all improved land in farms, 1920.....	.....	0.4	0.4	2.2	0.4	2.3	5.1	0.1
36	Unimproved land, 1920.....acres..	23,760	1,361	600	.....	96	6,923	.....	341
37	Unimproved land prior to drainage.....acres..	23,760	2,878	1,500	5,216	3,197	14,560	12,085	1,396
38	Decrease since drainage.....acres..	.....	1,517	900	5,216	3,101	7,637	12,085	1,055
39	Per cent of decrease.....	.....	52.7	60.0	100.0	97.0	52.5	100.0	75.6
40	Swampy or subject to overflow, 1920.....acres..	.....	81	600	.....	.....	2,729	.....	498
41	Swampy or subject to overflow prior to drainage.....acres..	14,256	18,688	5,100	1,690	3,197	19,839	11,973	1,136
42	Decrease since drainage.....acres..	14,256	18,607	4,500	1,690	3,197	17,110	11,973	638
43	Per cent of decrease.....	100.0	99.5	88.2	100.0	100.0	86.2	100.0	56.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
44	Total capital invested in and required for completion of operating enterprises.....dollars..	96,908	326,436	86,581	85,000	13,028	162,774	57,000	21,782
45	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	53,000	301,436	86,581	50,000	13,028	162,774	57,000	21,782
46	Additional capital required to complete these enterprises.....dollars..	43,908	25,000	50,000	35,000	.....	.....	.....	.....
47	Average cost per acre when completed.....dollars..	2.04	15.22	14.43	8.76	4.08	5.04	4.72	12.45
48	Enterprises constructing open ditches only.....dollars..	96,908	280,000	.....	.....	13,028	* 66,908	57,000	.....
49	Average cost per acre when completed.....dollars..	2.04	14.00	.....	.....	4.08	3.53	4.72	.....
50	Enterprises constructing tile drains only.....dollars..	.....	46,436	.....	85,000	.....	63,831	.....	8,421
51	Average cost per acre when completed.....dollars..	.....	32.16	.....	8.76	.....	9.67	.....	17.01
52	Enterprises constructing open ditches and tile drains.....dollars..	.....	.....	86,581	.....	.....	† 32,035	.....	13,361
53	Average cost per acre when completed.....dollars..	.....	.....	14.43	.....	.....	4.77	.....	10.65
<b>CROPS.</b>									
54	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres..	.....	20,083	5,400	9,700	.....	25,347	12,085	343
55	Wheat as principal crop on drained land.....acres..	23,760	.....	.....	.....	3,101	.....	.....	1,065
56	Barley as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....

- <sup>1</sup> Includes only Codrington, Grant, Hamlin, and Miner Counties.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Includes one enterprise constructing also 1.8 miles of levee.  
<sup>4</sup> Includes one enterprise constructing also 0.6 mile of levee.  
<sup>5</sup> Per cent not shown when more than 1,000.  
<sup>6</sup> Includes cost of 1.8 miles of levee.  
<sup>7</sup> Includes cost of 0.6 mile of levee.

## TENNESSEE.

The following pages present the statistics of drainage for Tennessee collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

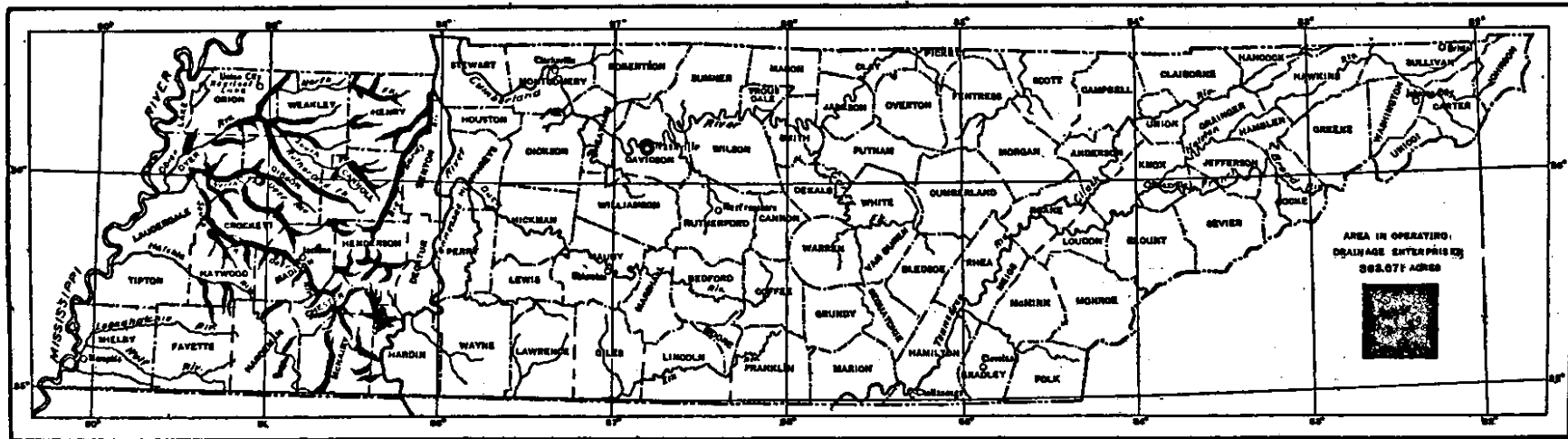
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state .....	252, 774	100. 0
Farms reporting land having drainage.....	8, 887	3. 5
Farms reporting land needing drainage.....	20, 997	8. 3
All land in farms.....acres..	19, 510, 856	100. 0
Improved land in farms.....acres..	11, 185, 302	57. 3
Farm land reported as provided with drainage.....acres..	254, 118	1. 3
Farm land reported as needing drainage.....acres..	640, 479	3. 3
Needing drainage only.....acres..	76, 644	0. 4
Needing drainage and clearing.....acres..	563, 835	2. 9
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state.....acres..	26, 679, 680	100. 0
All land in operating drainage enterprises.....acres..	363, 671	1. 4
Improved land.....acres..	163, 213	0. 6
Per cent of all improved land in farms.....	1. 5	.....
Timber and cut-over land.....acres..	189, 945	0. 7
Other unimproved land.....acres..	10, 503	(1)
Swampy, subject to overflow, seeped, or alkali.....acres..	104, 063	0. 4
Suffering a loss of crops from defective drainage.....acres..	29, 879	0. 1
Improved land prior to drainage.....acres..	86, 028	0. 3
Increase since drainage began.....acres..	77, 190	0. 3
Land in nonoperating enterprises.....acres..	82, 284	0. 3
Open ditches in operating enterprises.....miles..	912. 7	100. 0
Completed.....miles..	777. 3	85. 2
Additional under construction.....miles..	135. 4	14. 8
Tile drains in operating enterprises.....miles..	0. 4	100. 0
Completed.....miles..	0. 3	75. 0
Additional under construction.....miles..	0. 1	25. 0
Total capital invested in and required for completion of operating enterprises..	\$3, 447, 991	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	2, 925, 944	84. 9
Additional capital required to complete these enterprises.....	522, 047	15. 1
Average cost per acre when completed.....	9. 48	.....

1 Less than one-tenth of 1 per cent.

# TENNESSEE

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.





**Operating and nonoperating enterprises.**—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	445,955	100.0	\$2,995,515	100.0	\$1,447,230
Operating enterprises.....	363,671	81.5	2,925,944	97.7	522,047
With works completed.....	268,667	60.2	2,283,589	76.2	.....
With works under construction.....	95,004	21.3	642,355	21.4	522,047
Nonoperating enterprises.....	82,284	18.5	69,571	2.3	925,183

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to December 31, 1919," and for an "estimate of additional investment to complete."

**Location of enterprises.**—The drainage enterprises in the state lie almost entirely west of Tennessee River. Most of them are drained through the smaller tributaries of the Mississippi—namely, Obion River, Forked Deer River, and Hatchee River; some are drained through Big Sandy River, Beech River, and a few of the creeks entering the Tennessee; two small enterprises are drained into the Cumberland.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	445,955	100.0	\$2,995,515	100.0	\$1,447,230
Operating enterprises.....	363,671	81.5	2,925,944	97.7	522,047
Mississippi River.....	275,899	61.8	2,443,362	81.5	219,047
Tennessee and Cumberland Rivers.....	87,772	19.7	482,582	16.1	303,000
Nonoperating enterprises.....	82,284	18.5	69,571	2.3	925,183
Mississippi River.....	81,880	18.4	69,571	2.3	919,183
Tennessee and Cumberland Rivers.....	404	0.1	.....	.....	6,000

**Condition of land in enterprises.**—The enterprises generally are narrow strips bordering the streams, which in their natural condition are crooked and considerably obstructed. The resultant overflows cause damage to planted crops or keep the areas so wet that cultivation is not attempted until artificial drainage improvements have been provided. In the lower-lying counties near the Mississippi River, flood elevations in that stream cause backwater to overflow land along its tributaries. The soils are mostly alluvial, and when drained are naturally of greater fertility than those on the higher land.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	363,671	100.0	268,667	95,004	82,284
Improved land.....	163,218	44.9	135,284	27,934	23,116
Timber and cut-over land.....	189,945	52.2	129,536	60,409	57,150
Other unimproved land.....	10,508	2.9	3,847	6,661	2,018
Swampy or subject to overflow.....	104,063	28.6	21,631	82,432	76,004
Suffering a loss of crops.....	29,879	8.2	7,816	22,063	17,536

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 95 operating drainage enterprises are counted in Tennessee, with an average area of 3,828 acres. There are only 9 operating enterprises of 10,000 acres or more each, and there are 49 that comprise between 1,000 and 5,000 acres each. There is no overlapping of enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	363,671	363,671	100.0
Less than 200 acres.....	121	121	( <sup>1</sup> )
200 to 499 acres.....	2,156	2,156	0.6
500 to 999 acres.....	12,465	12,465	3.4
1,000 to 4,999 acres.....	117,651	117,651	32.4
5,000 to 9,999 acres.....	91,612	91,612	25.2
10,000 to 49,999 acres.....	139,666	139,666	38.4

<sup>1</sup> Less than one-tenth of 1 per cent.

**Character of enterprises.**—All the present drainage enterprises, both operating and nonoperating, for agricultural land in Tennessee are public corporations organized under the general drainage district law of the state, approved April 28, 1909 (ch. 185). The statute applies to the whole state except Reelfoot Lake.

Drainage districts and levee districts are established by the county courts upon petition from one or more persons to be affected by the proposed improvement, if the work "will be of public utility or conducive to the public health or welfare." The affairs of the district are managed by a board of directors consisting of the judge or chairman of the county court and two persons owning or interested in lands of the district, appointed by the court. The cost of the enterprise is paid by the landowners in proportion to the benefits their lands will receive; the assessments are collected like county taxes. Provision is made for districts embracing land in two or more counties.

The petition must describe approximately the land to be affected and the location of the proposed drains. The court appoints an engineer to make a survey, and to report regarding the land to be affected and the plan of reclamation that will be of public benefit, with an estimate of the cost of the project. The court appoints viewers to make recommendations regarding claims for damages, if any are filed, and after establishing the district he appoints three commissioners to apportion the cost. Public hearings are held, upon the engineer's report and again upon the commissioners' report. Appeal from decisions of the county court may be taken to the circuit court. The board of directors lets the contract and carries out the improvement, and may issue bonds running not more than 20 years.

This law provides that the owners of the land to be affected by a drain or system of drains may agree among themselves regarding the location of the improvement works, the amounts of damages to be paid, and the apportionment of the cost, and file their agreement in writing with the clerk of the county, whereupon the county court will assume jurisdiction and complete the enterprise in accordance with the agreement and in the manner that the law provides for establishing drainage districts. This provision is practicable only where few land owners are interested, and has been used by enterprises embracing a total of 2,500 acres.

Subdistricts within a drainage district may be formed in the same manner as an original district. They will be administered by the board of directors of the drainage district, and assessments for the subdistrict will be secondary to those of the original district.

The first drainage law of Tennessee was enacted in 1842, providing relief for a landowner who could not

drain his own land without crossing that of another owner who refused permission for the necessary ditch. The aggrieved owner was permitted to petition the county court, which then would appoint a jury to assess the damages that should be paid for the privilege sought. The petitioner, after paying such damages, or offering payment, might construct and maintain the ditch.

Public drainage work evidently began as supplemental to flood protection by levees. In 1871 the counties were authorized, upon affirmative vote of three-fourths of the voters affected, to issue bonds to raise funds to build levees. In 1901 they were authorized to retain the increment of taxes received, by reason of enhanced value of taxable property resulting from levees and drainage constructed with funds raised by bond issues of the county, to apply upon the payment of such bonds.

Some special acts have been passed, before and since the drainage law of 1909 was enacted, permitting persons interested in overflowed land to ditch and straighten certain streams, but the form of organization was not specified, and no enterprises were reported as organized under those special acts.

**Drainage Works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 777.3 miles of open ditches, 0.3 mile of tile drains, and 42.3 miles of accessory levees; the additional lengths under construction were 135.4 miles of open ditches, 0.1 mile of tile drains, and 10.2 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts for land drainage in Tennessee.

TABLE 6.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	363,671	100.0	\$2,925,944	100.0	\$522,047
Open ditches only.....	332,317	91.4	2,439,944	83.4	511,847
Open ditches and levees.....	30,854	8.5	481,000	16.4	7,700
The drains only.....	500	0.1	5,000	0.2	2,500

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

County Table II, line 16, shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises, as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted because the area served is very small, and those of 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both these groups, computed as 3 feet and 10 feet, respectively, would make the mean depth for the state 7.3 instead of 6.8 feet.

TABLE 7.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	363,671	100.0
Less than 3 feet.....	2,000	0.6
3.0 to 3.9 feet.....	6,700	1.8
4.0 to 4.9 feet.....	6,862	1.9
5.0 to 5.9 feet.....	31,300	22.4
6.0 to 6.9 feet.....	91,084	25.0
7.0 to 7.9 feet.....	56,793	15.6
8.0 to 8.9 feet.....	9,647	2.7
9.0 to 9.9 feet.....	45,544	12.5
10 feet and more.....	63,741	17.5
Not reporting branches.....		

Maintenance of Works.—The general drainage law provides (act of April 3, 1915, chapter 63), that the board of directors of a drainage district may provide for keeping the drainage works in repair and free from obstructions, by levying a special assessment not to exceed in any year an amount equal to 10 cents per acre upon all the land in the district, and to be based upon the apportionment of the benefits made by the commissioners for apportioning the cost of original construction.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	363,671	100.0	\$2,925,944	100.0	\$522,047
By district forces.....	216,559	59.5	1,564,859	53.5	463,200
By contract.....	98,810	27.2	891,474	30.5	23,000
By landowners.....	600	0.1	5,000	0.2	2,500
By other methods.....	600	0.2	7,015	0.2	
No maintenance provided.....	47,202	13.0	457,596	15.6	33,347

Date of Organization.—The progress in drainage development is shown only roughly by the dates of

the organization of enterprises, which are the dates when the districts were established by the county courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	363,671	100.0	363,671	100.0
1910 to 1914.....	135,679	37.3	135,679	37.3
1915 to 1919.....	227,992	62.7	227,992	62.7

TABLE 10.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$2,925,944	100.0	\$522,047
1910 to 1914.....	1,218,662	41.7	12,200
1915 to 1919.....	1,707,282	58.3	509,847

TABLE 11.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1910 to 1914.....	287.5	31.5	0.4	100.0	52.5	100.0
1915 to 1919.....	625.2	68.5				

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and cotton. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture, to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—TENNESSEE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Bedford.	Benton.	Carroll.	Chester.	Cooke.	Crockett.	Decatur.
1	Number of all farms in the state or county.....	252,774	3,340	1,983	4,141	1,667	2,800	3,072	1,513
2	Farms reporting land having drainage.....	8,887	330	277	249	216	114	220	373
3	Farms reporting land needing drainage.....	20,997	387	579	415	462	449	131	394
4	Farms in drainage and levee districts.....	2,669	4	2	261	163	4	227	1
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres	26,679,680	328,960	291,840	396,160	200,320	273,280	170,880	184,320
6	All land in farms..... acres	19,519,856	253,606	203,781	332,123	151,830	218,463	147,308	169,376
7	Improved land in farms..... acres	11,185,302	201,379	80,407	165,804	62,713	119,390	117,670	64,609
8	Woodland in farms..... acres	7,080,169	70,259	104,210	108,409	62,118	96,320	26,851	90,077
9	Other unimproved land in farms..... acres	1,245,385	12,067	19,164	57,910	26,999	2,753	2,787	14,689
10	Farm land reported as provided with drainage..... acres	254,118	5,584	4,781	9,577	8,248	2,895	7,168	7,400
11	Farm land reported as needing drainage..... acres	640,479	6,172	20,800	14,563	14,042	18,676	6,029	12,443
12	Drainage only..... acres	76,644	1,644	1,386	2,300	1,720	3,325	1,205	1,630
13	Drainage and clearing..... acres	563,835	4,528	19,414	12,263	12,322	15,351	4,824	10,813

		Dyer.	Fayette.	Franklin.	Gibson.	Greene.	Hamb- len.	Harde- man.	Hardin.	Haw- kins.
1	Number of all farms in the county.....	3,922	5,875	2,220	6,585	5,313	1,564	3,535	2,907	3,314
2	Farms reporting land having drainage.....	220	7	119	377	177	58	105	336	119
3	Farms reporting land needing drainage.....	159	222	418	931	498	38	258	329	96
4	Farms in drainage and levee districts.....	127	1	2	420	4		18	182	10
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres	320,000	395,520	368,000	405,120	392,320	101,120	446,080	372,480	308,480
6	All land in farms..... acres	199,198	355,523	214,252	330,804	345,728	109,203	333,857	230,037	286,328
7	Improved land in farms..... acres	158,323	236,785	129,426	251,837	245,593	83,480	144,215	109,496	181,460
8	Woodland in farms..... acres	39,274	78,937	69,023	59,957	86,740	22,219	139,320	106,553	96,102
9	Other unimproved land in farms..... acres	1,601	39,801	15,803	19,010	13,395	3,504	50,322	13,988	8,766
10	Farm land reported as provided with drainage..... acres	7,891	384	2,056	10,709	4,118	1,481	3,788	6,848	3,922
11	Farm land reported as needing drainage..... acres	5,840	5,748	12,859	20,500	8,270	572	13,332	7,011	2,107
12	Drainage only..... acres	1,287	463	659	1,998	1,912	195	1,710	2,146	619
13	Drainage and clearing..... acres	4,553	5,285	12,200	18,502	6,358	377	11,622	4,865	1,488

		Hay- wood.	Hender- son.	Henry.	Hick- man.	Jeffer- son.	Lake.	Lauder- dale.	McNairy.	Modi- son.
1	Number of all farms in the county.....	4,359	3,290	4,286	1,928	2,209	850	3,406	3,283	4,467
2	Farms reporting land having drainage.....	43	726	134	59	62	16	83	412	94
3	Farms reporting land needing drainage.....	230	694	690	113	61	205	65	517	265
4	Farms in drainage and levee districts.....	72	248	124		1	23	81	145	98
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres	325,120	343,040	400,640	364,800	199,680	78,080	291,840	378,320	353,280
6	All land in farms..... acres	207,711	300,632	349,597	235,045	182,477	60,250	173,437	283,843	305,617
7	Improved land in farms..... acres	159,717	140,360	192,247	97,899	135,552	52,619	122,735	117,654	179,052
8	Woodland in farms..... acres	37,645	108,631	115,598	120,057	41,585	7,122	47,158	146,587	88,350
9	Other unimproved land in farms..... acres	10,349	51,641	41,753	17,089	5,340	509	8,544	19,602	38,215
10	Farm land reported as provided with drainage..... acres	2,751	16,194	5,192	785	2,642	490	2,707	8,355	6,796
11	Farm land reported as needing drainage..... acres	7,404	21,674	24,477	1,931	2,037	6,523	7,892	15,649	8,303
12	Drainage only..... acres	432	8,896	5,973	68	210	3,506	1,912	2,298	508
13	Drainage and clearing..... acres	6,972	17,778	18,504	1,863	1,827	3,017	5,980	13,351	7,795

		Marion.	Meigs.	Mont- gomery.	Obion.	Roane.	Ruther- ford.	Sumner.	Weak- ley.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,637	935	4,121	3,378	1,637	5,264	4,585	5,050	144,598
2	Farms reporting land having drainage.....	104	35	118	716	156	170	26	418	2,115
3	Farms reporting land needing drainage.....	128	19	209	534	406	222	383	362	10,135
4	Farms in drainage and levee districts.....			25	138	1	2	2	198	85
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres	314,240	127,360	330,240	353,280	248,320	392,960	357,120	371,200	16,497,280
6	All land in farms..... acres	114,882	124,528	217,968	296,797	180,463	361,006	318,559	318,104	11,467,625
7	Improved land in farms..... acres	50,812	65,291	222,095	224,632	90,607	222,056	225,666	225,397	6,308,424
8	Woodland in farms..... acres	55,293	54,666	66,000	70,086	79,792	120,169	69,893	75,391	4,519,777
9	Other unimproved land in farms..... acres	8,777	4,571	29,873	2,079	10,064	19,681	28,000	17,316	639,424
10	Farm land reported as provided with drainage..... acres	1,978	1,284	3,374	55,183	2,413	4,459	483	21,061	30,641
11	Farm land reported as needing drainage..... acres	3,018	407	6,373	22,293	9,779	3,706	6,641	13,792	309,616
12	Drainage only..... acres	531	182	983	3,357	1,597	1,917	426	3,866	23,783
13	Drainage and clearing..... acres	2,487	225	5,390	18,936	8,182	1,789	6,215	9,926	285,833

<sup>1</sup> No drainage on farms reported in Dickson, Houston, Lewis, and Van Buren Counties.

DRAINAGE—TENNESSEE.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Carroll.	Chester.	Crockett.	Dyer.	Fayette.	Gibson.	Hardeman.	
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres..	26,679,680	396,160	200,220	170,880	320,000	395,520	405,120	446,080
2	All land in operating drainage enterprises.....acres..	363,671	33,724	13,125	17,282	43,106	1,928	46,484	5,542
3	Improved land.....acres..	183,218	8,043	8,423	8,669	18,853	1,169	22,951	2,201
4	Per cent of all improved land in farms.....	1.5	4.9	13.4	7.4	11.9	0.5	9.1	1.5
5	Timber and cut-over land.....acres..	189,945	24,971	4,703	8,613	24,253	759	23,533	3,341
6	Other unimproved land.....acres..	10,508	710						
7	Swampy or subject to overflow, in enterprises.....acres..	104,063	5,832	1,112		25,000	121	948	3,194
8	Suffering a loss of crops from defective drainage.....acres..	29,379	1,771			8,000	121	474	97
9	Assessed acreage.....	363,671	33,724	13,125	17,282	43,106	1,928	46,484	5,542
10	Excess over all land in operating enterprises.....acres..								
<b>DRAINAGE WORKS.</b>									
Open ditches:									
11	Completed.....miles..	777.3	114.9	61.8	39.5	71.2	5.0	79.3	17.6
12	Additional under construction.....miles..	135.4	21.3	0.7		10.5	0.5		5.5
13	Maximum completed in any enterprise.....miles..	55.0	55.0	24.5	10.6	20.0	2.8	26.2	7.0
14	Maximum width, at bottom of ditch <sup>1</sup> .....feet..	80	30	23	70	80	12	30	15
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	16.0	12.0	12.0	15.0	16.0	7.5	11.0	8.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	6.8	6.2	7.0	7.2	7.8	6.0	7.2	6.0
Tile drains:									
17	Completed.....miles..	0.3							
18	Additional under construction.....miles..	0.1							
19	Maximum completed in any enterprise.....miles..	0.3							
20	Maximum size of tile.....inches..	10							
Accessory levees and dikes:									
21	Completed.....miles..	42.3							
22	Additional under construction.....miles..	10.2							
23	Area drained by open ditches only <sup>1</sup> .....acres..	332,317	33,724	13,125	17,282	43,106	1,928	46,484	5,542
24	Length of these ditches.....miles..	362.2	156.2	62.5	39.5	81.7	5.5	79.3	23.1
25	Average length per acre.....feet..	13.7	21.3	25.1	12.1	10.0	15.1	9.0	22.0
26	Area having open ditches and levees <sup>1</sup> .....acres..	30,854							
27	Length of these ditches.....miles..	50.5							
28	Average length per acre.....feet..	8.6							
29	Length of the accessory levees.....miles..	62.5							
30	Area drained by tile only <sup>1</sup> .....acres..	500							
31	Length of these tile.....miles..	0.4							
32	Average length per acre.....feet..	4.2							
<b>DEVELOPMENT OF LAND.</b>									
33	Improved land in operating enterprises, 1920.....acres..	183,218	8,043	8,423	8,669	18,853	1,169	22,951	2,201
34	Improved land prior to drainage.....acres..	86,028	2,119	2,725	4,379	13,321	618	12,003	1,221
35	Increase since drainage.....acres..	77,190	5,924	4,697	4,290	5,532	551	10,948	980
36	Per cent of increase.....	89.7	279.6	126.1	98.0	41.5	89.2	91.2	80.3
37	Per cent increase is of all improved land in farms, 1920.....	0.7	3.6	7.5	3.6	3.5	0.2	4.3	0.7
38	Timber and cut-over land, 1920.....acres..	189,945	24,971	4,703	8,613	24,253	759	23,533	3,341
39	Timber and cut-over land prior to drainage.....acres..	262,163	30,895	9,116	12,903	29,785	1,310	34,481	4,321
40	Decrease since drainage.....acres..	72,218	5,924	4,413	4,290	5,532	551	10,948	980
41	Per cent of decrease.....	27.5	19.1	48.4	33.2	18.6	42.1	31.8	22.7
42	Other unimproved land, 1920.....acres..	10,508	710						
43	Other unimproved land prior to drainage.....acres..	15,450	710	284					
44	Decrease since drainage.....acres..	4,972		284					
45	Per cent of decrease.....	32.1		100.0					
46	Swampy or subject to overflow, 1920.....acres..	104,063	5,832	1,112		25,000	121	948	3,194
47	Swampy or subject to overflow prior to drainage.....acres..	353,027	33,724	13,125	16,782	43,106	1,928	36,806	5,542
48	Decrease since drainage.....acres..	248,964	27,892	12,013	16,782	18,106	1,807	35,858	2,348
49	Per cent of decrease.....	70.5	82.7	91.5	100.0	42.0	93.7	97.4	42.4
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
50	Total capital invested in and required for completion of operating enterprises.....dollars..	3,447,991	390,566	125,941	179,355	466,011	15,660	328,095	45,117
51	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	2,925,944	310,216	124,946	179,355	346,511	14,451	328,095	36,915
52	Additional capital required to complete these enterprises.....dollars..	522,047	80,350	995		119,500	1,209		8,202
53	Average cost per acre when completed.....dollars..	8.48	10.69	9.60	10.38	10.81	8.12	7.06	8.14
54	Enterprises constructing open ditches only.....dollars..	2,951,791	390,566	125,941	179,355	466,011	15,660	328,095	45,117
55	Average cost per acre when completed.....dollars..	8.88	10.69	9.60	10.38	10.81	8.12	7.06	8.14
56	Enterprises constructing open ditches and levees.....dollars..	483,700							
57	Average cost per acre when completed.....dollars..	15.84							
58	Enterprises constructing tile drains only.....dollars..	7,500							
59	Average cost per acre when completed.....dollars..	15.00							
<b>CROPS.</b>									
60	Improved land in enterprises reporting— Corn as principal crop on drained land.....acres..	110,022	7,695	8,119	3,535	10,128		22,951	2,201
61	Cotton as principal crop on drained land.....acres..	53,196	348	303	5,134	8,725	1,169		

<sup>1</sup> When works under construction have been completed.

## DRAINAGE—TENNESSEE.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Hardin.	Hay-wood.	Hender-son.	Henry.	McNairy.	Madison.	Obion.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres	372,480	325,120	343,040	400,640	376,320	353,280	353,280	1,642,240
2	All land in operating drainage enterprises.....	acres	19,345	35,334	20,684	31,589	12,729	23,174	27,160	32,465
3	Improved land.....	acres	11,534	20,059	11,433	6,800	7,041	11,727	13,678	10,840
4	Per cent of all improved land in farms.....		10.4	12.5	8.1	3.5	6.0	6.5	6.1	0.2
5	Timber and cut-over land.....	acres	8,011	15,275	8,655	21,660	5,688	11,447	13,484	15,552
6	Other unimproved land.....	acres			596	3,129				6,073
7	Swampy or subject to overflow in enterprises.....	acres	4,045	1,480	2,658	24,454		1,154	18,252	15,813
8	Suffering a loss of crops from defective drainage.....	acres	700	592	1,614	5,256			7,551	3,703
9	Assessed acreage.....		19,345	35,334	20,684	31,589	12,729	23,174	27,160	32,465
10	Excess over all land in operating enterprises.....	acres								
<b>DRAINAGE WORKS.</b>										
Open ditches:										
11	Completed.....	miles	44.6	58.3	64.2	35.5	52.2	48.8	58.0	26.4
12	Additional under construction.....	miles		5.9	5.0	70.7	1.3			14.0
13	Maximum completed in any enterprise.....	miles	9.0	17.4	13.0	19.5	12.0	15.0	29.0	16.0
14	Maximum width, at bottom of ditch.....	feet	24	50	30	45	20	45	47	70
15	Maximum of average depths of outlet ditches.....	feet	12.0	15.0	12.0	10.0	8.0	11.0	10.0	11.0
16	Mean depth of branch ditches.....	feet	8.0	6.4	6.8	6.1	6.0	7.2	8.0	7.0
Tile drains:										
17	Completed.....	miles								0.3
18	Additional under construction.....	miles								0.1
19	Maximum completed in any enterprise.....	miles								0.4
20	Maximum size of tile.....	inches								10
Accessory levees and dikes:										
21	Completed.....	miles							13.8	28.5
22	Additional under construction.....	miles							10.2	
23	Area drained by open ditches only.....	acres	19,345	35,334	20,684	31,589	12,729	23,174	5,900	22,871
24	Length of these ditches.....	miles	44.6	64.2	69.2	106.2	53.5	48.8	16.0	31.9
25	Average length per acre.....	feet	12.2	9.6	17.6	17.7	22.2	11.1	14.8	7.5
26	Area having open ditches and levees.....	acres							21,260	9,594
27	Length of these ditches.....	miles							42.0	8.5
28	Average length per acre.....	feet							10.4	4.7
29	Length of the accessory levees.....	miles							24.0	28.5
30	Area drained by tile only.....	acres								500
31	Length of these tile.....	miles								0.4
32	Average length per acre.....	feet								4.0
<b>DEVELOPMENT OF LAND.</b>										
33	Improved land in operating enterprises, 1920.....	acres	11,334	20,059	11,433	6,800	7,041	11,727	13,678	10,840
34	Improved land prior to drainage.....	acres	2,003	10,830	6,854	6,605	3,611	3,757	7,895	7,112
35	Increase since drainage.....	acres	9,326	9,229	4,579	195	3,430	7,970	5,811	3,728
36	Per cent of increase.....		464.4	85.2	66.8	3.0	95.0	212.1	73.9	52.4
37	Per cent increase is of all improved land in farms, 1920.....		8.5	5.8	3.3	0.1	2.9	4.4	2.6	0.4
38	Timber and cut-over land, 1920.....	acres	8,011	15,275	8,655	21,660	5,688	11,447	13,484	15,552
39	Timber and cut-over land prior to drainage.....	acres	15,357	24,504	11,166	21,855	9,118	19,417	19,295	18,640
40	Decrease since drainage.....	acres	7,346	9,229	2,511	195	3,430	7,970	5,811	3,088
41	Per cent of decrease.....		47.8	37.7	22.5	0.9	37.6	41.0	30.1	16.6
42	Other unimproved land, 1920.....	acres			596	3,129				6,073
43	Other unimproved land prior to drainage.....	acres	1,980		2,864	3,129				6,713
44	Decrease since drainage.....	acres	1,980		2,063					640
45	Per cent of decrease.....		100.0		77.6					9.5
46	Swampy or subject to overflow, 1920.....	acres	4,045	1,480	2,658	24,454		1,154	18,252	15,813
47	Swampy or subject to overflow prior to drainage.....	acres	19,345	35,334	20,684	31,589	12,729	22,833	27,160	32,340
48	Decrease since drainage.....	acres	15,300	33,854	18,026	7,135	12,729	21,679	8,903	16,527
49	Per cent of decrease.....		79.1	95.8	87.1	22.6	100.0	94.9	32.8	51.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
50	Total capital invested in and required for completion of operating enterprises.....	dollars	95,210	221,742	188,576	327,791	114,337	185,585	400,450	393,505
51	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	95,210	208,951	175,078	116,975	112,737	185,585	392,750	300,171
52	Additional capital required to complete these enterprises.....	dollars		14,791	13,500	210,816	1,600		7,700	93,334
53	Average cost per acre when completed.....	dollars	4.92	6.28	9.12	10.38	8.99	8.01	14.74	12.12
54	Enterprises constructing open ditches only.....	dollars	95,210	221,742	188,576	327,791	114,337	185,585	71,750	226,005
55	Average cost per acre when completed.....	dollars	4.92	6.28	9.12	10.38	8.99	8.01	12.18	10.10
56	Enterprises constructing open ditches and levees.....	dollars							328,700	160,000
57	Average cost per acre when completed.....	dollars							15.46	16.68
58	Enterprises constructing tile drains only.....	dollars								7,500
59	Average cost per acre when completed.....	dollars								15.00
<b>CROPS.</b>										
60	Improved land in enterprises reporting—									
61	Corn as principal crop on drained land.....	acres	11,120		9,833	6,800	1,875	5,085	13,678	7,004
62	Cotton as principal crop on drained land.....	acres	314	20,059	1,600		5,166	6,642		3,836

<sup>1</sup> Includes only Benton, Lauderdale, Montgomery, Sumner, and Weakley Counties.<sup>2</sup> When works under construction have been completed.

## TEXAS.

The following pages present the statistics of drainage for Texas collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

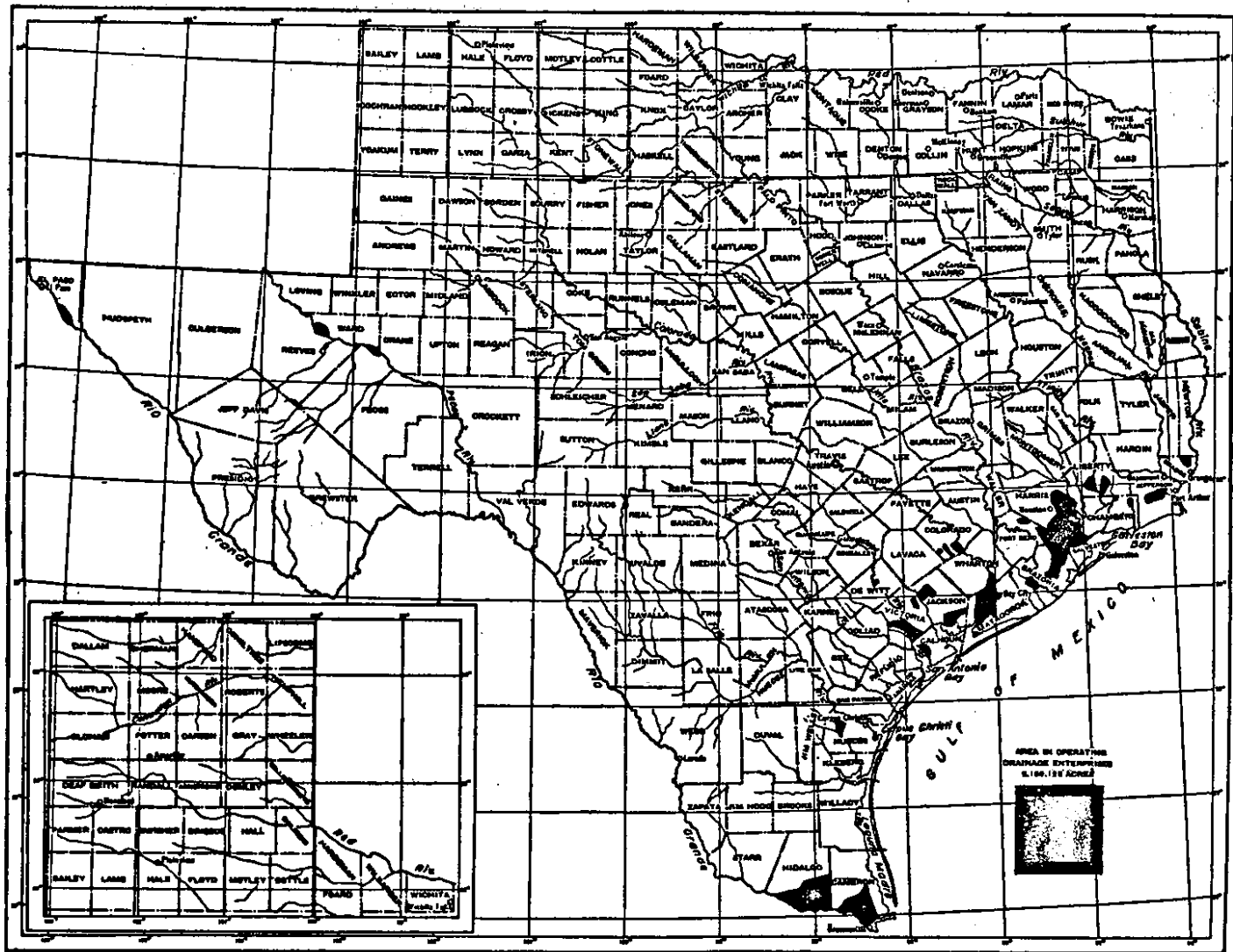
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	436, 033	100. 0
Farms reporting land having drainage.....	8, 106	1. 9
Farms reporting land needing drainage.....	35, 108	8. 1
All land in farms..... acres..	114, 020, 621	100. 0
Improved land in farms..... acres..	31, 227, 508	27. 4
Farm land reported as provided with drainage..... acres..	756, 263	0. 7
Farm land reported as needing drainage..... acres..	4, 130, 614	3. 6
Needing drainage only..... acres..	385, 225	0. 3
Needing drainage and clearing..... acres..	3, 745, 389	3. 3
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	167, 934, 720	100. 0
All land in operating drainage enterprises..... acres..	2, 166, 128	1. 3
Improved land..... acres..	1, 107, 153	0. 7
Per cent of all improved land in farms.....	3. 6	
Timber and cut-over land..... acres..	111, 922	0. 1
Other unimproved land..... acres..	947, 053	0. 6
Swampy, subject to overflow, seeped, or alkali..... acres..	201, 051	0. 1
Suffering a loss of crops from defective drainage..... acres..	128, 765	(1)
Improved land prior to drainage..... acres..	566, 275	0. 3
Increase since drainage began..... acres..	540, 878	0. 3
Land in nonoperating enterprises..... acres..		
Open ditches in operating enterprises..... miles..	2, 824. 1	100. 0
Completed..... miles..	2, 728. 5	96. 6
Additional under construction..... miles..	95. 6	3. 4
Tile drains in operating enterprises..... miles..		
Completed..... miles..		
Additional under construction..... miles..		
Total capital invested in and required for completion of operating enterprises.....	\$6, 400, 805	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	5, 700, 805	89. 1
Additional capital required to complete these enterprises.....	700, 000	10. 9
Average cost per acre when completed.....	2. 95	

1 Less than one-tenth of 1 per cent.

# TEXAS

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.





Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in Texas. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>2</sup> .....	2,166,128	100.0	\$5,700,805	100.0	\$700,000
With works completed.....	2,080,128	96.0	5,055,805	88.7	.....
With works under construction....	86,000	4.0	645,000	11.3	700,000

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."  
<sup>2</sup> No nonoperating enterprises in Texas.

Location of enterprises.—The greater part of the land in drainage enterprises in Texas is situated in the counties near the gulf coast, more particularly in the eastern part of the state. There is a large area in such enterprises in the lower Rio Grande Valley, near Brownsville, and three areas in the upper Rio Grande and Pecos River Valleys. The approximate location of the land in the drainage enterprises is shown by the map on page 2, but it was necessary to prepare that map from information which, in many instances, was very indefinite regarding the location of the enterprise within the county.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	2,166,128	100.0	\$5,700,805	100.0	\$700,000
Pecos River.....	47,440	2.2	83,000	1.5	.....
Rio Grande.....	513,871	23.7	1,281,000	22.1	600,000
San Antonio River.....	50,000	2.3	56,680	1.0	.....
Colorado River.....	288,281	13.3	765,824	13.4	100,000
Brazos River.....	205,707	9.5	682,000	12.0	.....
Trinity River.....	92,589	4.3	202,500	3.6	.....
Sabine Lake.....	68,275	3.2	118,600	2.0	.....
Gulf of Mexico.....	896,965	41.5	2,533,201	44.4	.....

<sup>1</sup> No nonoperating enterprises in Texas.

Condition of land in enterprises.—The drainage enterprises in the eastern part of Texas are for the drainage and reclamation of land generally swampy or subject to overflow. In the counties bordering the Gulf of Mexico are extensive tracts so little above

sea level that the winding streams are too sluggish to drain the land. In the western part of the state, artificial drainage is for the reclamation and protection of land injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. In the Brownsville section are conditions like those of the humid eastern counties and others like those of the arid western region.

For the state, 8,000 acres of irrigated land in drainage enterprises are reported as not having needed drainage, but as having been assessed merely for contributing to the injury of the other land. This acreage is omitted from the tabulations.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES. <sup>1</sup>			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	2,166,128	100.0	2,080,128	86,000
Improved land.....	1,107,153	51.1	1,052,653	54,500
Timber and cut-over land.....	111,922	5.2	111,922	.....
Other unimproved land.....	947,053	43.7	915,553	31,500
Swampy, overflowed, seeped, or alkali..	201,051	9.3	183,451	17,600
Suffering a loss of crops.....	128,765	5.9	116,965	11,800

<sup>1</sup> No nonoperating enterprises in Texas.

Size of enterprises.—There are 54 operating drainage enterprises in Texas, with an average area of 40,113 acres. Of this number, 30 are of 10,000 to 50,000 acres each, and only 8 are smaller than 10,000 acres each. There is no overlapping of the enterprises in this state, and no enterprise is situated in more than one county.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	2,166,128	2,166,128	100.0
200 to 499 acres.....	1,957	1,957	0.1
500 to 999 acres.....	9,619	9,619	0.4
1,000 to 4,999 acres.....	32,032	32,032	1.5
5,000 to 9,999 acres.....	746,544	746,544	34.5
10,000 to 49,999 acres.....	918,105	918,105	42.4
50,000 to 499,999 acres.....	457,871	457,871	21.1

**Character of enterprises.**—The drainage enterprises in Texas are drainage districts organized under the state drainage district laws of 1907 and 1911, drainage work in the Rio Grande Project of the United States Reclamation Service, a small levee improvement district that has constructed drainage ditches, and one enterprise under private ownership.

The office of State Reclamation Engineer was created by an act of April 7, 1913, to plan and lay out the improvements necessary to reclaim the swamp and overflowed land of the state and make it suitable for agricultural uses. This act abolished the State Levee and Drainage Board and the office of the State Levee and Drainage Commissioner, created by act of March 19, 1909 (ch. 81), which was rewritten by act of March 20, 1911 (ch. 88). It is specifically provided that no money appropriated by the act shall be used for construction of the improvement works. The law requires that each drainage, levee, or improvement district shall file with the State Reclamation Engineer a complete record of its organization, plans, and estimates, immediately prior to the approval of its bond issue by the attorney general of the state.

The drainage district law approved March 28, 1911 (ch. 118), supersedes the act of March 23, 1907 (ch. 40), which was similar to the later law in its principal provisions. The present statute authorizes the establishment of drainage districts by the county commissioners' court, upon petition from 25 freehold resident taxpayers or from one-third of all such taxpayers in the proposed district. After the sufficiency of the petition is determined at public hearing, the commissioners appoint an engineer to make a survey and preliminary plans for the improvement works. Public hearing is held again upon the engineer's report. Before the district is organized, the issue of bonds and levy of the drainage tax must be approved by two-thirds of the voting property taxpayers at a special election. Three drainage commissioners to administer the affairs of the district are appointed by the county commissioners, or they are elected by the real property taxpayers of the district if a majority of those taxpayers petition for such an election. The bonds of the district may not be issued for longer than 40 years, and must be approved by the attorney general of the state. They are paid by the proceeds of taxes levied annually upon all real, personal, and other property in the district. This law does not provide for organizing a drainage district located in more than one county. The several amendments to this law have not affected the character of the enterprises as described.

Levee improvement districts are organized under a law of April 1, 1915 (ch. 146), which repealed a somewhat similar law of March 19, 1909 (ch. 85). These districts are established by the county commissioners' court upon petition from the owners of a majority of the acreage in the proposed district, and each is under the control of three district supervisors appointed by the court. Bond issues and taxes for drainage

must be approved as in drainage districts. The Conservation and Reclamation District Act of March 24, 1919 (ch. 44), makes it unlawful for any levee improvement district to construct or maintain any levee or other improvement without first obtaining the State Reclamation Engineer's approval of the proposed work.

The first public drainage law of Texas was passed in April, 1895 (ch. 97). It provided for the establishment of drainage districts by the county commissioners' court, to be under the control of that court, upon petition from five owners of land to be affected. The work was to be apportioned to each tract of land, corporation, county highway, and railroad in proportion to the benefits to be derived by each. A similar law was enacted in 1897 (ch. 77). An act of April 11, 1899 (ch. 64), authorizes the creation of drainage districts by the county commissioners' court, to be controlled by that court, the cost of drainage to be paid by an ad valorem tax upon all property in the county or subdivision thereof. A statute of 1905 (ch. 110) provides that drainage districts may be established by the county commissioners' court upon petition from 50 or a majority of the resident owners of land that will be affected, to be under the control of that court or of elected trustees as desired by the property holders. This act authorizes the formation of drainage districts situated in two or more counties. No enterprises were reported as organized under these laws, though all are still in effect except in so far as that of 1895 has been superseded by that of 1897.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises <sup>1</sup> .....	2,166,128	100.0	\$5,700,905	100.0	\$700,000
Drainage districts.....	2,096,282	96.8	4,954,981	86.9	100,000
Laws of 1907, ch. 40.....	1,560,205	72.0	3,266,390	57.3	.....
Laws of 1911, ch. 118.....	536,077	24.7	1,688,601	29.6	100,000
U. S. Reclamation Service.....	66,000	2.6	635,000	11.1	600,000
Other <sup>2</sup> .....	13,846	0.6	110,824	1.9	.....

<sup>1</sup> No nonoperating enterprises in Texas.

<sup>2</sup> Includes 1,477 acres in a levee improvement district under laws of 1915 (ch. 146); 7,500 acres under individual ownership; and 4,869 acres in a drainage district under a law not specified.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 2,728.5 miles of open ditches and 59.8 miles of accessory levees; the additional works under construction were 95.6 miles of open ditches only. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of open ditches or tile drains. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	2,166,128	100.0	\$5,700,805	100.0	\$700,000
Open ditches only.....	1,617,933	74.7	4,889,205	85.8	700,000
Open ditches and levees.....	548,195	25.3	811,600	14.2	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those of 10 feet and more were omitted; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.0 instead of 3.8 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	2,166,128	100.0
Less than 3 feet.....	64,260	3.0
3.0 to 3.9 feet.....	585,088	27.0
4.0 to 4.9 feet.....	828,948	37.3
5.0 to 5.9 feet.....	249,207	11.5
6.0 to 6.9 feet.....	1,477	0.1
7.0 to 7.9 feet.....	20,289	0.9
8.0 to 8.9 feet.....	.....	.....
9.0 to 9.9 feet.....	.....	.....
10 feet and more.....	55,000	2.6
Not reporting branches.....	330,871	17.6

Maintenance of works.—The drainage district law of 1911, as amended March 5, 1915 (ch. 33), provides for the maintenance of each drainage district by the commissioners of the district, who must submit annually to the county commissioners' court a report of the condition of the district and estimates for the maintenance work required. Taxes are levied by the court on all property in the district sufficient to pay for the maintenance, but not to exceed in any year one-half of 1 per cent of the assessed valuation, and when collected are placed in the construction and maintenance fund of the district. Bonds not required for construction cost may be sold, with the

consent of the court, for maintenance purposes. The drainage law of 1907 also provided that it should be the duty of the drainage commissioners to maintain the drainage works of the districts established under that statute.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,166,128	100.0	\$5,700,805	100.0	\$700,000
By district forces.....	1,852,087	85.5	4,919,205	86.3	700,000
By contract.....	284,541	13.1	707,000	12.4	.....
No maintenance provided <sup>1</sup> .....	29,500	1.4	74,600	1.3	.....

<sup>1</sup> Includes 7,500 acres maintained by landowners.

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners' courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	2,166,128	100.0	2,166,128	100.0
1900 to 1904.....	7,500	0.3	7,500	0.3
1905 to 1909.....	886,481	40.9	886,481	40.9
1910 to 1914.....	1,009,724	46.6	1,009,724	46.6
1915 to 1919.....	262,423	12.1	262,423	12.1

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$5,700,805	100.0	\$700,000
1900 to 1904.....	50,000	0.9	.....
1905 to 1909.....	1,590,000	27.7	.....
1910 to 1914.....	3,362,876	59.0	600,000
1915 to 1919.....	707,929	12.4	100,000

## DRAINAGE—TEXAS.

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	2,824.1	100.0	59.8	100.0
1900 to 1904.....	6.2	0.2	4.0	6.7
1905 to 1909.....	612.3	21.7	52.0	87.0
1910 to 1914.....	1,746.7	61.8	1.0	1.7
1915 to 1919.....	458.9	16.2	2.8	4.7

Crops.—The principal crops grown upon the drained land in drainage enterprises are cotton, corn, and vegetables. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—TEXAS.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Bandera.	Bastrop.	Bell.	Bexar.	Blanco.	Bosque.	Bowie.	Brazoria.
1	Number of all farms in the state or county.....	436,033	670	3,325	4,555	3,205	713	2,467	4,970	2,074
2	Farms reporting land having drainage.....	8,106	59	92	22	34	145	29	8	730
3	Farms reporting land needing drainage.....	35,108	326	145	.....	294	250	154	130	78
4	Farms in drainage and levee districts.....	2,778	2	3	.....	15	1	.....	1	723
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county..... acres..	167,934,720	519,040	554,880	693,120	808,320	490,000	624,000	558,720	857,600
6	All land in farms..... acres..	114,020,621	464,199	390,582	534,247	576,218	429,221	539,735	316,692	303,037
7	Improved land in farms..... acres..	31,227,503	37,912	182,718	372,040	234,287	46,532	201,131	200,907	165,150
8	Woodland in farms..... acres..	14,532,913	5,296	162,116	102,113	86,339	53,223	131,799	106,203	60,048
9	Other unimproved land in farms..... acres..	68,260,205	420,991	45,748	60,094	255,592	329,466	206,805	9,582	77,839
10	Farm land reported as provided with drainage..... acres..	756,263	2,150	7,117	1,645	1,020	7,930	1,494	3,148	86,337
11	Farm land reported as needing drainage..... acres..	4,130,614	24,154	9,683	.....	19,700	12,676	6,861	7,321	24,010
12	Drainage only..... acres..	385,225	12	819	.....	115	100	626	81	5,666
13	Drainage and clearing..... acres..	3,745,369	24,142	8,864	.....	19,585	12,476	6,235	7,240	18,344

		Brazos.	Brown.	Burleson.	Calhoun.	Cameron.	Cass.	Chambers.	Clay.	Collin.
1	Number of all farms in the county.....	3,023	2,303	2,685	533	1,507	5,355	506	2,118	6,001
2	Farms reporting land having drainage.....	93	56	17	333	26	115	21	7	12
3	Farms reporting land needing drainage.....	54	385	174	278	19	985	135	188	6
4	Farms in drainage and levee districts.....	2	.....	38	104	39	3	1	.....	.....
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	382,080	611,840	437,760	360,320	896,640	608,640	395,520	741,120	561,920
6	All land in farms..... acres..	277,405	545,472	293,063	163,494	299,279	429,423	179,430	721,789	462,225
7	Improved land in farms..... acres..	143,515	182,004	140,697	58,602	83,121	238,140	51,321	276,527	419,478
8	Woodland in farms..... acres..	115,797	147,671	134,010	9,240	29,046	180,464	8,946	89,425	21,276
9	Other unimproved land in farms..... acres..	18,093	215,797	18,350	100,652	187,112	10,819	119,263	355,837	21,471
10	Farm land reported as provided with drainage..... acres..	4,918	4,262	927	36,668	1,666	3,092	462	1,130	411
11	Farm land reported as needing drainage..... acres..	6,315	26,737	14,514	57,008	1,192	53,090	8,683	27,937	267
12	Drainage only..... acres..	886	140	482	28,390	165	1,285	4,087	1,566	18
13	Drainage and clearing..... acres..	5,429	20,597	14,032	28,618	1,027	51,805	4,596	26,371	249

		Colorado.	Comanche.	Cooke.	Coryell.	Dallas.	Delta.	Denton.	El Paso.	Ellis.
1	Number of all farms in the county.....	2,469	3,015	2,919	3,069	5,379	2,191	4,200	542	5,774
2	Farms reporting land having drainage.....	126	346	17	311	49	24	35	153	40
3	Farms reporting land needing drainage.....	417	201	163	479	139	140	248	68	18
4	Farms in drainage and levee districts.....	42	.....	1	9	16	3	.....	136	3
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	622,080	606,720	577,280	694,400	549,760	167,040	609,280	590,720	624,000
6	All land in farms..... acres..	457,298	454,339	440,101	559,051	453,167	145,478	528,215	217,367	530,195
7	Improved land in farms..... acres..	189,848	216,129	237,874	246,011	358,570	122,512	395,308	30,119	469,771
8	Woodland in farms..... acres..	150,468	146,587	79,654	158,975	36,024	15,261	69,507	63,838	15,931
9	Other unimproved land in farms..... acres..	136,982	91,613	122,573	154,065	58,573	6,708	69,400	186,610	44,493
10	Farm land reported as provided with drainage..... acres..	19,955	30,609	919	18,509	3,276	1,384	812	14,052	2,361
11	Farm land reported as needing drainage..... acres..	33,914	13,152	5,022	22,587	10,023	3,746	7,300	4,275	1,801
12	Drainage only..... acres..	14,725	1,799	266	829	3,804	10	2,120	877	454
13	Drainage and clearing..... acres..	19,189	11,383	4,756	21,758	6,219	3,736	5,180	3,398	1,317

		Erath.	Fannin.	Fayette.	Fort Bend.	Galveston.	Gonzales.	Grayson.	Hamilton.	Harde- man.
1	Number of all farms in the county.....	3,387	6,338	4,728	3,325	723	4,361	5,599	2,049	1,077
2	Farms reporting land having drainage.....	16	106	218	8	136	44	86	14	18
3	Farms reporting land needing drainage.....	257	589	511	123	55	685	159	136	73
4	Farms in drainage and levee districts.....	8	3	24	1	8	10	5	.....	13
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	693,120	536,320	619,520	506,880	252,800	652,800	602,880	533,120	487,040
6	All land in farms..... acres..	556,065	460,727	514,358	384,741	102,332	608,301	508,520	444,790	366,152
7	Improved land in farms..... acres..	233,568	390,079	223,394	307,057	27,600	264,874	399,487	179,155	166,237
8	Woodland in farms..... acres..	122,209	60,948	204,520	49,716	3,935	204,477	61,001	74,192	3,320
9	Other unimproved land in farms..... acres..	200,288	19,700	86,444	127,968	70,497	138,950	48,032	191,443	196,595
10	Farm land reported as provided with drainage..... acres..	1,129	8,037	4,991	2,052	8,956	2,039	1,537	456	1,355
11	Farm land reported as needing drainage..... acres..	15,165	16,833	15,529	11,626	12,483	92,688	2,593	7,619	11,372
12	Drainage only..... acres..	1,260	4,533	1,301	9,456	12,023	908	648	61	854
13	Drainage and clearing..... acres..	13,905	12,300	14,228	2,170	430	91,760	1,945	7,558	10,518

		Harris.	Harrison.	Hidalgo.	Hopkins.	Hunt.	Jackson.	Jefferson.	Johnson.	Kaufman.
1	Number of all farms in the county.....	2,880	5,789	1,727	5,445	5,135	1,485	419	3,367	4,398
2	Farms reporting land having drainage.....	529	31	46	20	36	343	128	20	102
3	Farms reporting land needing drainage.....	769	767	96	59	93	140	56	25	325
4	Farms in drainage and levee districts.....	372	1	61	29	3	331	13	1	70
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	1,053,560	553,080	1,042,560	520,320	571,520	571,520	588,800	473,600	633,760
6	All land in farms..... acres..	379,262	390,842	394,874	397,734	432,751	398,771	130,230	370,817	397,990
7	Improved land in farms..... acres..	216,879	230,656	99,822	270,014	341,460	126,961	93,435	245,023	313,752
8	Woodland in farms..... acres..	69,149	147,839	14,455	89,252	59,762	74,751	7,491	31,823	53,198
9	Other unimproved land in farms..... acres..	93,234	12,347	280,597	38,468	31,529	197,059	29,304	93,971	31,030
10	Farm land reported as provided with drainage..... acres..	135,200	610	3,488	946	2,530	38,182	36,448	720	11,000
11	Farm land reported as needing drainage..... acres..	109,378	39,418	56,455	2,357	3,734	60,253	16,986	706	18,112
12	Drainage only..... acres..	84,984	744	1,869	1,112	1,609	13,699	13,759	398	2,830
13	Drainage and clearing..... acres..	24,394	38,674	54,586	2,245	2,125	36,554	3,227	308	15,282

DRAINAGE—TEXAS.

COUNTY TABLE L—DRAINAGE ON FARMS: 1920—Continued.

		Kendall.	Kent.	Kerr.	Lamar.	Lampasas.	Lee.	Leon.	Liberty.	Limestone.
1	Number of all farms in the county.....	617	412	561	6,831	1,139	2,295	3,301	1,314	5,095
2	Farms reporting land having drainage.....	19	14	47	436	77	49	21	217	116
3	Farms reporting land needing drainage.....	113	11	161	221	212	455	322	210	399
4	Farms in drainage and levee districts.....			9	21	2	1	3	164	3
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	382,720	580,000	730,880	604,800	473,600	359,680	704,640	742,400	623,360
6	All land in farms.....acres..	376,306	549,654	679,768	450,761	394,626	309,873	448,637	199,957	462,388
7	Improved land in farms.....acres..	37,688	48,868	38,429	354,637	104,066	113,741	176,220	73,449	345,027
8	Woodland in farms.....acres..	66,038	25,291	168	80,243	47,807	183,416	253,551	44,117	75,292
9	Other unimproved land in farms.....acres..	272,580	275,495	643,171	15,881	242,753	12,716	18,868	82,891	41,068
10	Farm land reported as provided with drainage.....acres..	780	2,310	2,091	25,069	2,446	503	740	39,438	6,808
11	Farm land reported as needing drainage.....acres..	4,833	10,050	26,586	8,705	14,875	29,062	34,824	49,190	17,993
12	Drainage only.....acres..	18	1,100	870	1,485	259	379	614	30,715	421
13	Drainage and clearing.....acres..	4,815	8,950	26,216	7,220	14,616	28,683	34,210	18,475	17,672

		McCulloch.	McLennan.	Madison.	Mata-gorda.	Milam.	Montague.	Morris.	Nacog-doches.	Navarro.
1	Number of all farms in the county.....	1,207	5,709	2,226	1,616	5,606	3,005	1,745	4,219	6,293
2	Farms reporting land having drainage.....	2	23	106	108	79	9	29	105	45
3	Farms reporting land needing drainage.....	176	154	298	66	409	101	365	798	481
4	Farms in drainage and levee districts.....		26		47	1	4		1	5
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	686,720	671,360	316,800	727,040	613,760	594,560	165,760	677,760	678,400
6	All land in farms.....acres..	466,579	568,599	241,726	408,587	480,353	449,506	112,367	408,628	566,919
7	Improved land in farms.....acres..	131,795	440,977	108,952	221,676	328,555	201,317	71,688	197,497	438,853
8	Woodland in farms.....acres..	20,036	56,333	119,005	48,828	105,927	145,832	32,724	196,288	32,999
9	Other unimproved land in farms.....acres..	314,748	71,289	18,769	136,683	45,871	102,357	7,955	12,843	45,067
10	Farm land reported as provided with drainage.....acres..	1,928	2,556	1,835	58,606	2,257	750	603	3,740	2,661
11	Farm land reported as needing drainage.....acres..	9,556	8,072	21,166	25,034	21,668	4,391	9,391	43,165	22,063
12	Drainage only.....acres..		2,356	282	14,837	512	1,574	709	560	74
13	Drainage and clearing.....acres..	9,556	5,716	20,884	10,197	21,156	2,817	8,682	42,615	21,989

		Nueces.	Orange.	Palo Pinto.	Parker.	Polk.	Presidio.	Red River.	Reeves.	Refugio.
1	Number of all farms in the county.....	1,247	311	1,242	2,945	2,022	102	5,832	206	310
2	Farms reporting land having drainage.....	7	149	21	27	58	2	53	2	21
3	Farms reporting land needing drainage.....	41	226	70	154	546	10	102	2	65
4	Farms in drainage and levee districts.....	12	17				1	13	2	2
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	496,000	232,320	613,120	560,000	778,880	2,439,680	664,960	1,779,840	473,600
6	All land in farms.....acres..	323,935	64,872	432,443	456,447	161,408	1,212,914	385,236	1,050,716	155,983
7	Improved land in farms.....acres..	162,621	26,071	94,944	195,542	61,960	6,723	261,996	16,385	35,988
8	Woodland in farms.....acres..	13,098	20,339	113,186	142,412	95,988		115,466		4,269
9	Other unimproved land in farms.....acres..	148,216	18,463	224,313	118,493	3,460	1,206,191	7,774	1,034,331	115,726
10	Farm land reported as provided with drainage.....acres..	3,167	12,365	547	651	2,145	408	1,220	560	6,221
11	Farm land reported as needing drainage.....acres..	18,358	23,960	7,533	4,697	32,498	13,475	5,878	1,822	21,131
12	Drainage only.....acres..	130	9,339	130	70	804	12,508	855	22	3,426
13	Drainage and clearing.....acres..	18,228	14,621	7,403	4,527	31,694	967	5,023	1,800	17,705

		Robert-son.	Rusk.	San Patricio.	Smith.	Tarrant.	Titus.	Tom Green.	Tyler.	Upshur.
1	Number of all farms in the county.....	4,908	6,089	757	6,317	3,336	2,938	680	1,134	3,690
2	Farms reporting land having drainage.....	75	159	10	191	16	20	5	75	53
3	Farms reporting land needing drainage.....	211	898	236	387	22	264	81	675	515
4	Farms in drainage and levee districts.....	3	2	12	1	7	3		1	42
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	558,080	629,120	432,640	588,800	577,920	254,720	930,560	581,120	884,000
6	All land in farms.....acres..	392,122	496,963	204,295	456,057	395,322	195,771	750,663	123,968	265,381
7	Improved land in farms.....acres..	236,513	283,148	96,007	294,948	253,224	116,478	95,530	35,123	158,806
8	Woodland in farms.....acres..	132,496	183,704	31,084	131,727	71,487	68,476	44,054	88,111	96,301
9	Other unimproved land in farms.....acres..	23,113	20,111	77,204	29,382	70,611	10,817	611,079	5,754	10,274
10	Farm land reported as provided with drainage.....acres..	5,043	3,758	2,892	5,560	531	434	515	1,676	1,294
11	Farm land reported as needing drainage.....acres..	15,981	39,490	31,556	11,187	288	6,140	159,161	49,103	22,319
12	Drainage only.....acres..	1,234	495	440	594	121	6	1,420	261	685
13	Drainage and clearing.....acres..	14,757	32,995	31,116	10,593	167	6,134	157,741	48,842	21,634

		Val Verde.	Victoria.	Ward.	Washing-ton.	Webb.	Wharton.	William-son.	Young.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	285	2,101	238	4,158	257	2,967	4,598	1,480	184,957
2	Farms reporting land having drainage.....	92	239	87	135	6	3	30	7	286
3	Farms reporting land needing drainage.....	6	281	19	371	11	44	58	439	14,031
4	Farms in drainage and levee districts.....		179	54			1	1	2	56
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	1,973,120	869,600	539,280	401,920	2,060,160	711,680	722,560	560,000	111,180,800
6	All land in farms.....acres..	1,699,287	551,984	349,476	348,028	971,850	438,068	610,036	484,282	75,726,897
7	Improved land in farms.....acres..	7,050	151,060	19,051	188,202	21,698	245,952	393,663	147,107	14,888,264
8	Woodland in farms.....acres..	315	114,312	5,000	85,950	114,639	41,875	129,004	71,271	7,596,448
9	Other unimproved land in farms.....acres..	1,691,913	386,582	326,425	78,874	835,513	150,241	87,369	265,904	53,242,185
10	Farm land reported as provided with drainage.....acres..	1,155	20,114	6,612	6,299	918	1,465	943	485	8,483
11	Farm land reported as needing drainage.....acres..	503	45,172	2,594	20,455	1,630	4,406	4,291	54,117	2,293,110
12	Drainage only.....acres..	188	22,424	582	3,424	470	1,966	117	365	46,524
13	Drainage and clearing.....acres..	315	22,748	2,012	17,031	1,210	2,440	4,174	53,752	2,246,586

<sup>1</sup>Drainage on farms reported in Anderson, Angelina, Archer, Atascosa, Austin, Briscoe, Brooks, Burnet, Caldwell, Camp, Coleman, Collingsworth, Comal, Culberson, De Witt, Falls, Franklin, Freestone, Gillespie, Goliad, Gregg, Grimes, Guadalupe, Hardin, Haskell, Hays, Hemphill, Henderson, Hill, Hood, Houston, Jack, Jasper, Jim Wells, Kimble, Kleberg, Lavaca, Live Oak, Llano, Marion, Mason, Maverick, Medina, Mills, Mitchell, Montgomery, Nolan, Panola, Pecos, Rains, Rockwall, Runnels, Sabine, San Augustine, San Saba, Stephens, Stonewall, Swisher, Taylor, Terrell, Travis, Trinity, Uvalde, Van Zandt, Walker, Wilson, and Wood Counties.

# DRAINAGE—TEXAS.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Brazoria.	Calhoun.	Cameron.	Chambers.	Colorado.	De Witt.	El Paso.	Fort Bend.	Galveston.	Harris.	
<b>LAND AREA.</b>												
1	Approximate land area of the state or county..... acres..	167,934,720	857,600	360,320	896,640	395,520	623,080	562,560	690,720	506,880	252,800	1,058,560
2	All land in operating drainage enterprises..... acres..	2,166,128	327,362	36,426	202,556	16,000	48,250	9,600	56,000	36,915	93,911	238,266
3	Improved land..... acres..	1,107,153	145,000	27,320	178,000	12,500	25,650	1,920	28,500	27,686	125,899	142,148
4	Per cent of all improved land in farms.....	3.6	87.8	61.0	93.8	24.4	15.1	0.9	94.6	13.4	62.8	85.5
5	Timber and cut-over land..... acres..	111,922	2,072			900	475					79,770
6	Other unimproved land..... acres..	947,053	180,290	9,106	124,556	2,600	22,125	7,680	27,500	9,229	68,012	16,348
7	Swampy, seeped, or alkali, in enterprises..... acres..	201,051	32,736	3,643	10,256	2,600	12,000		5,600	4,459	18,782	47,835
8	Suffering a loss of crops from defective drainage..... acres..	128,765	17,016	2,732	10,256	2,050	7,200		5,600	3,345	11,269	23,211
9	Assessed acreage.....	2,166,128	327,362	36,426	202,556	16,000	48,250	9,600	56,000	36,915	93,911	238,266
10	Excess over all land in operating enterprises..... acres..											
<b>DRAINAGE WORKS.</b>												
Open ditches:												
11	Completed..... miles..	2,728.5	456.2	45.0	165.0	30.0	28.4	4.0	70.0	177.0	80.0	407.0
12	Additional under construction..... miles..	95.6					48.6		47.0			
13	Maximum completed in any enterprise..... miles..	140.0	120.0	45.0	100.0	20.0	14.0	4.0	70.0	140.0	41.0	122.0
14	Maximum width at bottom of ditch <sup>1</sup> ..... feet..	200	18	14	25	8	11	12	12	60	12	20
15	Maximum of average depths of outlet ditches <sup>2</sup> ..... feet..	10.0	5.0	4.0	6.0	8.0	4.0	4.0	10.0	5.0	4.0	6.0
16	Mean depth of branch ditches <sup>3</sup> ..... feet..	3.8	3.4	4.0	5.2	3.0	3.6	4.0		3.5	3.5	4.0
Accessory levees and dikes:												
17	Completed..... miles..	59.8	15.0									
18	Additional under construction..... miles..											
19	Area drained by open ditches only <sup>3</sup> ..... acres..	1,617,933	285,927	36,426	202,556	16,000	48,250	9,600	56,000	36,915	93,911	238,266
20	Length of these ditches..... miles..	2,567.0	375.2	45.0	165.0	30.0	77.0	4.0	117.0	177.0	80.0	407.0
21	Average length per acre..... feet..	8.4	6.9	6.5	4.3	9.9	8.4	2.2	11.0	25.3	4.5	9.0
22	Area having open ditches and levees <sup>3</sup> ..... acres..	548,195	41,435									
23	Length of these ditches..... miles..	257.1	81.0									
24	Average length per acre..... feet..	2.5	10.3									
25	Length of the accessory levees..... miles..	59.8	15.0									
<b>DEVELOPMENT OF LAND.</b>												
26	Improved land in operating enterprises, 1920..... acres..	1,107,153	145,000	27,320	178,000	12,500	25,650	1,920	28,500	27,686	125,899	142,148
27	Improved land prior to drainage..... acres..	566,275	105,954	9,106	54,625	8,600	21,380	1,920	28,000	27,686	18,782	23,827
28	Increase since drainage..... acres..	540,878	39,046	18,214	23,375	3,900	4,270		500		7,117	118,321
29	Per cent of increase.....	95.5	36.9	200.0	42.8	45.3	20.0		1.8		37.9	496.6
30	Per cent increase is of all improved land in farms, 1920.....	1.7	23.6	34.0	28.1	7.8	2.5		1.7		25.5	54.6
31	Timber and cut-over land, 1920..... acres..	111,922	2,072			900	475					79,770
32	Timber and cut-over land prior to drainage..... acres..	116,642	2,072			2,000	475					79,770
33	Decrease since drainage..... acres..	4,720				1,100						
34	Per cent of decrease.....	4.0				55.0						
35	Other unimproved land, 1920..... acres..	947,053	180,290	9,106	124,556	2,600	22,125	7,680	27,500	9,229	68,012	16,348
36	Other unimproved land prior to drainage..... acres..	1,483,211	219,336	27,320	147,931	5,400	26,395	7,680	28,000	9,229	75,129	134,669
37	Decrease since drainage..... acres..	536,158	39,046	18,214	23,375	2,800	4,270		500		7,117	118,321
38	Per cent of decrease.....	36.1	17.8	66.7	15.8	51.9	16.2		1.8		9.5	87.9
39	Swampy or subject to overflow, 1920..... acres..	201,051	32,736	3,643	10,256	2,600	12,000		5,600	4,459	18,782	47,835
40	Swampy or subject to overflow prior to drainage..... acres..	1,000,442	130,046	18,213	48,738	18,300	24,020	5,760	14,000	27,686	56,947	152,321
41	Decrease since drainage..... acres..	799,391	98,210	14,570	38,482	10,700	12,020	5,760	8,400	23,227	37,565	104,456
42	Per cent of decrease.....	79.9	75.0	80.0	79.0	80.5	50.0	100.0	60.0	83.9	66.7	68.6
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
43	Total capital invested in and required for completion of operating enterprises..... dollars..	6,400,805	1,064,000	60,000	757,120	23,000	140,000	30,000	1,235,000	180,000	165,000	615,000
44	Capital invested in these enterprises to Dec. 31, 1919..... dollars..	5,700,805	1,064,000	60,000	757,120	23,000	40,000	30,000	635,000	180,000	165,000	615,000
45	Additional capital required to complete these enterprises..... dollars..	700,000					100,000		600,000			
46	Average cost per acre when completed..... dollars..	2.95	3.25	1.65	3.74	1.44	2.90	3.13	22.05	4.88	1.76	2.58
47	Enterprises constructing open ditches only..... dollars..	5,589,205	864,000	60,000	757,120	23,000	140,000	30,000	1,235,000	180,000	165,000	615,000
48	Average cost per acre when completed..... dollars..	3.45	3.02	1.65	3.74	1.44	2.90	3.13	22.05	4.88	1.76	2.58
49	Enterprises constructing open ditches and levees..... dollars..	811,600	200,000									
50	Average cost per acre when completed..... dollars..	1.48	4.83									
<b>CROPS.</b>												
Improved land in enterprises reporting—												
51	Corn as principal crop on drained land..... acres..	490,263	145,000	27,320			4,275					32,374
52	Cotton as principal crop on drained land..... acres..	350,518			81,020			1,920		27,686	25,899	109,774
53	Vegetables as principal crop on drained land..... acres..	145,703			46,950							
54	Alfalfa as principal crop on drained land..... acres..	28,500							28,500			
55	Other crops as principal ones on drained land..... acres..	92,171				12,500	21,875					

<sup>1</sup> Office estimate; the reported figures exceeded the improved acreage in all farms in the county as determined by the census of agriculture.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> The reported figures have been reduced by the same acreage as the improved land, 1920.

## DRAINAGE—TEXAS.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Hender-son.	Hidalgo.	Jackson.	Jeffer-son.	Liberty.	Mata-gorda.	Nucess.	Orange.	Victoria.	Ward.	Whar-ton.	
<b>LAND AREA.</b>												
1	Approximate land area of the county.....acres	605,440	1,042,560	571,520	588,800	742,400	727,040	496,000	232,320	569,600	529,280	711,680
2	All land in operating drainage enterprises.....acres	1,477	357,871	137,873	46,275	91,112	223,394	23,763	22,000	133,000	47,440	16,637
3	Improved land.....acres	977	<sup>1</sup> 98,723	96,265	20,824	57,863	167,218	9,505	6,800	102,750	<sup>1</sup> 17,664	14,141
4	Per cent of all improved land in farms.....	0.5	98.9	75.8	22.3	78.8	75.4	5.8	25.3	68.0	92.7	5.7
5	Timber and cut-over land.....acres	500		14,021	2,314	120	750		11,000			
6	Other unimproved land.....acres		269,148	27,587	23,187	33,129	55,426	14,258	4,400	30,250	29,776	2,496
7	Swampy, seeped, or alkali, in enterprises.....acres			6,451	4,628	4,532	27,065		5,500	13,300		1,664
8	Suffering a loss of crops from defective drainage.....acres			4,392	2,082	2,875	22,498		1,650	10,275		1,414
9	Assessed acreage.....	1,477	357,871	137,873	46,275	91,112	223,394	23,763	22,000	133,000	47,440	16,637
10	Excess over all land in operating enterprises.....acres											
<b>DRAINAGE WORKS.</b>												
11	Open ditches:											
12	Completed.....miles	2.9	25.0	537.5	15.0	125.1	210.4	55.0	30.0	195.0	49.0	21.0
13	Additional under construction.....miles											
14	Maximum completed in any enterprise.....miles	2.9	25.0	122.0	15.0	60.1	75.0	55.0	30.0	110.0	30.0	21.0
15	Maximum width at bottom of ditch <sup>1</sup> .....feet	20	200	20	60	30	12	12	10	12	6	8
16	Maximum of average depths of outlet ditches <sup>2</sup> .....feet	6.0	5.0	4.0	4.0	5.0	6.0	4.0	5.0	4.0	5.0	4.0
17	Mean depth of branch ditches <sup>2</sup> .....feet	6.0		3.0	3.0	3.9	4.0	4.0		3.3	5.0	3.0
18	Accessory levees and dikes:											
19	Completed.....miles	1.8	15.0	1.0			26.0		1.0			
20	Additional under construction.....miles											
21	Area drained by open ditches only <sup>3</sup> .....acres			114,873	46,275	91,112	120,982	23,763		133,000	47,440	16,637
22	Length of these ditches.....miles			460.5	15.0	125.1	169.2	55.0		165.0	49.0	21.0
23	Average length per acre.....feet			21.2	1.7	7.2	7.4	12.2		7.7	5.5	6.7
24	Area having open ditches and levees <sup>3</sup> .....acres	1,477	357,871	23,000			102,412		22,000			
25	Length of these ditches.....miles	2.9	25.0	77.0			41.2		30.0			
26	Average length per acre.....feet	10.4	0.4	17.7			2.1		7.2			
27	Length of the accessory levees.....miles	1.8	15.0	1.0			26.0		1.0			
<b>DEVELOPMENT OF LAND.</b>												
28	Improved land in operating enterprises, 1920.....acres	977	198,723	96,265	20,824	57,863	167,218	9,505	6,800	102,750	17,664	14,141
29	Improved land prior to drainage.....acres		<sup>4</sup> 62,935	21,345	11,569	11,518	81,736	5,941	2,200	53,500	7,332	8,319
30	Increase since drainage.....acres	977	35,788	74,920	9,255	46,345	85,482	3,564	4,400	49,250	10,332	5,822
31	Per cent of increase.....		56.9	351.0	80.0	402.4	104.6	60.0	200.0	92.1	140.9	70.0
32	Per cent increase is of all improved land in farms, 1920.....	0.5	35.9	59.0	9.9	63.1	38.6	2.2	16.9	32.8	54.2	2.4
33	Timber and cut-over land, 1920.....acres	500		14,021	2,314	120	750		11,000			
34	Timber and cut-over land prior to drainage.....acres	1,477		16,544	2,314	240	750		11,000			
35	Decrease since drainage.....acres	977		2,523		120						
36	Per cent of decrease.....	66.1		15.3		50.0						
37	Other unimproved land, 1920.....acres		259,148	27,587	23,137	33,129	55,426	14,258	4,400	30,250	29,776	2,496
38	Other unimproved land prior to drainage.....acres		294,936	99,984	32,392	79,354	140,908	17,822	8,800	79,500	40,108	8,318
39	Decrease since drainage.....acres		35,788	72,397	9,255	46,225	85,482	3,564	4,400	49,250	10,332	5,822
40	Per cent of decrease.....		12.1	72.4	28.6	58.3	60.7	20.0	50.0	61.9	25.8	70.0
41	Swampy or subject to overflow, 1920.....acres			6,451	4,628	4,532	27,065		5,500	13,300		1,664
42	Swampy or subject to overflow prior to drainage.....acres	1,477	35,787	110,989	23,137	82,001	131,858	3,564	15,400	57,200	35,220	12,478
43	Decrease since drainage.....acres	1,477	35,787	104,538	18,509	77,469	104,793	3,564	9,900	43,900	35,220	10,814
44	Per cent of decrease.....	100.0	100.0	94.2	80.0	94.5	79.5	100.0	64.3	76.7	100.0	86.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
45	Total capital invested in and required for completion of oper-ating enterprises.....dollars	45,000	176,000	453,452	92,000	157,500	675,824	158,429	24,600	215,880	83,000	50,000
46	Capital invested in these enterprises to Dec. 31, 1919.....dollars	45,000	176,000	453,452	92,000	157,500	675,824	158,429	24,600	215,880	83,000	50,000
47	Additional capital required to complete these enter-prises.....dollars											
48	Average cost per acre when completed.....dollars	30.47	0.49	3.29	1.99	1.73	3.08	6.67	1.12	1.62	1.75	3.01
49	Enterprises constructing open ditches only.....dollars			380,452	92,000	157,500	382,824	158,429		215,880	83,000	50,000
50	Average cost per acre when completed.....dollars			3.31	1.99	1.73	3.16	6.67		1.62	1.75	3.01
51	Enterprises constructing open ditches and levees.....dollars	45,000	176,000	73,000			293,000		24,600			
52	Average cost per acre when completed.....dollars	30.47	0.49	3.17			2.86		1.12			
<b>CROPS.</b>												
53	Improved land in enterprises reporting—											
54	Corn as principal crop on drained land.....acres			16,084		38,610	109,709			102,750		14,141
55	Cotton as principal crop on drained land.....acres	977		80,181			45,890	9,505			17,664	
56	Vegetables as principal crop on drained land.....acres		98,723									
57	Alfalfa as principal crop on drained land.....acres											
58	Other crops as principal ones on drained land.....acres				20,824	19,253	11,619		6,600			

<sup>1</sup> Office estimate; the reported figures exceeded the improved acreage in all farms in the county as determined by the census of agriculture.

<sup>2</sup> When works under construction have been completed.

<sup>3</sup> The reported figures have been reduced by the same acreage as the improved land, 1920.



## UTAH.

The following pages present the statistics of drainage for Utah collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of unimproved land not yet in farms. The

statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

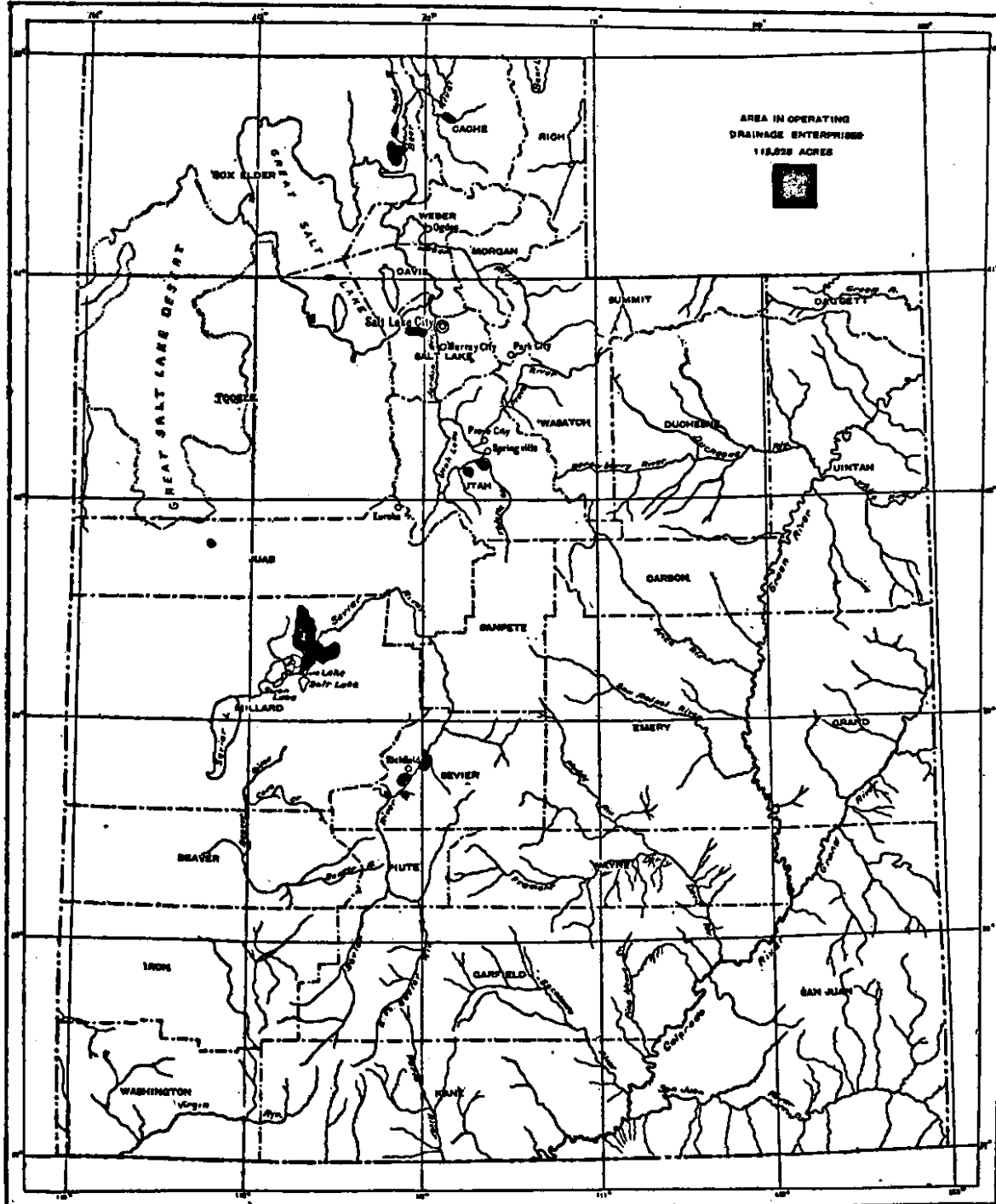
ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	25,662	100.0
Farms reporting land having drainage.....	2,729	10.6
Farms reporting land needing drainage.....	3,085	12.0
All land in farms..... acres..	5,050,410	100.0
Improved land in farms..... acres..	1,715,380	34.0
Farm land reported as provided with drainage..... acres..	74,316	1.5
Farm land reported as needing drainage..... acres..	165,926	3.3
Needing drainage only..... acres..	74,786	1.5
Needing drainage and clearing..... acres..	91,140	1.8
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	52,597,760	100.0
All land in operating drainage enterprises..... acres..	113,823	0.2
Improved land..... acres..	97,314	0.2
Per cent of all improved land in farms.....	5.7	
Unimproved land <sup>1</sup> ..... acres..	16,509	(?)
Swampy, subject to overflow, seeped, or alkali..... acres..	88,181	0.2
Suffering a loss of crops from defective drainage..... acres..	76,803	0.1
Improved land prior to drainage..... acres..	89,394	0.2
Increase since drainage began..... acres..	7,920	(?)
Land in nonoperating enterprises..... acres..	20,731	(?)
Open ditches in operating enterprises..... miles..	124.8	100.0
Completed..... miles..	120.3	96.4
Additional under construction..... miles..	4.5	3.6
Tile drains in operating enterprises..... miles..	1,376.7	100.0
Completed..... miles..	599.1	43.5
Additional under construction..... miles..	777.6	56.5
Total capital invested in and required for completion of operating enterprises..	\$2,870,773	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	1,005,473	35.0
Additional capital required to complete these enterprises.....	1,865,300	65.0
Average cost per acre when completed.....	25.22	

<sup>1</sup> No timber or cut-over land reported.

<sup>2</sup> Less than one-tenth of 1 per cent.

# UTAH

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



(874)

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago, but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by decree of the county commissioners and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	134,554	100.0	\$1,014,973	100.0	\$2,512,800
Operating enterprises.....	113,823	84.6	1,005,473	99.1	1,865,300
With works completed.....	23,993	17.8	495,007	48.8	
With works under construction.	89,830	66.8	510,466	50.3	1,865,300
Nonoperating enterprises.....	20,731	15.4	9,500	0.9	647,500

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—All of the drainage enterprises in Utah lie in the central and north central part of the state, and all are within the rim of the Great Basin.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	134,554	100.0	\$1,014,973	100.0	\$2,512,800
Operating enterprises.....	113,823	84.6	1,005,473	99.1	1,865,300
Sevier River.....	88,281	65.6	641,973	63.3	1,720,300
Great Salt Lake.....	25,542	19.0	363,500	35.8	145,000
Nonoperating enterprises.....	20,731	15.4	9,500	0.9	647,500
Sevier River.....	14,872	11.1	7,500	0.7	492,500
Great Salt Lake.....	5,859	4.3	2,000	0.2	155,000

Condition of land in enterprises.—The enterprises have been organized almost entirely to drain and pro-

tect land injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation.

For the state, 275 acres of irrigated land in drainage enterprises are reported as not having needed drainage but as having been included and assessed merely as being responsible for damage to the other lands.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	113,823	100.0	23,993	89,830	20,731
Improved land.....	97,314	85.5	18,349	78,965	17,876
Unimproved land <sup>1</sup> .....	16,509	14.5	5,644	10,865	3,055
Swampy, seeped, or alkali.....	88,181	77.5	6,476	81,705	20,809
Suffering a loss of crops.....	76,803	67.5	2,277	74,526	17,398

<sup>1</sup> No timber or cut-over land reported.

Size of enterprises.—The average area included in the 17 operating drainage enterprises in Utah is 6,695 acres; only 3 of them comprise as much as 10,000 acres each. The average area in the 6 nonoperating enterprises is 3,455 acres. None of the enterprises embraces land in more than one county, and there is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	113,823	113,823	100.0
500 to 999 acres.....	1,749	1,749	1.5
1,000 to 4,999 acres.....	29,104	29,104	25.6
5,000 to 9,999 acres.....	5,280	5,280	4.6
10,000 to 49,999 acres.....	77,690	77,690	68.3

Character of enterprises.—All the drainage enterprises in Utah, except commercial and private undertakings, are operating now (Jan. 1, 1920) under the

only general drainage law of the state. This is chapter 41, approved March 19, 1919, which was made applicable to all drainage districts formed under earlier laws.

This law provides for the establishment of drainage districts by the board of county commissioners, upon petition from a majority of the owners of land in the proposed district who must own at least one-third of the acreage to be affected, or from not less than one-third of the owners who must hold a majority of the acreage. The drainage works are laid out, constructed, and maintained by a board of supervisors consisting of three competent persons appointed by the county commissioners. The cost of the enterprise is apportioned against the tracts of land in the district by the supervisors, in proportion to the benefits each will receive, proper allowance being made also for any damages that will be caused. The supervisors report annually to the commissioners concerning all work done, all money collected, and all expenditures made; they also report semiannually at meetings of the residents of the district, during the progress of construction. For a district comprising land in more than one county, proceedings are held in that county in which the greatest portion is situated. No land in one drainage district may be included in a second district without the consent of the board of supervisors of the first district.

The petition must describe the boundaries of the district and state the general plan of drainage. The boundaries may be amended by the county commissioners when, after public hearing upon the petition, they establish the district and appoint the supervisors. Investigation is made by the supervisors, who then report to the commissioners regarding the practicability of the enterprise. If they report that the total cost will exceed the benefits, the district is abandoned at the cost of the petitioners. If they report favorably, the district boundaries are fixed by the commissioners, after public hearing if additional land is included except by consent of the owners of that land. The apportionment of costs is equalized and confirmed by the county commissioners, after hearing all complaints regarding the assessments. The supervisors may issue bonds to pay for the construction work, running not less than 5 nor more than 40 years, if the issue is approved by vote of the landowners in the district.

The first general drainage law of this state was that of April 16, 1896 (ch. 132), authorizing the establishment of drainage districts upon petition from 50 or more persons, constituting a majority of the owners of the land to be affected. The districts were to be controlled by 3 or 5 directors elected by the freeholders of the district; the costs were to be paid by an assessment spread uniformly upon all the land in the district. This law was amended March 14, 1907 (ch. 108), to require that the petition be signed by only a majority of the owners holding title to a major part

of the land, and to apportion the cost in proportion to the benefits. The supreme court of Utah declared this law unconstitutional, in 1911, because it did not provide opportunity for the owners to show that their land would not be benefited or was not assessed equitably. The main provisions of the law of March 21, 1913 (ch. 95), which was amended March 22, 1915 (ch. 114), were similar to those of the present law.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	134,554	100.0	\$1,014,973	100.0	\$2,512,800
Operating enterprises.....	113,823	84.6	1,005,473	99.1	1,865,300
Drainage districts.....	105,519	78.4	776,516	76.5	1,865,300
Laws of 1907, ch. 108.....	750	0.6	3,500	0.3	.....
Laws of 1913, ch. 95.....	102,341	76.0	708,016	69.8	1,813,300
Laws of 1919, ch. 41.....	2,428	1.8	65,000	6.4	52,000
Commercial developments <sup>1</sup> .....	8,304	6.2	228,957	22.6	.....
Nonoperating enterprises.....	20,731	15.4	9,500	0.9	647,500
Drainage districts.....	20,731	15.4	9,500	0.9	647,500
Laws of 1913, ch. 95.....	16,219	12.0	7,000	0.7	480,000
Laws of 1919, ch. 41.....	4,512	3.4	2,500	0.2	187,500

<sup>1</sup> Includes 1,050 acres under individual ownership.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 120.3 miles of open ditches, 599.1 miles of tile drains, and 2 miles of accessory levees; the additional lengths under construction were 4.5 miles of open ditches and 777.6 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. Some of the districts, however, are installing drainage systems planned in such detail as is intended to accomplish complete drainage of the land without requiring any supplemental drains to be installed by the individual owners. Pumping is used for draining only 1,400 acres in drainage enterprises in Utah, and then only part time, in seasons of flood.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	113,823	100.0	\$1,005,473	100.0	\$1,865,300
Open ditches only.....	1,050	0.9	10,000	1.0	.....
Tile drains only.....	4,321	3.8	113,550	11.3	27,500
Open ditches and tile drains <sup>1</sup> .....	108,452	96.3	881,923	87.7	1,837,800

<sup>1</sup> Includes 2,700 acres having open ditches, tile drains, and levees.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	113,823	100.0
3.0 to 3.9 feet.....	1,050	0.9
4.0 to 4.9 feet.....	18,590	11.9
5.0 to 5.9 feet.....	4,554	4.0
6.0 to 6.9 feet.....	79,210	69.6
7.0 to 7.9 feet.....	3,022	2.7
Not reporting branches.....	12,397	10.9

Maintenance of works.—The first drainage law of Utah (1896) authorized the levy of taxes in a drainage district for maintenance purposes. The present law (1919) repeats the provision in earlier laws that the board of supervisors shall make annually an estimate of the money to be raised in the district, including the expense of maintaining the drains and other works, which is levied against the land in proportion to the benefits to the various tracts. The drainage districts that have completed construction report that the drains are maintained by district forces, except for one small district which reports that the drains are not being maintained.

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the begin-

ning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		ASSESSED AREA.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	113,823	100.0	113,823	100.0
1905 to 1909.....	750	0.7	750	0.7
1910 to 1914.....	9,380	8.2	9,380	8.2
1915 to 1919.....	103,693	91.1	103,693	91.1

TABLE 10.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,005,473	100.0	\$1,865,300
1905 to 1909.....	3,500	0.3	.....
1910 to 1914.....	120,000	12.0	150,000
1915 to 1919.....	881,973	87.7	1,715,300

TABLE 11.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees....	124.8	100.0	1,376.7	100.0	2.0	100.0
1905 to 1909.....	.....	.....	0.6	0.1	.....	.....
1910 to 1914.....	15.2	12.2	63.5	4.6	.....	.....
1915 to 1919.....	109.6	87.8	1,312.6	95.3	2.0	100.0

Crops.—The principal crops grown upon the drained land in drainage enterprises are alfalfa, sugar beets, grain, and hay other than alfalfa. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

## DRAINAGE—UTAH.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Box Elder.	Cache.	Carbon.	Davis.	Duchesne.	Juab.	
1	Number of all farms in the state or county .....	25,662	1,859	2,242	235	1,172	1,248	419	
2	Farms reporting land having drainage.....	2,729	502	164	12	338	16	14	
3	Farms reporting land needing drainage.....	3,085	174	198	19	206	254	11	
4	Farms in drainage and levee districts.....	791	151	43		8	14		
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county.....acres..	52,597,760	3,484,160	744,960	951,680	176,000	2,090,240	2,176,640	
6	All land in farms.....acres..	5,050,410	642,348	317,698	36,899	98,732	252,081	106,741	
7	Improved land in farms.....acres..	1,715,380	219,657	183,654	12,117	52,029	96,697	49,751	
8	Woodland in farms.....acres..	212,762	11,047	25,373	2,312	6,320	12,006	3,659	
9	Other unimproved land in farms.....acres..	3,122,268	311,644	108,671	21,470	40,383	143,328	52,331	
10	Farm land reported as provided with drainage.....acres..	74,316	24,242	8,541	877	5,816	803	873	
11	Farm land reported as needing drainage.....acres..	165,926	20,153	3,854	617	5,502	9,738	541	
12	Drainage only.....acres..	74,786	17,880	3,671	128	5,328	5,988	231	
13	Drainage and clearing.....acres..	91,140	2,273	183	489	174	2,750	310	
		Millard.	Salt Lake.	Sanpete.	Sevier.	Summit.	Utah.	Weber.	All other counties. <sup>1</sup>
1	Number of all farms in the county .....	1,038	2,438	1,813	1,108	521	3,237	1,687	6,645
2	Farms reporting land having drainage.....	86	254	70	239	12	506	436	80
3	Farms reporting land needing drainage.....	702	245	200	113	128	444	329	662
4	Farms in drainage and levee districts.....	57	94	35	187	1	127	57	17
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	4,199,040	483,840	1,034,240	1,265,920	1,196,800	1,301,760	346,240	33,146,240
6	All land in farms.....acres..	185,197	317,281	291,007	113,005	271,778	318,133	259,566	1,841,994
7	Improved land in farms.....acres..	91,685	92,447	138,552	66,960	38,807	135,996	66,855	470,173
8	Woodland in farms.....acres..	1,502	24,913	12,154	2,808	26,268	7,043	12,924	64,435
9	Other unimproved land in farms.....acres..	92,010	199,921	240,301	43,237	206,705	175,094	179,787	1,307,386
10	Farm land reported as provided with drainage.....acres..	5,274	3,483	785	7,822	768	10,070	7,266	2,590
11	Farm land reported as needing drainage.....acres..	8,714	9,677	7,540	4,110	3,821	10,738	8,091	72,830
12	Drainage only.....acres..	4,493	3,630	6,089	3,946	761	8,656	4,434	9,551
13	Drainage and clearing.....acres..	4,221	6,047	1,451	164	3,060	2,082	3,657	63,279

<sup>1</sup> No drainage on farms reported in Grand, Piute, Rich, and Wayne Counties.

# DRAINAGE—UTAH.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Box Elder.	Millard.	Salt Lake.	Sevier.	Other counties. <sup>1</sup>
<b>LAND AREA.</b>							
1	Approximate land area of the state or county.....acres.....	52,597,760	3,494,160	4,199,040	483,840	1,265,920	2,046,720
2	All land in operating drainage enterprises.....acres.....	113,823	12,690	76,634	4,080	11,647	8,772
3	Improved land.....acres.....	97,314	7,245	76,634	200	6,485	6,750
4	Per cent of all improved land in farms.....	5.7	8.3	83.5	0.2	9.7	2.1
5	Unimproved land.....acres.....	16,509	5,445	.....	3,880	5,162	2,022
6	Swampy, seeped, or alkali, in enterprises.....acres.....	88,181	4,000	74,357	3,880	3,922	2,022
7	Suffering a loss of crops from defective drainage.....acres.....	76,803	.....	74,357	200	1,246	1,000
8	Assessed acreage.....	113,823	12,690	76,634	4,080	11,647	8,772
9	Excess over all land in operating enterprises.....acres.....	.....	.....	.....	.....	.....	.....
<b>DRAINAGE WORKS.</b>							
Open ditches:							
10	Completed.....miles.....	120.3	15.0	89.6	0.5	1.2	14.0
11	Additional under construction.....miles.....	4.5	.....	.....	4.5	.....	.....
12	Maximum completed in any enterprise.....miles.....	58.8	8.0	58.8	0.5	1.0	7.0
13	Maximum width at bottom of ditch.....feet.....	24	20	24	12	6	8
14	Maximum of average depths of outlet ditches.....feet.....	16.0	15.0	7.0	3.5	6.0	7.0
15	Mean depth of branch ditches.....feet.....	5.7	3.9	5.9	6.0	.....	5.7
Tile drains:							
16	Completed.....miles.....	599.1	206.6	67.0	.....	81.5	74.0
17	Additional under construction.....miles.....	777.6	.....	653.0	55.0	38.1	31.5
18	Maximum completed in any enterprise.....miles.....	206.0	206.0	92.0	.....	42.0	.....
19	Maximum size of tile.....inches.....	24	18	20	.....	24	.....
Accessory levees and dikes:							
20	Completed.....miles.....	2.0	.....	.....	.....	.....	2.0
21	Additional under construction.....miles.....	.....	.....	.....	.....	.....	.....
22	Area drained by open ditches only.....acres.....	1,050	1,050	.....	.....	.....	.....
23	Length of these ditches.....miles.....	7.0	7.0	.....	.....	.....	.....
24	Average length per acre.....feet.....	35.2	35.2	.....	.....	.....	.....
25	Area drained by tile only.....acres.....	4,321	750	.....	.....	3,571	.....
26	Length of these tile.....miles.....	38.2	0.6	.....	.....	37.6	.....
27	Average length per acre.....feet.....	46.7	4.2	.....	.....	55.6	.....
28	Area drained by open ditches and tile.....acres.....	4,108,452	10,890	76,634	4,080	8,076	4,872
29	Length of these drains.....miles.....	1,456.3	214.0	979.6	5.0	83.2	174.5
30	Average length per acre.....feet.....	70.9	103.8	67.5	6.5	54.4	151.7
31	Length of the accessory levees.....miles.....	2.0	.....	.....	.....	.....	2.0
<b>DEVELOPMENT OF LAND.</b>							
32	Improved land in operating enterprises, 1920.....acres.....	97,314	7,245	76,634	200	6,485	6,750
33	Improved land prior to drainage.....acres.....	89,394	2,889	76,634	200	6,351	8,320
34	Increase since drainage.....acres.....	7,920	4,356	.....	.....	134	3,430
35	Per cent of increase.....	8.9	150.7	.....	.....	2.1	163.3
36	Per cent increase is of all improved land in farms, 1920.....	0.5	2.0	.....	.....	0.2	1.1
37	Unimproved land, 1920.....acres.....	16,509	5,445	.....	3,880	5,162	2,022
38	Unimproved land prior to drainage.....acres.....	24,429	9,601	.....	3,880	5,296	5,452
39	Decrease since drainage.....acres.....	7,920	4,356	.....	.....	134	3,430
40	Per cent of decrease.....	32.4	44.4	.....	.....	2.5	62.9
41	Swampy, seeped, or alkali, 1920.....acres.....	88,181	4,000	74,357	3,880	3,922	2,022
42	Swampy, seeped, or alkali prior to drainage.....acres.....	104,592	9,800	76,634	3,880	5,776	8,502
43	Decrease since drainage.....acres.....	16,411	5,800	2,277	.....	1,854	6,480
44	Per cent of decrease.....	15.7	59.2	3.0	.....	32.1	76.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>							
45	Total capital invested in and required for completion of operating enterprises.....dollars.....	2,870,773	188,500	2,028,957	80,000	333,316	240,000
46	Capital invested in these enterprises to Dec. 31, 1919.....dollars.....	1,005,473	188,500	428,157	5,000	213,816	170,000
47	Additional capital required to complete these enterprises.....dollars.....	1,865,300	.....	1,600,800	75,000	119,500	70,000
48	Average cost per acre when completed.....dollars.....	25.22	14.85	26.48	19.61	28.62	27.36
49	Enterprises constructing open ditches only.....dollars.....	10,000	10,000	.....	.....	.....	.....
50	Average cost per acre when completed.....dollars.....	9.52	9.52	.....	.....	.....	.....
51	Enterprises constructing tile drains only.....dollars.....	141,050	3,500	.....	.....	137,550	.....
52	Average cost per acre when completed.....dollars.....	32.64	4.67	.....	.....	38.52	.....
53	Enterprises constructing open ditches and tile drains.....dollars.....	2,719,723	175,000	2,028,957	80,000	195,766	240,000
54	Average cost per acre when completed.....dollars.....	25.08	16.07	26.48	19.61	24.24	27.36
<b>CROPS.</b>							
Improved land in enterprises reporting—							
55	Alfalfa as principal crop on drained land.....acres.....	80,884	.....	76,634	200	.....	4,050
56	Sugar beets as principal crop on drained land.....acres.....	14,630	5,445	.....	.....	6,485	2,700
57	Other crops as principal ones on drained land.....acres.....	1,800	1,800	.....	.....	.....	.....

<sup>1</sup> Includes only Cache and Utah Counties.  
<sup>2</sup> No timber or cut-over land reported.  
<sup>3</sup> When works under construction have been completed.  
<sup>4</sup> Includes 2,700 acres having open ditches, tile drains, and levees.  
<sup>5</sup> Includes cost of 2 miles of accessory levees.

## WASHINGTON.

The following tables present the statistics of drainage for Washington collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	66,288	100.0
Farms reporting land having drainage.....	10,020	15.1
Farms reporting land needing drainage.....	14,823	21.6
All land in farms..... acres.....	13,244,720	100.0
Improved land in farms..... acres.....	7,129,848	53.8
Farm land reported as provided with drainage..... acres.....	274,696	2.1
Farm land reported as needing drainage..... acres.....	576,005	4.3
Needing drainage only..... acres.....	45,206	0.3
Needing drainage and clearing..... acres.....	530,799	4.0
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres.....	42,775,040	100.0
All land in operating drainage enterprises..... acres.....	94,924	0.2
Improved land..... acres.....	81,836	0.2
Per cent of all improved land in farms.....	1.1	.....
Timber and cut-over land..... acres.....	850	(1)
Other unimproved land..... acres.....	12,188	(1)
Swampy, subject to overflow, seeped, or alkali..... acres.....	10,873	(1)
Suffering a loss of crops from defective drainage..... acres.....	8,996	(1)
Improved land prior to drainage..... acres.....	49,748	0.1
Increase since drainage began..... acres.....	32,138	0.1
Land in nonoperating enterprises..... acres.....	4,865	(1)
Open ditches in operating enterprises..... miles.....	169.8	100.0
Completed..... miles.....	162.4	95.6
Additional under construction..... miles.....	7.4	4.4
Tile drains in operating enterprises..... miles.....	83.7	100.0
Completed..... miles.....	83.0	99.2
Additional under construction..... miles.....	0.7	0.8
Total capital invested in and required for completion of operating enterprises.....	\$1,436,419	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	1,397,419	97.3
Additional capital required to complete these enterprises.....	39,000	2.7
Average cost per acre when completed.....	15.13	.....

(1) Less than one-tenth of 1 per cent.





Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These include both those which have completed their drainage works and those with such works under construction. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to finance the undertakings, and let contracts for the construction work, and also districts for which decree of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	99,789	100.0	\$1,442,419	100.0	\$114,000
Operating enterprises.....	94,924	95.1	1,397,419	96.9	39,000
With works completed.....	90,094	90.3	1,376,809	95.5	.....
With works under construction.....	4,840	4.8	20,610	1.4	39,000
Nonoperating enterprises.....	4,865	4.9	45,000	3.1	75,000

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The great part of the drainage enterprises lies in the Yakima Valley, in the south central part of the state, though there are some enterprises to drain lands subject to overflow along Clark Fork and Colville River in the northeast corner and a very few to drain wet and swampy lands in the south and southwest parts of the state. There are no drainage enterprises in the region tributary to Puget Sound.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	99,789	100.0	\$1,442,419	100.0	\$114,000
Operating enterprises.....	94,924	95.1	1,397,419	96.9	39,000
Pacific Ocean.....	4,200	4.2	37,044	2.6	10,000
Columbia River and Snake River.....	30,965	31.0	336,800	23.3	.....
Yakima River.....	59,759	59.9	1,023,375	71.0	29,000
Non operating enterprises.....	4,865	4.9	45,000	3.1	75,000
Yakima River.....	4,865	4.9	45,000	3.1	75,000

Condition of land in enterprises.—All the enterprises in Benton and Yakima Counties are within the boundaries of the United States Reclamation Service projects. They are for the drainage and protection of lands injured or threatened with seepage and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation.

In Benton County, 5,800 acres of irrigated land in drainage enterprises are reported as not having needed drainage, but as having been included and assessed merely as responsible for damage to the other lands.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	94,924	100.0	90,094	4,840	4,865
Improved land.....	81,886	86.3	78,271	3,615	3,174
Timber and cut-over land.....	850	0.9	250	600	.....
Other unimproved land.....	12,188	12.8	11,563	625	1,691
Swampy, seeped, or alkali.....	10,873	11.5	9,743	1,130	1,416
Suffering a loss of crops.....	8,996	9.5	7,971	1,025	.....

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 52 operating drainage enterprises are counted in Washington, with an average area of 2,029 acres assessed. Just 26 of them comprise between 1,000 and 5,000 acres each. The assessed acreage exceeds the land in enterprises by 10,553 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprise.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	94,924	105,477	100.0
Less than 200 acres.....	.....	322	0.3
200 to 499 acres.....	822	1,625	1.5
500 to 999 acres.....	6,830	9,161	8.7
1,000 to 4,999 acres.....	45,723	52,820	50.1
5,000 to 9,999 acres.....	19,649	19,649	18.6
10,000 to 49,999 acres.....	21,900	21,900	20.8

**Character of enterprises.**—The drainage enterprises in Washington are known as drainage districts, diking and drainage districts, and drainage improvement districts, varying slightly in character but all organized under general drainage laws of the state.

Drainage districts are incorporated under an act of March 20, 1895 (ch. 115), and may comprise any portion of a county having five or more inhabitants or freeholders. They are established by the county commissioners upon petition from owners of a major part of the acreage and after favorable vote of the qualified voters residing in the proposed district. Each district must be conducive to the public health, convenience, and welfare; must increase the public revenue; must have sufficient outlet for drainage; and must cost less than the estimated benefits to be derived. A board of three elected drainage commissioners has exclusive charge of construction and maintenance for all drainage systems within the district. The cost of the enterprise is apportioned against the land in proportion to benefits. The plan of drainage and the assessments of benefits and damages to each landowner are prepared by the drainage commissioners and are submitted to the superior court of the county with petition that the works be constructed. After public hearing the benefits and damages are determined by jury, subject to appeal to the supreme court of the state. The district may issue bonds for 5 to 10 years upon petition from a majority of the landowners.

Diking and drainage districts, comprising portions of two or more counties and containing 100 or more inhabitants, are formed under an act of March 20, 1909 (ch. 225). Each is established by the state commissioner of public lands and the commissioners of the counties affected in joint meeting. The districts must be conducive to the public health, convenience, and welfare; must increase the public revenue; and must be of benefit to a majority of the land included. The petition for establishment must be signed by 100 freeholders in the proposed district or by a majority in each county when the total number is less than 200. The enterprise must be approved

in each county by vote of the qualified electors resident in the district. The cost of the undertaking is assessed against the land in proportion to the benefits that will be derived. A board of five elected district commissioners prepares the plan of drainage, makes the assessments, and secures construction of the works. Appeals regarding assessments may be taken to the superior court of the county and thence to the supreme court of the state. Bonds may be issued by the district for not exceeding 10 years.

The drainage improvement districts have been organized under acts of March 8, 1901 (ch. 66), and March 24, 1913 (ch. 176), when the landowners did not wish to incorporate as drainage districts or were too few. The later act repealed the earlier one. These districts are established by the county commissioners, who are the executive board for all such districts in the county. Petition for establishment may be made by one landowner, and the county engineer must report that the proposed work is feasible. The drainage plan, estimate of cost, and schedule of property that will be damaged are made by the county engineer, subject to modification by the commissioners at public hearing. If an award of damages is not acceptable to the landowner, condemnation proceedings are instituted. After the drainage works are constructed the cost is apportioned against all property benefited, including cities and irrigation systems, in proportion to the benefits. For a district in more than one county the petition is filed in each county; the engineers examine the project together, but report separately for their respective counties; the hearings are held and contracts are let by the boards of county commissioners acting jointly.

No enterprises were reported as diking districts, established under the act of 1895 (ch. 117), or as local improvement districts within irrigation districts under an act of 1917 (ch. 162). The diking districts, similar to drainage districts in method of organization, in 1907 were authorized to improve water courses flowing through or within the districts, and to construct all ditches necessary to protect the land or preserve the dikes. The local improvement districts may be established by the directors of the irrigation districts for drainage or other local improvements. A petition must be signed by the holders of title to one-fourth the acreage to be assessed. The enterprise will be managed by the directors of the irrigation district, and the cost assessed against the land in proportion to benefits.

Private drains may be established by the superior court of any county under an act of March 14, 1899 (ch. 125), when one landowner can not secure drainage except across the land of an objecting owner. After

investigation by the county surveyor and two other viewers, public hearing is held and the court awards damages which must be paid by the petitioners before beginning construction. An act of March 20, 1913 (ch. 133), provides that one owner may secure a private way of necessity across land of another by proceedings the same as for condemnation of private property by railroads.

The many amendments to the drainage laws enumerated, dealing with the details of procedure, powers of officials, extension and abandonment of drainage enterprises, are not mentioned herein and do not affect the types of organization as described above. All state, school, and granted lands are subject to assessment for drainage improvements like other lands.

Washington Territory was organized in 1854, and was admitted as a state in 1889. In 1858 a law was passed generally similar to that of 1899 for establishing private ditches. Acts of 1875 and 1883 were somewhat similar to the act of 1913 for drainage improvement districts. The first state legislature enacted a drainage law (approved Mar. 19, 1890) generally similar to that of 1913 authorizing drainage improvement districts. This was declared unconstitutional by the supreme court of the state in 1893 and 1894, as providing for taking private property without just compensation.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	99,789	100.0	\$1,442,419	100.0	\$114,000
Operating enterprises.....	94,924	95.1	1,397,419	96.9	39,000
Drainage districts.....	29,100	29.1	161,634	11.2	.....
Diking and drainage districts..	5,000	5.0	48,500	3.4	.....
Drainage improvement districts.....	60,824	67.0	1,187,285	82.3	39,000
Law of 1901.....	31,991	32.1	342,194	23.7	.....
Law of 1913 <sup>1</sup> .....	28,833	34.9	845,091	58.6	39,000
Nonoperating enterprises.....	4,865	4.9	45,000	3.1	75,000
Drainage improvement districts.....	4,865	4.9	45,000	3.1	75,000

<sup>1</sup> Includes 1,100 acres under individual ownership.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 162.4 miles of open ditches and 83 miles of tile drains. The additional lengths under construction were 7.4 miles of open ditches, 0.7 mile of tile drains, and 1 mile of accessory levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or

tile drains. There are no pumping districts among the operating drainage enterprises in Washington, though there are 2,745 acres in nonoperating enterprises that will be drained, according to the plans, partly by gravity and partly by pumping.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	94,924	100.0	\$1,397,419	100.0	\$39,000
Open ditches only <sup>1</sup> .....	64,405	67.8	592,445	42.4	12,000
Open ditches and tile drains.....	25,147	26.5	612,659	43.5	27,000
Tile drains only.....	5,372	5.7	192,315	13.8	.....

<sup>1</sup> Includes 1,000 acres that will have open ditches and levees.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would show the mean depth for the state 5.3 instead of 5.4 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	94,924	100.0
Less than 3 feet.....	553	0.6
3.0 to 3.9 feet.....	7,358	7.7
4.0 to 4.9 feet.....	9,263	9.8
5.0 to 5.9 feet.....	13,147	13.7
6.0 to 6.9 feet.....	23,523	24.9
7.0 to 7.9 feet.....	10,262	10.8
Not reporting branches.....	30,818	32.5

Maintenance of works.—The commissioners of the drainage districts are required by law to make an estimate each year of the expense for maintenance and repair of the drainage system during the succeeding year, which is assessed against the lands in the district in like proportion as the original assessment of

benefits. The commissioners of diking and drainage districts are required to levy an annual tax upon all the property in the district for maintenance of the improvement works, to be levied and collected in like manner as provided by law for levying and collecting school district taxes. The supervisors of drainage improvement districts must make annually an estimate of maintenance expenses, from which the county commissioners levy the assessment apportioned in the same manner as that to pay the cost of construction, though the basis of apportionment may be changed by the commissioners upon petition and after public hearing. The works of each local improvement district are kept in repair by the directors of the irrigation district the same as the irrigation works, but the expenses are paid from the operation and maintenance fund of that local improvement district, which is provided by special assessment against the lands in the local improvement district. No maintenance was reported for some completed districts established under laws requiring the officials to keep the drains in repair. Possibly this is due to the construction work being completed so recently that no expenses have been incurred for repair work.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	94,924	100.0	\$1,397,419	100.0	\$39,000
By district forces.....	85,829	90.5	1,224,419	87.6	39,000
No maintenance provided <sup>1</sup> .....	9,095	9.5	173,000	12.4	.....

<sup>1</sup> Includes 1,100 acres maintained by landowners.

**Date of organization.**—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was com-

pleted. No drainage enterprises were reported as organized in Washington earlier than 1900.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	94,924	100.0	105,477	100.0
1900 to 1904.....	3,200	3.4	3,200	3.0
1905 to 1909.....	39,966	42.1	39,966	37.9
1910 to 1914.....	30,761	32.4	35,304	33.5
1915 to 1919.....	14,497	15.3	20,507	19.4
Not reported.....	6,500	6.8	6,500	6.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,397,419	100.0	\$39,000
1900 to 1904.....	26,634	1.9	.....
1905 to 1909.....	352,850	25.2	.....
1910 to 1914.....	594,937	42.6	.....
1915 to 1919.....	382,998	27.4	39,000
Not reported.....	40,000	2.9	.....

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1900 to 1904.....	4.5	2.7	.....	.....	.....	.....
1905 to 1909.....	65.8	38.8	6.0	7.2	.....	.....
1910 to 1914.....	69.5	40.3	38.9	46.5	.....	.....
1915 to 1919.....	26.0	15.3	38.8	46.3	1.0	100.0
Not reported.....	5.0	2.9	.....	.....	.....	.....

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are alfalfa, hay other than alfalfa, and wheat. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—WASHINGTON.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adams.	Chelan.	Clallam.	Clarke.	Cowlitz.	Grant.	Grays Harbor.
1	Number of all farms in the state or county.....	66,288	1,064	2,095	607	3,066	1,066	1,110	1,064
2	Farms reporting land having drainage.....	10,020	2	42	167	275	89	6	93
3	Farms reporting land needing drainage.....	14,323	2	116	337	630	582	10	245
4	Farms in drainage and levee districts.....	2,680	4	11	2	26	56	1	5
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	42,775,040	1,223,680	1,856,000	1,104,640	405,760	737,920	1,740,800	1,196,160
6	All land in farms..... acres..	13,244,720	938,395	235,621	58,043	194,309	110,259	743,518	94,767
7	Improved land in farms..... acres..	7,139,843	727,876	65,810	20,132	75,673	27,994	413,758	28,798
8	Woodland in farms..... acres..	1,813,061	2,243	55,817	29,776	66,974	46,604	6,305	48,402
9	Other unimproved land in farms..... acres..	4,302,816	208,276	113,994	8,135	51,662	35,661	323,455	22,567
10	Farm land reported as provided with drainage..... acres..	274,696	1,260	947	3,563	5,035	5,179	815	1,578
11	Farm land reported as needing drainage..... acres..	676,005	225	3,836	18,799	37,875	28,547	855	10,060
12	Drainage only..... acres..	45,206	105	348	1,838	2,065	2,320	550	1,344
13	Drainage and clearing..... acres..	630,799	130	3,488	16,961	35,810	26,127	805	8,716
		Island.	Jefferson.	King.	Kitsap.	Kititas.	Klickitat.	Lewis.	Lincoln.
1	Number of all farms in the county.....	763	348	3,801	1,535	928	1,177	3,030	1,860
2	Farms reporting land having drainage.....	271	92	1,048	541	129	45	653	33
3	Farms reporting land needing drainage.....	296	118	1,156	612	196	89	1,261	38
4	Farms in drainage and levee districts.....	53	4	192	44	2	23	24	7
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	123,120	1,155,200	1,351,040	237,440	1,490,560	1,168,600	1,516,160	1,473,280
6	All land in farms..... acres..	61,932	35,917	151,562	43,835	215,918	562,331	226,162	1,329,405
7	Improved land in farms..... acres..	17,127	6,457	68,272	13,411	65,984	190,516	79,322	532,678
8	Woodland in farms..... acres..	25,868	17,903	47,391	22,856	35,074	89,044	89,231	64,578
9	Other unimproved land in farms..... acres..	8,937	9,557	35,899	7,618	83,860	282,671	57,599	432,149
10	Farm land reported as provided with drainage..... acres..	6,791	3,218	20,177	3,259	4,027	3,950	16,838	1,805
11	Farm land reported as needing drainage..... acres..	11,183	10,728	29,206	8,547	10,274	5,141	64,323	2,519
12	Drainage only..... acres..	2,379	758	3,537	798	1,881	1,211	2,065	1,358
13	Drainage and clearing..... acres..	8,804	9,970	25,669	7,749	8,393	3,930	52,263	1,161
		Mason.	Okanogen.	Pacific.	Pend Oreille.	Pierce.	San Juan.	Skagit.	Snohomish.
1	Number of all farms in the county.....	483	2,856	453	586	3,159	535	2,401	3,095
2	Farms reporting land having drainage.....	115	43	131	75	948	209	849	945
3	Farms reporting land needing drainage.....	207	321	215	301	1,028	214	615	1,185
4	Farms in drainage and levee districts.....		2	54	34	142	1	513	240
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	595,200	3,341,440	572,800	871,040	1,088,640	113,920	1,135,880	1,320,660
6	All land in farms..... acres..	40,807	639,786	48,804	119,496	118,754	68,513	136,350	151,594
7	Improved land in farms..... acres..	6,373	212,497	10,509	42,921	41,953	18,922	73,243	53,410
8	Woodland in farms..... acres..	22,946	113,747	19,058	59,103	40,328	30,859	85,789	53,727
9	Other unimproved land in farms..... acres..	9,548	303,653	19,237	17,472	36,473	18,732	24,338	44,447
10	Farm land reported as provided with drainage..... acres..	1,805	907	3,186	2,551	13,322	5,915	37,694	18,539
11	Farm land reported as needing drainage..... acres..	10,970	15,201	12,874	25,959	21,694	11,570	19,790	32,349
12	Drainage only..... acres..	504	906	1,627	1,265	2,272	967	2,177	2,625
13	Drainage and clearing..... acres..	10,166	14,295	11,247	24,704	19,422	10,903	17,613	29,724
		Spokane.	Stevens.	Thurston.	Wahkium.	Walla Walla.	Whitcomb.	Yakima.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	4,830	2,727	1,490	373	1,502	3,369	5,755	9,140
2	Farms reporting land having drainage.....	295	194	194	128	39	960	1,330	49
3	Farms reporting land needing drainage.....	658	850	412	129	30	1,861	122	232
4	Farms in drainage and levee districts.....	30	45	68	86	17	109	876	10
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	1,123,840	1,603,200	453,760	170,880	809,600	1,332,480	3,237,760	8,214,400
6	All land in farms..... acres..	811,205	472,490	140,040	33,209	703,251	177,742	479,629	4,060,965
7	Improved land in farms..... acres..	449,637	139,391	45,953	8,577	474,161	73,673	261,866	2,548,449
8	Woodland in farms..... acres..	207,468	245,844	48,438	16,294	14,120	56,695	15,224	186,425
9	Other unimproved land in farms..... acres..	154,201	87,255	45,649	8,338	214,970	47,474	202,539	1,326,091
10	Farm land reported as provided with drainage..... acres..	16,375	7,685	4,852	3,044	1,468	23,316	54,558	1,036
11	Farm land reported as needing drainage..... acres..	25,235	73,681	17,726	2,938	546	61,233	2,894	9,305
12	Drainage only..... acres..	1,689	1,307	2,163	412	251	2,998	912	594
13	Drainage and clearing..... acres..	23,546	72,374	15,565	2,526	295	58,235	1,982	8,711

<sup>1</sup>No drainage reported in Asotin, Douglas, Franklin, Garfield, and Skamania Counties.

DRAINAGE—WASHINGTON.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Benton.	Klickitat.	Pacific.	Stevens.	Yakima.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>								
1	Approximate land area of the state or county.....acres..	42,775,040	1,069,440	1,168,000	572,800	1,603,200	3,237,760	2,347,520
2	All land in operating drainage enterprises.....acres..	94,924	10,340	4,965	4,200	15,000	55,919	4,500
3	Improved land.....acres..	81,886	9,715	4,468	2,960	13,750	47,593	3,400
4	Per cent of all improved land in farms.....	1.1	4.8	2.3	28.2	9.9	18.2	0.3
5	Timber and cut-over land.....acres..	850			600	250		
6	Other unimproved land.....acres..	12,188	625	497	640	1,000	8,326	1,100
7	Swampy, seeped, or alkali, in enterprises.....acres..	10,873	914	497	640	1,000	7,222	600
8	Suffering a loss of crops from defective drainage.....acres..	8,996	725		600	938	6,733	
9	Assessed acreage.....	105,477	10,340	4,965	3,200	15,000	66,472	5,500
10	Excess over all land in operating enterprises.....acres..	10,553					10,553	
<b>DRAINAGE WORKS.</b>								
11	Open ditches:							
12	Completed.....miles..	162.4	7.9	12.0	4.5	26.0	86.5	25.5
13	Additional under construction.....miles..	7.4	3.9					3.5
14	Maximum completed in any enterprise.....miles..	18.0	3.0	12.0	4.5	18.0	13.9	11.0
15	Maximum width at bottom of ditch <sup>2</sup> .....feet..	40	6	30	10	40	5	14
16	Maximum of average depths of outlet ditches <sup>2</sup> .....feet..	10.0	7.0	8.0	3.5	9.0	10.0	10.0
17	Mean depth of branch ditches <sup>2</sup> .....feet..	5.4	4.5	6.0	3.0		5.6	3.8
18	Tile drains:							
19	Completed.....miles..	83.0					82.0	1.0
20	Additional under construction.....miles..	0.7	0.7					
21	Maximum completed in any enterprise.....miles..	14.1					14.1	1.0
22	Maximum size of tile <sup>2</sup> .....inches..	22					32	8
23	Accessory levees and dikes:							
24	Completed.....miles..	1.0			1.0			
25	Under construction.....miles..							
26	Area drained by open ditches only <sup>3</sup> .....acres..	* 64,405	7,890	4,965	* 4,200	15,000	28,950	3,400
27	Length of these ditches.....miles..	108.9	6.8	12.0	4.5	26.0	41.6	18.0
28	Average length per acre.....feet..	8.9	4.6	12.8	5.7	9.2	7.6	28.0
29	Length of the accessory levees.....miles..	1.0			1.0			
30	Area drained by tile only <sup>3</sup> .....acres..	5,372					5,372	
31	Length of these tile.....miles..	28.2					28.2	
32	Average length per acre.....feet..	27.7					27.7	
33	Area drained by both ditches and tile <sup>3</sup> .....acres..	25,147	2,450				21,597	1,100
34	Length of these drains.....miles..	116.4	5.7				98.7	12.0
35	Average length per acre.....feet..	24.4	12.3				24.1	57.6
<b>DEVELOPMENT OF LAND.</b>								
36	Improved land in operating enterprises, 1920.....acres..	81,886	9,715	4,468	2,960	13,750	47,593	3,400
37	Improved land prior to drainage.....acres..	49,748	9,715	497			39,536	
38	Increase since drainage.....acres..	32,138		3,971	2,960	13,750	8,057	3,400
39	Per cent of increase <sup>4</sup> .....	64.6		799.0			20.4	
40	Per cent increase is of all improved land in farms, 1920.....	0.5		2.1	28.2	9.9	3.1	0.3
41	Timber and cut-over land, 1920.....acres..	850			600	250		
42	Timber and cut-over land prior to drainage.....acres..	1,500			1,000	500		
43	Decrease since drainage.....acres..	650			400	250		
44	Per cent of decrease.....	43.3			40.0	50.0		
45	Other unimproved land, 1920.....acres..	12,188	625	497	640	1,000	8,326	1,100
46	Other unimproved land prior to drainage.....acres..	43,676	625	4,468	3,200	14,500	16,383	4,500
47	Decrease since drainage.....acres..	31,488		3,971	2,560	13,500	8,067	3,400
48	Per cent of decrease.....	72.1		88.9	80.0	93.1	49.2	75.6
49	Swampy, seeped, or alkali, 1920.....acres..	10,873	914	497	640	1,000	7,222	600
50	Swampy, seeped, or alkali, prior to drainage.....acres..	38,871	2,803	4,468	3,200	9,000	16,500	2,900
51	Decrease since drainage.....acres..	27,998	1,889	3,971	2,560	8,000	9,278	2,300
52	Per cent of decrease.....	72.0	67.4	88.9	80.0	88.9	56.2	79.3
<b>CAPITAL INVESTED AND COST PER ACRE.</b>								
53	Total capital invested in and required for completion of operating enterprises.....dollars..	1,436,419	79,200	123,000	47,044	118,500	1,013,675	55,000
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	1,397,419	50,200	123,000	37,044	118,500	1,013,675	55,000
55	Additional capital required to complete these enterprises.....dollars..	39,000	29,000		10,000			
56	Average cost per acre when completed.....dollars..	15.13	7.66	24.77	11.20	7.90	18.13	12.22
57	Enterprises constructing open ditches only.....dollars..	* 604,445	46,700	123,000	* 47,044	118,500	244,201	25,000
58	Average cost per acre when completed.....dollars..	9.39	5.93	24.77	11.20	7.90	8.44	7.35
59	Enterprises constructing tile drains only.....dollars..	192,315					192,315	
60	Average cost per acre when completed.....dollars..	35.80					35.80	
61	Enterprises constructing both open ditches and tile drains.....dollars..	639,659	32,500				577,159	30,000
62	Average cost per acre when completed.....dollars..	25.44	15.27				26.72	27.27
<b>CROPS.</b>								
63	Improved land in enterprises reporting—							
64	Alfalfa as principal crop on drained land.....acres..	52,418	4,625				47,593	
65	Hay (except alfalfa) as principal crop on drained land.....acres..	19,710			3,560	13,750		3,400
66	Wheat as principal crop on drained land.....acres..	4,468		4,468				
67	Not reporting principal crop on drained land.....acres..	5,200	4,800		400			

<sup>1</sup> Includes only Adams and Spokane Counties.  
<sup>2</sup> When works under construction have been completed.  
<sup>3</sup> Includes 1,000 acres having open ditches and levees.

<sup>4</sup> Per cent not shown when more than 1,000.  
<sup>5</sup> Includes cost of 1 mile of levees.

## WISCONSIN.

The following pages present the statistics of drainage for Wisconsin collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of timbered and other unimproved

land not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

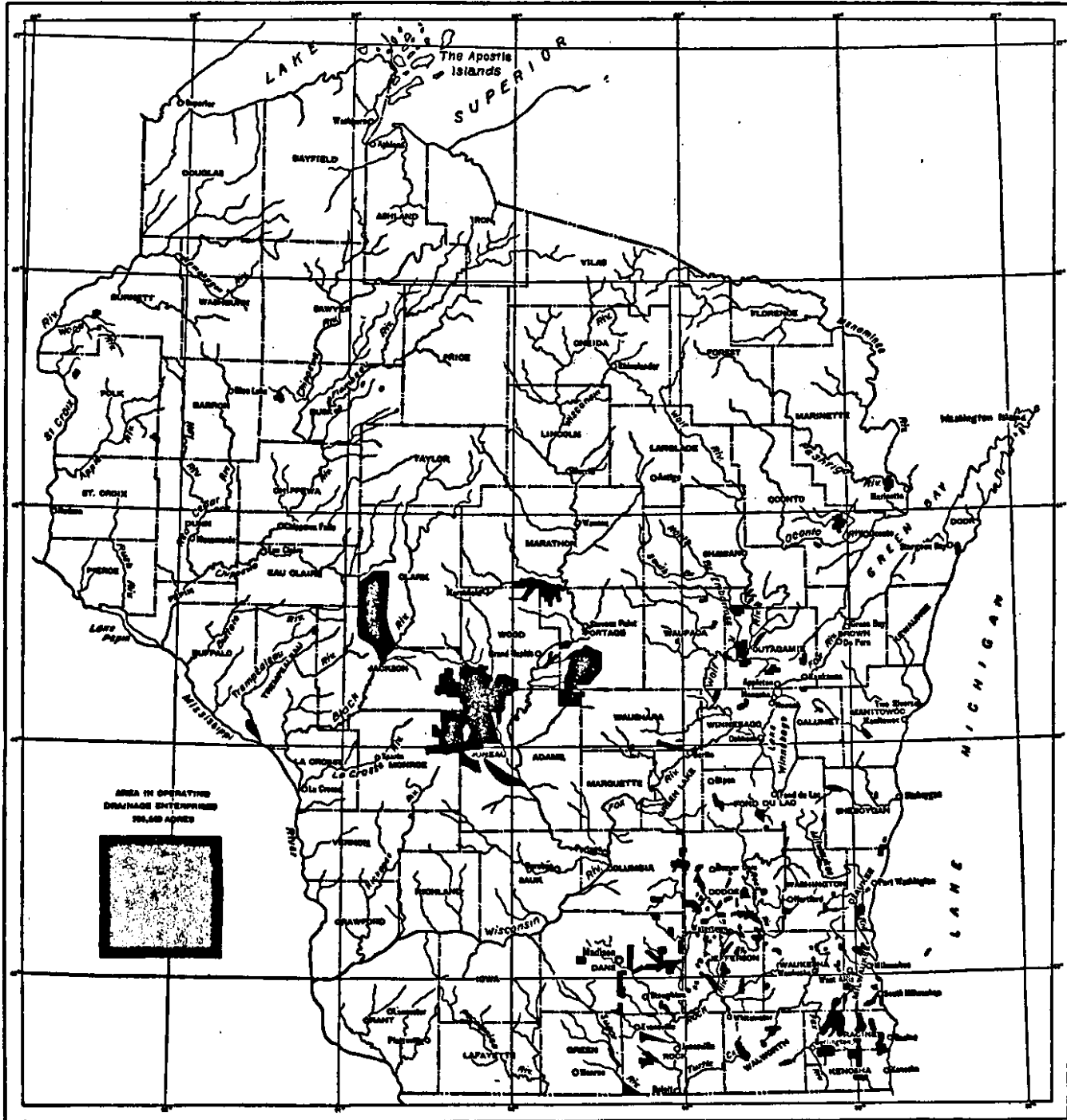
ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	189, 295	100. 0
Farms reporting land having drainage.....	21, 838	11. 5
Farms reporting land needing drainage.....	52, 228	27. 6
All land in farms..... acres..	22, 148, 223	100. 0
Improved land in farms..... acres..	12, 452, 216	56. 2
Farm land reported as provided with drainage..... acres..	658, 411	3. 0
Farm land reported as needing drainage..... acres..	1, 839, 273	8. 3
Needing drainage only..... acres..	461, 612	2. 1
Needing drainage and clearing..... acres..	1, 377, 661	6. 2
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	35, 363, 840	100. 0
All land in operating drainage enterprises..... acres..	794, 569	2. 2
Improved land..... acres..	254, 504	0. 7
Per cent of all improved land in farms.....	2. 0	.....
Timber and cut-over land..... acres..	177, 744	0. 5
Other unimproved land..... acres..	362, 321	1. 0
Swampy, subject to overflow, seeped, or alkali..... acres..	130, 111	0. 4
Suffering a loss of crops from defective drainage..... acres..	9, 848	(1)
Improved land prior to drainage..... acres..	50, 071	0. 1
Increase since drainage began..... acres..	204, 433	0. 6
Land in nonoperating enterprises..... acres..	19, 000	0. 1
Open ditches in operating enterprises..... miles..	1, 779. 3	100. 0
Completed..... miles..	1, 691. 3	95. 1
Additional under construction..... miles..	88. 0	4. 9
Tile drains in operating enterprises..... miles..	251. 4	100. 0
Completed..... miles..	211. 3	84. 0
Additional under construction..... miles..	40. 1	16. 0
Total capital invested in and required for completion of operating enterprises..	\$4, 564, 625	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	4, 163, 055	91. 2
Additional capital required to complete these enterprises.....	401, 570	8. 8
Average cost per acre when completed.....	5. 74	.....

1 Less than one-tenth of 1 per cent



# WISCONSIN

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by decrees of the courts and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	813,569	100.0	\$4,168,055	100.0	\$512,570
Operating enterprises.....	794,569	97.7	4,163,055	99.9	401,570
With works completed.....	572,208	70.3	3,208,944	77.0	.....
With works under construction..	222,361	27.8	954,111	22.9	401,570
Nonoperating enterprises.....	19,000	2.3	5,000	0.1	111,000

<sup>1</sup> The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—More than 60 per cent of the acreage in operating drainage enterprises in Wisconsin is located in a group of seven counties near the center of the state, and most of the other land in such enterprises is in the southeastern counties. There are comparatively few operating enterprises in the northern third of the state and none in the southwestern corner.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	813,569	100.0	\$4,168,055	100.0	\$512,570
Operating enterprises.....	794,569	97.7	4,163,055	99.9	401,570
Illinois River.....	57,351	7.0	381,130	9.1	.....
Rock River.....	110,814	13.6	667,670	16.0	43,000
Wisconsin River.....	370,016	45.5	1,914,833	45.9	37,600
Chippewa River.....	5,614	0.7	75,414	1.8	13,000
St. Croix River.....	5,080	0.6	23,678	0.6	.....
Mississippi River.....	138,037	17.0	219,500	5.3	115,000
Lake Michigan.....	107,657	13.2	880,830	21.1	192,970
Nonoperating enterprises.....	19,000	2.3	5,000	0.1	111,000
Rock River.....	5,000	0.6	1,500	.....	58,000
Wisconsin River.....	10,800	1.3	.....	.....	30,000
Lake Michigan.....	3,200	0.4	3,500	0.1	25,000

Condition of land in enterprises.—The drainage enterprises in Wisconsin have been organized in most part for the reclamation of swamp or marsh land or for the improvement of areas that were usually too wet for most profitable cultivation. The tracts generally are near or bordering the smaller streams of the state.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of total.			
All land in enterprises.....	794,569	100.0	572,208	222,361	19,000
Improved land.....	254,504	32.0	220,908	33,596	290
Timber and cut-over land.....	177,744	22.4	84,280	93,464	3,325
Other unimproved land.....	362,321	45.6	267,020	95,301	15,385
Swampy or subject to overflow.....	130,111	16.4	68,908	61,203	18,300
Suffering a loss of crops.....	9,848	1.2	9,774	74	.....

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 290 operating drainage enterprises are counted in Wisconsin, with an average area of 2,740 acres each. There are 29 such enterprises of 5,000 acres or more each, 118 of between 500 and 5,000 acres, and 143 of less than 500 acres each. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	794,569	794,569	100.0
Less than 200 acres.....	5,800	5,800	0.7
200 to 499 acres.....	26,010	26,010	3.3
500 to 999 acres.....	27,975	27,975	3.5
1,000 to 4,999 acres.....	168,051	168,051	21.1
5,000 to 9,999 acres.....	75,427	75,427	9.5
10,000 to 49,999 acres.....	228,426	228,426	28.7
50,000 to 99,999 acres.....	262,880	262,880	33.1

Character of enterprises.—All drainage enterprises in Wisconsin, except commercial and private undertakings and districts formed by special acts of the legislature, are either drainage districts operating

under the drainage district law of July 15, 1919 (ch. 557), or "drainages" operating under the farm drainage law of June 27, 1919 (ch. 446). These statutes repealed the earlier laws of the state providing for the formation of drainage enterprises, except so far as might be necessary or expedient to complete undertakings already begun, and all drainage district works and town drains constructed under earlier laws are to be maintained under the new drainage district law and farm drainage law, respectively.

A drainage district is established, according to the law of 1919, by the circuit court of any county in which all or a part of the district is situated, after receipt of a petition from the owners of a major part of the land in the proposed district or from a majority of the owners representing one-third or more of the land. Three drainage commissioners for each district are appointed by the court to investigate as to the feasibility and public utility of the proposed work and, when the district has been established, to administer its affairs. The cost of drainage is assessed against the land in proportion to the benefits that will accrue to the various tracts, but that for any part of the work may be assessed against the particular land or corporation to be benefited by that part. If the cost will exceed the benefits, the enterprise is abandoned, unless one or more petitioners agree to pay the excess and furnish security therefor. The commissioners' preliminary report must include a report from the state chief engineer regarding the practicability and completeness of the proposed plan of improvement and a report from the college of agriculture of the University of Wisconsin regarding the character of the soils and the value of the land for agriculture. If the enterprise will affect any navigable stream, the plan must be approved by the state railroad commission. The plan of drainage improvement and the assessments of damages and of benefits are made by the drainage commissioners. The plan of drainage must be approved or disapproved by the state chief engineer. The court holds public hearings upon the petition for establishment, upon the commissioners' preliminary report, and upon their final report presenting plans, cost estimate, and assessments. The commissioners may issue bonds or notes of the district to finance the work. Subdistricts may be formed within any drainage district, by the circuit court, upon petition and after public hearing; the cost is to be assessed by the commissioners of the original drainage district against the land to be benefited.

Very nearly all the drainage districts in Wisconsin were established under the drainage district law of April 23, 1891 (ch. 401), and the revision of June 17, 1905 (ch. 419). Each of those statutes provided that the districts should be organized by the circuit courts and be administered by three commissioners for each district, and that the cost should be assessed in proportion to the anticipated benefits. The requirements

for establishment and the method of organization were much like those of the new drainage district law, but neither of the earlier statutes included any provisions similar to those now requiring that reports upon the proposed work and upon the value of the land be secured from the state chief engineer and the college of agriculture.

A "drainage" under the 1919 statute is established by the county court upon petition from the owners of a major part of the land affected or from a majority of the owners controlling one-third or more of that land, or upon petition from a majority of the town board or boards of supervisors of the town or towns in which the land is situated. All "drainages" are administered by the farm drainage board of the county, composed of three residents appointed by the court when the first petition for a "drainage" is filed. This drainage board makes a preliminary investigation as to the practicability and public utility of the project and, after the "drainage" has been established by decree of the court, prepares the plan of drainage, assesses damages and benefits against the tracts of land, and lets contracts for construction. Public hearings are held by the county court upon the drainage board's preliminary report before the "drainage" is established, and later upon the assessments of damages and of benefits. With its earlier report the drainage board must submit, if the "drainage" will comprise more than 200 acres, a report from the state chief engineer regarding the sufficiency of the proposed work and one from the college of agriculture concerning the character of the soil and the value of the land. The final plan of drainage must be approved by the state chief engineer. The cost of the enterprise may exceed the estimated benefits only if the petitioners give security to cover the excess. The drainage board may issue notes or bonds to finance the work of each "drainage."

Town drains established under laws of March 9, 1871 (ch. 64), and of June 25, 1913 (ch. 579), were in general similar to the "drainages" to be established under the present farm drainage law. Petition for a drain was addressed to the town board of supervisors, which performed approximately the same functions as now are prescribed for the county court and the farm drainage board. For a drain to benefit land within a city or village, petition was addressed to the officials of the city or village, who would appoint a committee to investigate and to construct the drain if the project was approved. The cost was apportioned against the land in proportion to the benefits, and the law of 1871 permitted the landowners to perform the work of construction. No supervision over individual projects was exercised by the state, corresponding to what now is done in requiring reports from the state chief engineer and the college of agriculture.

The first drainage law of this state was enacted in 1852, providing means for one landowner to secure

drainage outlet across the land of an objecting owner, if necessary, through petition to a justice of the peace. A somewhat similar act of 1880 provided for proceedings under the county and circuit courts; an act of 1887 provided for proceedings under the town supervisors. A statute of 1862 (ch. 398) authorized the establishment and construction of county drains by the county board of supervisors upon petition from one or more landowners, damages and benefits being assessed by the supervisors. As amended (Revised Statutes of 1917, sec. 1381) that law authorizes the construction of drains by the county or town boards of supervisors for the benefit of land owned by the counties or towns.

There have been many amendments to the drainage laws mentioned herein, but they have not affected the general form of organization described.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	813,569	100.0	\$4,168,055	100.0	\$512,570
Operating enterprises.....	794,569	97.7	4,163,055	99.9	401,570
Drainage districts.....	684,898	84.2	3,460,032	83.0	346,820
Laws of 1891, ch. 401.....	296,183	36.4	1,373,060	32.9	35,600
Laws of 1905, ch. 419.....	379,705	46.7	2,041,972	49.0	311,220
Special acts.....	9,000	1.1	45,000	1.1	.....
"Drainages".....	105,601	13.0	664,423	15.9	54,750
Laws of 1871, ch. 64.....	49,619	6.1	186,664	4.5	750
Laws of 1913, ch. 579.....	53,140	6.5	449,152	10.8	54,000
Laws of 1919, ch. 446.....	2,842	0.3	28,607	0.7	.....
Other <sup>1</sup> .....	4,080	0.5	38,600	0.9	.....
Nonoperating enterprises.....	19,000	2.3	5,000	0.1	111,000
Drainage districts.....	19,000	2.3	5,000	0.1	111,000
Laws of 1905, ch. 419.....	15,500	1.9	1,500	.....	86,000
Laws of 1919, ch. 557.....	3,500	0.4	3,500	0.1	25,000

<sup>1</sup> Includes one commercial development, one individual ownership, and one enterprise not reporting character.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 1,691.3 miles of open ditches, 211.3 miles of tile drains, and 7.7 miles of accessory levees; the additional lengths under construction were 88.0 miles of open ditches, 40.1 miles of tile drains, and 2.5 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one drainage district in Wisconsin, comprising 6,597 acres, drained partly by pumping, having one centrifugal pump operated by steam engines of 150 horsepower.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

County Table II, line 16, shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises, as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted, because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both of these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 7.0 instead of 6.5 feet.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	794,569	100.0	\$4,163,055	100.0	\$401,570
Open ditches only.....	657,668	82.8	2,942,667	70.7	279,350
Open ditches and levees.....	27,584	3.5	282,666	6.8	.....
Tile drains only.....	2,958	0.4	59,770	1.4	.....
Open ditches and tile drains.....	102,359	12.9	834,952	20.1	72,220
Open ditches, tile drains, and levees.....	4,000	0.5	43,000	1.0	50,000

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	794,569	100.0
Less than 3 feet.....	520	0.1
3.0 to 3.9 feet.....	17,669	2.2
4.0 to 4.9 feet.....	72,916	9.2
5.0 to 5.9 feet.....	25,622	3.2
6.0 to 6.9 feet.....	188,683	23.5
7.0 to 7.9 feet.....	79,349	10.0
8.0 to 8.9 feet.....	217,735	27.4
9.0 to 9.9 feet.....	18,000	2.3
10 feet and more.....	83,800	10.5
Not reporting branches.....	92,275	11.6

**Maintenance of works.**—The drainage district law of 1919 requires that the commissioners of each drainage district file with the circuit court each year a report including a statement of what repairs will be necessary during the coming year and an assessment to cover the necessary repairs, maintenance, and incidental expenses. The court hears all objections and determines the amounts of assessment. The laws of 1891 and 1905 also authorized the levy of assessments for maintenance of the drains.

The farm drainage law requires the farm drainage board of each county to report annually to the county court regarding each "drainage" under its control, including a statement of the repairs needed in the ensuing year and an assessment to cover the cost of maintenance apportioned according to the confirmed benefits. The court hears objections to the report before confirming the assessment. The town drain

law of 1913 authorized the town supervisors to levy assessments for repair purposes, and that of 1871 required each landowner affected to keep in repair the section of drain assigned to him by the town supervisors.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	794,589	100.0	\$4,163,055	100.0	\$401,570
By district forces.....	181,416	22.8	1,038,827	25.0	2,750
By contract.....	348,896	44.0	2,109,393	50.7	39,600
By landowners.....	20,255	2.7	68,523	1.6	
By method not specified.....	14,866	1.9	152,947	3.7	
No maintenance provided.....	212,215	26.7	744,585	17.9	339,220
Not reporting.....	6,931	0.9	48,780	1.2	20,000

Date of organization.—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts or the town boards of supervisors, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction might occupy some years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	794,589	100.0	794,589	100.0
1870 to 1879.....	695	0.1	695	0.1
1880 to 1889.....	16,158	2.0	16,158	2.0
1890 to 1899.....	5,173	0.7	5,173	0.7
1900 to 1904.....	294,978	37.1	294,978	37.1
1905 to 1909.....	145,692	18.3	145,692	18.3
1910 to 1914.....	111,102	14.0	111,102	14.0
1915 to 1919.....	218,424	27.5	218,424	27.5
Not reported.....	2,347	0.3	2,347	0.3

Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL INVESTED.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$4,163,055	100.0	\$401,570
1870 to 1879.....	2,800	0.1	
1880 to 1889.....	65,966	1.6	
1890 to 1899.....	9,063	0.2	
1900 to 1904.....	1,814,577	31.6	86,350
1905 to 1909.....	1,042,098	25.0	
1910 to 1914.....	744,494	17.9	
1915 to 1919.....	983,693	23.1	365,220
Not reported.....	20,364	0.5	

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
1870 to 1879.....	9.5	0.5				
1880 to 1889.....	59.7	3.4				
1890 to 1899.....	26.3	1.5				
1900 to 1904.....	551.6	31.0				
1905 to 1909.....	455.6	25.6	19.5	7.8	2.6	25.5
1910 to 1914.....	311.3	17.5	19.0	7.6	5.1	50.0
1915 to 1919.....	357.0	20.1	211.6	84.2	2.5	24.5
Not reported.....	8.3	0.5	1.3	0.5		

Crops.—The principal crops grown upon the drained land in drainage enterprises are hay and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

# DRAINAGE—WISCONSIN.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adams.	Ashland.	Barron.	Bayfield.	Brown.	Buffalo.	Burnett.	Calumet.
1	Number of all farms in the state or county.....	189,295	1,557	1,131	4,516	1,791	3,498	2,089	1,872	2,087
2	Farms reporting land having drainage.....	21,838	87	32	117	252	517	51	145	255
3	Farms reporting land needing drainage.....	52,228	259	447	1,028	823	1,200	313	695	368
4	Farms in drainage and levee districts.....	3,693	34	2	22	.....	19	3	29	20
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the state or county..... acres..	35,363,840	437,760	692,480	566,400	961,920	338,560	439,680	550,400	207,360
6	All land in farms..... acres..	22,148,223	304,575	108,270	449,565	172,498	304,745	418,261	238,898	194,623
7	Improved land in farms..... acres..	12,452,216	148,138	38,253	208,936	50,389	207,027	202,321	79,611	145,005
8	Woodland in farms..... acres..	5,401,910	111,284	56,659	121,719	82,071	47,859	151,650	117,520	19,979
9	Other unimproved land in farms..... acres..	4,294,097	45,173	15,358	118,910	40,038	49,859	64,290	39,755	29,639
10	Farm land reported as provided with drainage..... acres..	658,411	7,827	665	2,477	5,460	12,761	1,069	4,035	5,660
11	Farm land reported as needing drainage..... acres..	1,839,273	13,245	27,845	41,158	15,835	30,578	8,019	33,012	7,084
12	Drainage only..... acres..	461,612	5,325	379	3,733	658	6,012	2,154	6,217	3,983
13	Drainage and clearing..... acres..	1,377,661	7,920	26,966	37,425	15,177	24,566	5,865	26,795	3,121

		Chip-pewa.	Clark.	Colum-bia.	Dane.	Dodge.	Door.	Douglas.	Dunn.	Eau Claire.	Fond du Lac.
1	Number of all farms in the county.....	3,729	5,116	3,320	6,217	4,633	2,396	1,557	3,566	2,368	4,190
2	Farms reporting land having drainage.....	123	188	436	721	1,051	181	55	123	91	535
3	Farms reporting land needing drainage.....	1,459	1,630	908	1,604	1,193	626	1,001	729	511	1,005
4	Farms in drainage and levee districts.....	22	82	231	177	187	11	3	36	17	77
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	664,060	779,520	497,920	769,280	574,090	300,160	855,680	559,160	408,320	464,640
6	All land in farms..... acres..	457,998	478,377	483,639	721,155	522,217	264,126	154,671	490,044	307,348	445,710
7	Improved land in farms..... acres..	227,601	185,802	301,889	512,289	374,839	149,557	40,428	265,663	194,467	321,182
8	Woodland in farms..... acres..	130,048	137,131	66,362	85,501	86,202	79,959	69,791	150,405	68,504	32,672
9	Other unimproved land in farms..... acres..	100,259	143,444	95,388	123,360	111,076	34,610	44,452	73,946	44,375	92,856
10	Farm land reported as provided with drainage..... acres..	2,349	4,864	11,344	16,859	22,182	2,996	1,012	2,685	1,846	14,792
11	Farm land reported as needing drainage..... acres..	70,001	72,922	32,867	34,919	30,395	17,112	63,343	28,392	17,603	20,393
12	Drainage only..... acres..	6,411	5,128	18,286	24,215	21,689	3,596	1,089	3,432	2,030	12,744
13	Drainage and clearing..... acres..	63,590	67,794	14,582	10,704	8,706	13,516	62,254	22,960	15,573	7,649

		Forest.	Green.	Green Lake.	Iowa.	Jackson.	Jefferson.	Juneau.	Keno-sha.	Kewau-nee.	Lafay-ette.
1	Number of all farms in the county.....	535	2,330	1,507	2,827	2,577	3,263	2,479	1,383	2,065	2,360
2	Farms reporting land having drainage.....	6	219	131	67	87	1,022	537	361	455	107
3	Farms reporting land needing drainage.....	167	368	346	140	746	1,158	915	797	1,007	250
4	Farms in drainage and levee districts.....	.....	14	39	2	22	187	291	99	11	1
<b>LAND AND FARM AREA.</b>											
5	Approximate land area of the county..... acres..	650,880	379,520	230,400	499,840	633,600	353,280	613,280	180,480	215,680	410,880
6	All land in farms..... acres..	56,029	344,642	213,618	460,938	369,345	331,204	327,601	155,832	210,584	373,121
7	Improved land in farms..... acres..	16,950	270,680	141,371	264,424	190,401	218,129	171,114	112,255	146,626	272,481
8	Woodland in farms..... acres..	24,685	35,290	21,469	85,004	128,098	43,622	95,359	15,471	33,937	35,308
9	Other unimproved land in farms..... acres..	14,384	38,672	50,778	121,510	70,846	69,458	61,088	28,106	30,021	65,332
10	Farm land reported as provided with drainage..... acres..	637	6,835	4,422	1,069	4,621	23,459	35,627	39,804	14,683	2,803
11	Farm land reported as needing drainage..... acres..	10,703	9,210	10,804	3,400	37,323	31,875	39,698	24,636	21,768	5,843
12	Drainage only..... acres..	502	5,328	5,187	1,910	7,138	18,740	11,628	15,949	6,057	3,045
13	Drainage and clearing..... acres..	10,141	3,882	5,617	1,490	30,190	13,135	28,170	8,687	15,711	2,798

DRAINAGE—WISCONSIN.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Mani- towoc.	Mar- athon.	Mar- nette.	Mar- quette.	Mil- waukee.	Monro.	Oconto.	Outa- gamie.	Oza- kee.	Pepin.
1	3,904	6,058	2,531	1,432	2,574	3,519	3,114	3,746	1,727	1,084
2	1,484	66	181	222	1,167	181	242	781	617	35
3	1,530	1,961	1,506	420	760	533	1,325	1,307	874	75
4	109	6	112	18	184	181	40	45	90	4
<b>LAND AND FARM AREA.</b>										
5	385,280	994,560	905,600	292,480	150,400	599,680	715,520	413,440	149,120	151,040
6	358,511	650,959	275,738	271,317	111,033	468,553	310,037	347,824	141,115	140,268
7	251,176	242,357	107,444	133,773	90,258	231,049	151,639	236,561	107,739	75,098
8	54,581	243,986	79,096	85,306	12,921	155,752	96,551	44,915	12,092	48,316
9	62,754	164,616	89,198	52,238	7,854	81,752	61,847	66,348	21,284	16,254
10	34,705	1,688	5,735	8,287	22,542	8,494	9,531	26,772	13,477	1,077
11	29,564	93,246	84,384	17,969	12,176	18,785	53,135	47,510	14,718	2,030
12	14,690	5,249	5,563	8,169	5,592	7,887	5,213	17,319	6,795	106
13	14,874	87,997	78,821	9,800	6,584	10,678	44,922	30,191	7,923	1,924

	Polk.	Portage.	Price.	Racine.	Rich- land.	Rock.	Rusk.	Sauk.	Sha- wano.	Shebo- yan.
1	4,058	3,326	1,935	2,215	2,533	3,660	1,946	3,697	3,977	3,664
2	103	312	46	1,619	116	335	44	200	303	1,262
3	1,196	534	1,272	1,170	305	702	794	578	1,393	1,630
4	56	251	8	473	6	64	55	4	13	30
<b>LAND AND FARM AREA.</b>										
5	598,400	519,660	818,560	207,360	377,600	458,240	592,000	536,880	741,120	333,440
6	434,216	427,913	161,894	195,963	361,450	427,083	184,213	494,925	431,614	311,332
7	185,140	250,287	40,387	146,456	186,824	343,328	46,676	279,878	193,770	226,734
8	186,044	103,858	71,921	20,969	132,623	38,825	24,518	135,662	140,511	42,561
9	63,032	73,768	49,586	28,538	42,003	44,930	113,019	79,385	97,338	42,037
10	2,157	31,913	598	71,843	1,644	11,876	596	4,521	6,456	34,208
11	46,595	26,059	66,150	30,557	6,405	22,206	27,886	12,603	44,823	27,400
12	5,969	3,244	1,430	18,781	2,887	12,727	2,281	6,822	11,283	13,395
13	40,626	22,815	64,720	11,776	3,518	9,479	25,605	5,781	33,540	14,006

	Trem- pealeau.	Wal- worth.	Wash- burn.	Wash- ington.	Wau- kesha.	Wau- paca.	Wau- shara.	Winne- bago.	Wood.	All other counties. <sup>1</sup>
1	3,138	2,779	1,380	2,799	3,405	3,770	2,468	2,711	3,066	26,469
2	98	560	23	623	1,075	345	190	706	350	137
3	578	972	422	1,129	306	1,142	372	1,023	693	4,271
4	10	59		87		62	18	44	108	13
<b>LAND AND FARM AREA.</b>										
5	478,720	358,400	534,400	275,840	351,360	485,760	413,440	293,760	517,760	7,578,890
6	461,525	330,011	178,298	264,351	333,519	420,206	363,417	256,327	321,907	3,356,325
7	270,239	239,306	57,827	174,486	227,310	236,807	233,745	186,332	137,063	1,705,897
8	135,567	38,037	71,401	38,230	52,073	92,965	84,493	25,511	79,030	970,046
9	55,719	52,666	49,070	51,635	54,136	90,434	45,179	44,484	105,814	680,352
10	1,293	18,020	633	9,339	18,202	7,473	6,595	21,468	22,876	2,189
11	14,644	26,322	27,953	20,534	5,659	32,364	11,908	24,778	44,836	188,056
12	6,331	18,959	4,100	13,144	2,863	12,993	4,636	14,639	6,358	14,133
13	8,313	7,363	23,853	7,440	2,796	10,371	7,272	10,139	36,478	173,873

<sup>1</sup>No drainage on farms reported in Crawford, Florence, Grant, Iron, La Crosse, Langlade, Lincoln, Oneida, Pierce, St. Croix, Sawyer, Taylor, Vernon, and Vilas Counties.

DRAINAGE—WISCONSIN.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Adams.	Clark.	Columbia.	Dane.	Dodge.	Door.	Fond du Lac.	
<b>LAND AREA.</b>									
1	Approximate land area of the state or county.....acres..	35,363,840	437,760	770,520	497,920	769,280	574,080	800,160	464,640
2	All land in operating drainage enterprises.....acres..	794,569	16,390	98,000	4,668	39,239	21,697	4,000	5,935
3	Improved land.....acres..	254,504	9,834	9,800	2,204	6,535	4,482	600	1,778
4	Per cent of all improved land in farms.....	2.0	6.6	5.0	0.7	1.3	1.2	0.4	0.6
5	Timber and cut-over land.....acres..	177,744	4,098	68,600	2,464	32,704	17,007	800	359
6	Other unimproved land.....acres..	362,321	2,458	19,600	2,464	32,704	17,007	2,600	3,768
7	Swampy or subject to overflow, in enterprises.....acres..	130,111	2,458	49,000	985	6,896	3,291	1,000	925
8	Suffering a loss of crops from defective drainage.....acres..	9,848	983	28	28	30	200		25
9	Assessed acreage.....acres..	794,569	16,390	98,000	4,668	39,239	21,697	4,000	5,935
10	Excess over all land in operating enterprises.....acres..								
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
11	Completed.....miles..	1,691.3	50.3	23.3	24.2	114.0	103.0	1.1	28.6
12	Additional under construction.....miles..	88.0		48.7		5.8		0.9	
13	Maximum completed in any enterprise.....miles..	144.5	50.3	23.3	7.0	26.0	10.5	1.1	4.0
14	Maximum width at bottom of ditch <sup>1</sup> .....feet..	60	16	10	8	24	8	8	40
15	Maximum of average depths of outlet ditches <sup>1</sup> .....feet..	13.0	8.0	6.0	10.0	10.0	10.0	4.0	7.0
16	Mean depth of branch ditches <sup>1</sup> .....feet..	6.5	8.0	6.0	5.1	5.0	3.7		7.0
<b>Tile drains:</b>									
17	Completed.....miles..	211.3				97.0	3.7		0.3
18	Additional under construction.....miles..	40.1				7.3		5.5	
19	Maximum completed in any enterprise.....miles..	43.0				43.0	1.2		0.3
20	Maximum size of tile <sup>1</sup> .....inches..	30				24	24		12
<b>Accessory levees and dikes:</b>									
21	Completed.....miles..	7.7							
22	Additional under construction.....miles..	2.5							
<b>Pumping plants:</b>									
23	Engine capacity.....horsepower..	160							
24	Pump capacity.....gallons per minute..								
25	Area served by pumps.....acres..	6,697							
26	Area drained by open ditches only <sup>1</sup> .....acres..	657,668	16,390	98,000	4,668	25,398	19,239		5,435
27	Length of these ditches.....miles..	1,482.6	50.3	70.0	24.2	83.2	93.0		26.3
28	Average length per acre.....feet..	11.7	16.2	3.8	27.4	18.3	25.6		26.3
29	Area having open ditches and levees <sup>1</sup> .....acres..	27,584							
30	Length of these ditches.....miles..	79.1							
31	Average length per acre.....feet..	15.1							
32	Length of the accessory levees.....miles..	7.7							
33	Area drained by tile only <sup>1</sup> .....acres..	2,958				1,270	60		
34	Length of these tile.....miles..	97.2				83.0	1.0		
35	Average length per acre.....feet..	173.5				345.1	88.0		
36	Area drained by open ditches and tile <sup>1</sup> .....acres..	102,359				12,571	2,278	4,000	450
37	Length of these drains.....miles..	347.6				52.9	12.7	7.5	2.6
38	Average length per acre.....feet..	17.9				22.2	29.4	9.9	30.5
39	Area having open ditches, tile drains, and levees <sup>1</sup> .....acres..	4,000							
40	Length of these drains.....miles..	44.2							
41	Average length per acre.....feet..	53.3							
42	Length of the accessory levees.....miles..	2.5							
<b>DEVELOPMENT OF LAND.</b>									
43	Improved land in operating enterprises, 1920.....acres..	254,504	9,834	9,800	2,204	6,535	4,482	600	1,778
44	Improved land prior to drainage.....acres..	50,071		9,800		1,333	398		761
45	Increase since drainage.....acres..	204,433	9,834		2,204	5,202	4,084	600	1,017
46	Per cent of increase.....	408.3				390.2			133.6
47	Per cent increase is of all improved land in farms, 1920.....	1.6	6.6		0.7	1.0	1.1	0.4	0.8
48	Timber and cut-over land, 1920.....acres..	177,744	4,098	68,600			108	800	359
49	Timber and cut-over land prior to drainage.....acres..	231,732	12,292	68,600		1,220	144	800	359
50	Decrease since drainage.....acres..	53,988	8,194			1,220	36		
51	Per cent of decrease.....	23.3	66.7			100.0	25.0		
52	Other unimproved land, 1920.....acres..	362,321	2,458	19,600	2,464	32,704	17,007	2,600	3,768
53	Other unimproved land prior to drainage.....acres..	512,766	4,098	19,600	4,668	36,686	21,055	3,200	4,785
54	Decrease since drainage.....acres..	150,445	1,640		2,204	3,982	4,048	600	1,017
55	Per cent of decrease.....	29.3	40.0		47.2	10.9	19.2	18.8	21.3
56	Swampy or subject to overflow, 1920.....acres..	130,111	2,458	49,000	985	6,896	3,291	1,000	925
57	Swampy or subject to overflow prior to drainage.....acres..	701,307	16,390	68,600	4,668	37,779	21,357	2,400	5,333
58	Decrease since drainage.....acres..	571,196	13,932	19,600	3,683	30,883	18,066	1,400	4,408
59	Per cent of decrease.....	81.4	85.0	28.6	78.9	81.7	84.6	58.3	82.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
60	Total capital invested in and required for completion of operating enterprises.....dollars..	4,564,625	98,000	159,000	41,352	346,313	95,545	28,000	72,066
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	4,163,055	98,000	44,000	41,352	326,313	95,545	3,000	72,066
62	Additional capital required to complete these enterprises.....dollars..	401,570		115,000		20,000		25,000	
63	Average cost per acre when completed.....dollars..	5.74	5.98	1.62	8.86	8.83	4.42	7.00	12.14
64	Enterprises constructing open ditches only.....dollars..	3,222,017	98,000	159,000	41,352	190,607	52,755		65,509
65	Average cost per acre when completed.....dollars..	4.90	5.98	1.62	8.86	7.50	2.74		11.04
66	Enterprises constructing open ditches and levees.....dollars..	282,666							
67	Average cost per acre when completed.....dollars..	10.25							
68	Enterprises constructing tile drains only.....dollars..	89,770				33,000	1,000		
69	Average cost per acre when completed.....dollars..	20.21				25.93	16.67		
70	Enterprises constructing open ditches and tile drains.....dollars..	907,172				122,706	41,790	28,000	6,557
71	Average cost per acre when completed.....dollars..	8.86				9.76	18.35	7.00	14.57
72	Enterprises constructing open ditches, tile drains, and levees.....dollars..	93,000							
73	Average cost per acre when completed.....dollars..	23.26							
<b>CROPS.</b>									
74	Improved land in enterprises reporting—								
75	Hay as principal crop on drained land.....acres..	97,966	9,834		1,606	2,744	680	600	306
76	Corn as principal crop on drained land.....acres..	97,075			38	2,121	3,802		932
77	Small grains as principal crop on drained land.....acres..	24,068			560	200			
78	Vegetables as principal crop on drained land.....acres..	3,647				1,470			
79	Other crops as principal ones on drained land.....acres..	19,590							
80	Not reporting principal crop on drained land.....acres..	13,160		9,800					640

<sup>1</sup> When works under construction have been completed.



DRAINAGE—WISCONSIN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

	Jackson.	Jefferson.	Juneau.	Kenosha.	Marathon.	Millwaukee.	Monroe.	Oconto.	
<b>LAND AREA.</b>									
1	Approximate land area of the county..... acres..	633,600	353,280	513,280	180,480	994,560	150,400	599,680	715,520
2	All land in operating drainage enterprises..... acres..	46,760	17,461	133,297	11,803	11,679	8,392	61,100	4,300
3	Improved land..... acres..	4,140	5,630	27,904	10,277	2,336	7,355	27,641	2,000
4	Per cent of all improved land in farms.....	2.2	2.6	16.3	9.2	1.0	8.1	12.0	1.3
5	Timber and cut-over land..... acres..	15,264	18	38,069	1,526	1,168	1,037	21,472	490
6	Other unimproved land..... acres..	27,356	11,813	67,324	1,526	1,168	1,037	11,987	1,810
7	Swampy or subject to overflow, in enterprises..... acres..		1,436	7,014	1,004			29,158	770
8	Suffering a loss of crops from defective drainage..... acres..		204	445				1,162	
9	Assessed acreage.....	46,760	17,461	133,297	11,803	11,679	8,392	61,100	4,300
10	Excess over all land in operating enterprises..... acres..								
<b>DRAINAGE WORKS.</b>									
<b>Open ditches:</b>									
11	Completed..... miles..	25.2	93.4	289.3	14.5	19.0	49.2	80.3	12.3
12	Additional under construction..... miles..	4.8		9.2				0.8	4.9
13	Maximum completed in any enterprise..... miles..	13.0	5.6	144.5	7.0	19.0	8.5	50.8	11.3
14	Maximum width at bottom of ditch <sup>1</sup> ..... feet..	30	8	40	30	60	18	20	10
15	Maximum of average depths of outlet ditches..... feet..	10.0	7.0	10.0	9.0	8.0	9.0	10.0	6.5
16	Mean depth of branch ditches <sup>1</sup> ..... feet..	7.0	3.2	6.1	7.0	7.0		7.4	5.7
<b>Tile drains:</b>									
17	Completed..... miles..		8.2		10.0		4.8		
18	Additional under construction..... miles..				0.7				1.0
19	Maximum completed in any enterprise..... miles..		3.5		4.2		2.3		
20	Maximum size of tile <sup>1</sup> ..... inches..		18		30		20		
<b>Accessory levees and dikes:</b>									
21	Completed..... miles..			0.8					
22	Additional under construction..... miles..								
<b>Pumping plants:</b>									
23	Engine capacity..... horsepower..								
24	Pump capacity..... gallons per minute..								
25	Area served by pumps..... acres..								
26	Area drained by open ditches only <sup>1</sup> ..... acres..	46,760	16,337	128,357	40	11,679	7,332	61,100	600
27	Length of these ditches..... miles..	30.0	88.4	262.5	0.5	19.0	47.2	81.1	1.0
28	Average length per acre..... feet..	3.4	28.6	11.6	66.0	8.6	34.0	7.0	8.8
29	Area having open ditches and levees <sup>1</sup> ..... acres..			4,940					
30	Length of these ditches..... miles..			16.0					
31	Average length per acre..... feet..			17.1					
32	Length of the accessory levees..... miles..			0.8					
33	Area drained by tile only <sup>1</sup> ..... acres..		230				820		
34	Length of these tile..... miles..		2.9				3.8		
35	Average length per acre..... feet..		66.6				24.5		
36	Area drained by open ditches and tile <sup>1</sup> ..... acres..		894		11,763		240		3,700
37	Length of these drains..... miles..		10.3		24.7		3.0		17.2
38	Average length per acre..... feet..		60.8		11.1		66.0		24.5
39	Area having open ditches, tile drains, and levees <sup>1</sup> ..... acres..								
40	Length of these drains..... miles..								
41	Average length per acre..... feet..								
42	Length of the accessory levees..... miles..								
<b>DEVELOPMENT OF LAND.</b>									
43	Improved land in operating enterprises, 1920..... acres..	4,140	5,630	27,904	10,277	2,336	7,355	27,641	2,000
44	Improved land prior to drainage..... acres..	2,500	50	3,271	4			3,384	1,480
45	Increase since drainage..... acres..	1,640	5,580	24,633	10,273	2,336	7,355	24,257	520
46	Per cent of increase.....	65.6		753.1				716.8	35.1
47	Per cent increase is of all improved land in farms, 1920.....	0.9	2.6	14.4	9.2	1.0	8.1	10.5	0.3
48	Timber and cut-over land, 1920..... acres..	15,264	18	38,069		8,175		21,472	490
49	Timber and cut-over land prior to drainage..... acres..	15,264	18	41,309	280	10,511		45,344	490
50	Decrease since drainage..... acres..			3,240	280	2,336		23,872	
51	Per cent of decrease.....			7.8	100.0	22.2		52.6	
52	Other unimproved land, 1920..... acres..	27,356	11,813	67,324	1,526	1,168	1,037	11,987	1,810
53	Other unimproved land prior to drainage..... acres..	26,996	17,393	66,717	11,519	1,168	8,392	12,372	2,330
54	Decrease since drainage..... acres..	1,640	5,580	21,393	9,993		7,355	385	520
55	Per cent of decrease.....	6.7	32.1	24.1	66.8		87.6	3.1	22.3
56	Swampy or subject to overflow, 1920..... acres..		1,436	7,014	1,004			29,158	770
57	Swampy or subject to overflow prior to drainage..... acres..	28,996	17,461	126,540	11,519	11,679	8,392	57,100	2,420
58	Decrease since drainage..... acres..	28,996	16,025	119,526	10,515	11,679	8,392	27,942	1,650
59	Per cent of decrease.....	100.0	91.8	94.5	91.3	100.0	100.0	48.9	68.2
<b>CAPITAL INVESTED AND COST PER ACRE.</b>									
60	Total capital invested in and required for completion of operating enterprises..... dollars..	113,570	47,187	761,004	100,100	53,200	110,120	167,039	44,232
61	Capital invested in these enterprises to Dec. 31, 1919..... dollars..	101,800	47,187	739,100	100,100	53,200	110,120	165,113	30,012
62	Additional capital required to complete these enterprises..... dollars..	11,770		21,904				1,926	14,220
63	Average cost per acre when completed..... dollars..	2.43	2.70	5.71	8.48	4.56	13.12	2.73	10.29
64	Enterprises constructing open ditches only..... dollars..	113,570	29,334	711,504	400	53,200	95,141	167,039	312
65	Average cost per acre when completed..... dollars..	2.43	1.80	5.54	10.00	4.56	12.98	2.73	0.52
66	Enterprises constructing open ditches and levees..... dollars..			49,500					
67	Average cost per acre when completed..... dollars..			10.02					
68	Enterprises constructing tile drains only..... dollars..		4,753				6,479		
69	Average cost per acre when completed..... dollars..		20.67				7.90		
70	Enterprises constructing open ditches and tile drains..... dollars..		13,100		99,700		8,500		43,920
71	Average cost per acre when completed..... dollars..		14.65		8.48		35.42		11.67
72	Enterprises constructing open ditches, tile drains, and levees..... dollars..								
73	Average cost per acre when completed..... dollars..								
<b>CROPS.</b>									
74	Improved land in enterprises reporting—								
75	Hay as principal crop on drained land..... acres..	1,640	181	8,905		2,336		23,622	150
76	Corn as principal crop on drained land..... acres..		5,129	1,500	10,249		6,845	4,000	
77	Small grains as principal crop on drained land..... acres..			15,050					
78	Vegetables as principal crop on drained land..... acres..				28		910		
79	Other crops as principal ones on drained land..... acres..						100	19	1,850
80	Not reporting principal crop on drained land..... acres..	2,500	330						

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

# DRAINAGE—WISCONSIN.

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COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Outa-gamie.	Osaukee.	Portage.	Racine.	Rock.	Rusk.	Shawano.	Sheboy-gan.	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres	413,440	149,120	519,680	207,360	458,240	592,000	741,120	333,440
2	All land in operating drainage enterprises.....	acres	18,305	5,960	67,567	61,847	15,792	5,174	4,600	7,106
3	Improved land.....	acres	5,468	4,462	21,734	47,265	5,372	1,104	2,970	561
4	Per cent of all improved land in farms.....		2.3	4.1	8.7	32.3	1.6	2.4	1.5	0.2
5	Timber and cut-over land.....	acres	649	928	2,920	3,920	174	1,630	1,630	3,206
6	Other unimproved land.....	acres	12,188	570	45,833	11,662	10,420	3,896	1,630	3,339
7	Swampy or subject to overflow, in enterprises.....	acres	530		5,500	5,562	4,656	712	720	4,000
8	Suffering a loss of crops from defective drainage.....	acres			5,500	414	72			
9	Assessed acreage.....		18,305	5,960	67,567	61,847	15,792	5,174	4,600	7,106
10	Excess over all land in operating enterprises.....	acres								
<b>DRAINAGE WORKS.</b>										
<b>Open ditches:</b>										
11	Completed.....	miles	63.4	23.7	153.4	95.3	30.5	17.6	16.0	22.4
12	Additional under construction.....	miles	6.6	1.0					1.1	6.2
13	Maximum completed in any enterprise.....	miles	23.4	4.9	108.0	37.5	9.0	6.8	5.0	18.8
14	Maximum width at bottom of ditch <sup>1</sup> .....	feet	6	26	60	30	20	2	6	36
15	Maximum of average depths of outlet ditches <sup>1</sup> .....	feet	8.0	8.0	8.0	12.0	8.0	9.0	8.0	18.0
16	Mean depth of branch ditches <sup>1</sup> .....	feet	4.3	6.6	7.8	7.0	5.9	3.0		7.0
<b>Tile drains:</b>										
17	Completed.....	miles		2.1		31.7		36.1		4.4
18	Additional under construction.....	miles	14.2			0.4		11.0		
19	Maximum completed in any enterprise.....	miles		1.1		10.3		26.7		2.0
20	Maximum size of tile <sup>1</sup> .....	inches	16	15		24		16		15
<b>Accessory levees and dikes:</b>										
21	Completed.....	miles	1.0							
22	Additional under construction.....	miles	2.5							
<b>Pumping plants:</b>										
23	Engine capacity.....	horsepower								
24	Pump capacity.....	gallons per minute								
25	Area served by pumps.....	acres								
26	Area drained by open ditches only <sup>1</sup> .....	acres	12,618	4,238	67,567	7,000	15,792	1,028	4,600	6,580
27	Length of these ditches.....	miles	38.2	19.8	153.4	7.0	30.5	7.5	17.1	28.0
28	Average length per acre.....	feet	16.0	24.7	12.0	5.3	10.2	33.5	19.6	22.5
29	Area having open ditches and levees <sup>1</sup> .....	acres	1,687							
30	Length of these ditches.....	miles	6.8							
31	Average length per acre.....	feet	21.3							
32	Length of the accessory levees.....	miles	1.0							
33	Area drained by tile only <sup>1</sup> .....	acres		22						276
34	Length of these tile.....	miles		1.0						4.0
35	Average length per acre.....	feet		240.0						76.5
36	Area drained by open ditches and tile <sup>1</sup> .....	acres		1,700		54,847		4,146		250
37	Length of these drains.....	miles		6.0		120.4		57.2		2.0
38	Average length per acre.....	feet		18.6		11.6		72.8		42.2
39	Area having open ditches, tile drains, and levees <sup>1</sup> .....	acres	4,000							
40	Length of these drains.....	miles	44.2							
41	Average length per acre.....	feet	53.3							
42	Length of the accessory levees.....	miles	2.5							
<b>DEVELOPMENT OF LAND.</b>										
43	Improved land in operating enterprises, 1920.....	acres	5,468	4,462	21,734	47,265	5,372	1,104	2,970	561
44	Improved land prior to drainage.....	acres	1,463	278		22,276	43	1,120	1,220	25
45	Increase since drainage.....	acres	4,005	4,184	21,734	24,989	5,329	999	1,850	536
46	Per cent of increase <sup>2</sup> .....		273.8			112.2		951.4	165.2	
47	Per cent increase is of all improved land in farms, 1920.....		1.7	3.9	8.7	17.1	1.6	2.1	1.0	0.2
48	Timber and cut-over land, 1920.....	acres	649	928		2,920		174		3,206
49	Timber and cut-over land prior to drainage.....	acres	2,905	1,202	7,745	2,920		174		3,337
50	Decrease since drainage.....	acres	2,256	274	7,745					181
51	Per cent of decrease.....		77.7	22.8	100.0					5.3
52	Other unimproved land, 1920.....	acres	12,188	570	45,833	11,662	10,420	3,896	1,630	3,339
53	Other unimproved land prior to drainage.....	acres	13,937	4,450	59,821	36,651	15,749	4,836	3,480	3,694
54	Decrease since drainage.....	acres	1,749	3,910	13,933	24,989	5,329	999	1,850	355
55	Per cent of decrease.....		12.6	87.3	23.4	68.2	33.8	20.4	53.2	9.6
56	Swampy or subject to overflow, 1920.....	acres	530		5,500	5,562	4,656	712	720	4,000
57	Swampy or subject to overflow prior to drainage.....	acres	11,038	5,960	67,567	49,907	15,792	3,740	4,600	7,106
58	Decrease since drainage.....	acres	10,558	5,960	62,067	44,345	11,136	3,028	3,880	3,106
59	Per cent of decrease.....		95.2	100.0	91.9	83.9	70.5	81.0	84.3	43.7
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
60	Total capital invested in and required for completion of operating enterprises.....	dollars	187,540	63,160	441,920	406,000	88,375	82,516	10,490	260,033
61	Capital invested in these enterprises to Dec. 31, 1919.....	dollars	117,540	60,160	441,920	406,000	88,375	80,516	9,740	135,033
62	Additional capital required to complete these enterprises.....	dollars	80,000	3,000				13,000	750	125,000
63	Average cost per acre when completed.....	dollars	9.15	10.60	6.54	6.66	5.60	15.95	2.28	36.50
64	Enterprises constructing open ditches only.....	dollars	59,874	24,660	441,920	85,000	88,375	7,617	10,490	238,900
65	Average cost per acre when completed.....	dollars	4.75	5.82	6.54	5.00	5.60	7.41	2.28	36.31
66	Enterprises constructing open ditches and levees.....	dollars	14,666							
67	Average cost per acre when completed.....	dollars	8.69							
68	Enterprises constructing tile drains only.....	dollars		1,000						8,633
69	Average cost per acre when completed.....	dollars		45.45						31.28
70	Enterprises constructing open ditches and tile drains.....	dollars		37,500		371,000		74,899		12,500
71	Average cost per acre when completed.....	dollars		22.06		6.76		18.07		50.00
72	Enterprises constructing open ditches, tile drains, and levees.....	dollars	98,000							
73	Average cost per acre when completed.....	dollars	23.25							
<b>CROPS.</b>										
74	Improved land in enterprises reporting—									
75	Hay as principal crop on drained land.....	acres	4,068	1,575	20,054			865	1,570	180
76	Corn as principal crop on drained land.....	acres		2,837		39,713	5,372			411
77	Small grains as principal crop on drained land.....	acres			1,060				1,400	
78	Vegetables as principal crop on drained land.....	acres						239		
79	Other crops as principal ones on drained land.....	acres	1,400		600	7,552				
80	Not reporting principal crop on drained land.....	acres								

<sup>1</sup> When works under construction have been completed.

<sup>2</sup> Per cent not shown when more than 1,000.

DRAINAGE—WISCONSIN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Trem- pealeau	Wal- worth.	Washing- ton.	Wauke- sha.	Wau- shara.	Winne- bago.	Wood.	Other counties. <sup>1</sup>	
<b>LAND AREA.</b>										
1	Approximate land area of the county.....	acres..	478,720	358,400	275,840	351,360	412,440	293,760	517,760	5,087,360
2	All land in operating drainage enterprises.....	acres..	4,301	8,910	4,500	7,848	7,240	6,246	64,343	20,209
3	Improved land.....	acres..	430	4,048	330	4,757	456	3,710	18,911	10,410
4	Per cent of all improved land in farms.....		0.2	1.7	0.2	2.1	0.2	2.0	13.8	0.5
5	Timber and cut-over land.....	acres..	2,581		2,825	419	190		4,536	1,833
6	Other unimproved land.....	acres..	1,290	4,862	1,345	2,672	6,594	2,536	40,896	7,966
7	Swampy or subject to overflow, in enterprises.....	acres..				501	794			3,199
8	Suffering a loss of crops from defective drainage.....	acres..				288	57			440
9	Assessed acreage.....		4,301	8,910	4,500	7,848	7,240	6,246	64,343	20,209
10	Excess over all land in operating enterprises.....	acres..								
<b>DRAINAGE WORKS.</b>										
11	Open ditches: Completed.....	miles..	7.3	23.3	20.5	35.1	16.9	10.0	137.0	85.2
12	Additional under construction.....	miles..								
13	Maximum completed in any enterprise.....	miles..	7.3	11.2	7.5	10.0	9.0	6.0	47.0	15.0
14	Maximum width at bottom of ditch.....	feet..	30	20	25	20	16	10	60	30
15	Maximum of average depths of outlet ditches.....	feet..	6.0	9.0	8.0	8.0	8.0	7.0	10.0	10.0
16	Mean depth of branch ditches.....	feet..	6.0	7.0	7.0	4.9	8.0		7.1	5.0
17	Tile drains: Completed.....	miles..		7.5	0.5	5.0				
18	Additional under construction.....	miles..								
19	Maximum completed in any enterprise.....	miles..		6.0	0.5	5.0				
20	Maximum size of tile.....	inches..		14	8	10				
21	Accessory levees and dikes: Completed.....	miles..	4.8					0.8		0.3
22	Additional under construction.....	miles..								
23	Pumping plants: Engine capacity.....	horsepower..	(*)							150
24	Pump capacity.....	gallons per minute..	(*)							
25	Area served by pumps.....	acres..	4,301							2,296
26	Area drained by open ditches only.....	acres..		4,810	4,300	6,348	7,240	6,246	49,983	17,913
27	Length of these ditches.....	miles..		14.7	19.5	25.1	16.9	10.0	90.0	33.2
28	Average length per acre.....	feet..		16.1	23.9	20.9	12.3	8.5	9.5	24.5
29	Area having open ditches and levees.....	acres..	4,301					14,360		2,296
30	Length of these ditches.....	miles..	7.3					47.0		2.0
31	Average length per acre.....	feet..	9.0					17.3		4.6
32	Length of the accessory levees.....	miles..	4.8					0.8		0.3
33	Area drained by tile only.....	acres..		280						
34	Length of these tile.....	miles..		1.5						
35	Average length per acre.....	feet..		28.3						
36	Area drained by open ditches and tile.....	acres..		3,820	200	1,500				
37	Length of these drains.....	miles..		14.6	1.5	15.0				
38	Average length per acre.....	feet..		20.2	39.6	52.8				
39	Area having open ditches, tile drains, and levees.....	acres..								
40	Length of these drains.....	miles..								
41	Average length per acre.....	feet..								
42	Length of the accessory levees.....	miles..								
<b>DEVELOPMENT OF LAND.</b>										
43	Improved land, in operating enterprises, 1920.....	acres..	430	4,048	330	4,757	456	3,710	18,911	10,410
44	Improved land prior to drainage.....	acres..		130	40				200	1,410
45	Increase since drainage.....	acres..	430	2,918	290	4,757	456	3,710	18,711	9,000
46	Per cent of increase.....				725.0					638.3
47	Per cent increase is of all improved land in farms, 1920.....		0.2	1.6	0.2	2.1	0.2	2.0	13.7	0.4
48	Timber and cut-over land, 1920.....	acres..	2,581		2,825	419	190		4,536	1,833
49	Timber and cut-over land prior to drainage.....	acres..	2,581		2,975	1,169	570		7,279	2,163
50	Decrease since drainage.....	acres..			150	750	390		2,743	330
51	Per cent of decrease.....				5.0	64.2	66.7		37.7	15.3
52	Other unimproved land, 1920.....	acres..	1,290	4,862	1,345	2,672	6,594	2,536	40,896	7,966
53	Other unimproved land prior to drainage.....	acres..	1,720	8,780	1,485	6,679	6,670	6,246	56,884	16,636
54	Decrease since drainage.....	acres..	430	3,918	140	4,007	76	3,710	15,968	8,670
55	Per cent of decrease.....		26.0	44.6	9.4	60.0	1.1	59.4	28.1	52.1
56	Swampy or subject to overflow, 1920.....	acres..				501	794			3,199
57	Swampy or subject to overflow prior to drainage.....	acres..	4,301	8,910	4,500	7,848	7,240	6,246	59,807	16,061
58	Decrease since drainage.....	acres..	4,301	8,910	4,500	7,347	6,446	6,246	59,807	12,862
59	Per cent of decrease.....		100.0	100.0	100.0	93.6	89.0	100.0	100.0	80.1
<b>CAPITAL INVESTED AND COST PER ACRE.</b>										
60	Total capital invested in and required for completion of operating enterprises.....	dollars..	50,000	63,465	64,500	44,835	27,000	20,400	394,200	143,463
61	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	50,000	63,465	64,500	44,835	27,000	20,400	394,200	143,463
62	Additional capital required to complete these enterprises.....	dollars..								
63	Average cost per acre when completed.....	dollars..	11.63	7.12	14.33	5.71	3.73	3.27	6.13	7.10
64	Enterprises constructing open ditches only.....	dollars..		33,560	59,500	27,835	27,000	20,400	250,700	118,463
65	Average cost per acre when completed.....	dollars..		6.98	13.84	4.38	3.73	3.27	5.02	6.61
66	Enterprises constructing open ditches and levees.....	dollars..	50,000						143,500	25,000
67	Average cost per acre when completed.....	dollars..	11.63						9.99	10.80
68	Enterprises constructing tile drains only.....	dollars..		4,906						
69	Average cost per acre when completed.....	dollars..		17.52						
70	Enterprises constructing open ditches and tile drains.....	dollars..		25,000	5,000	17,000				
71	Average cost per acre when completed.....	dollars..		6.54	25.00	11.33				
72	Enterprises constructing open ditches, tile drains, and levees.....	dollars..								
73	Average cost per acre when completed.....	dollars..								
<b>CROPS.</b>										
74	Improved land in enterprises reporting—									
75	Hay as principal crop on drained land.....	acres..	430			311	456		3,265	6,736
76	Corn as principal crop on drained land.....	acres..		4,048	330	3,696	2,828			3,674
77	Small grains as principal crop on drained land.....	acres..				750			5,026	
78	Vegetables as principal crop on drained land.....	acres..								
79	Other crops as principal ones on drained land.....	acres..							5,620	
80	Not reporting principal crop on drained land.....	acres..								

<sup>1</sup> Includes only Barron, Brown, Buffalo, Burnett, Calumet, Green, Green Lake, Manitowoc, Marinette, Polk, and Waupaca Counties.   
<sup>2</sup> When works under construction have been completed.   
<sup>3</sup> Pumping plant located in Buffalo County.   
<sup>4</sup> Per cent not shown when more than 1,000

## WYOMING.

The following pages present the statistics of drainage for Wyoming collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the state.....	15,748	100.0
Farms reporting land having drainage.....	433	2.7
Farms reporting land needing drainage.....	1,127	7.2
All land in farms..... acres..	11,809,351	100.0
Improved land in farms..... acres..	2,102,005	17.8
Farm land reported as provided with drainage..... acres..	35,654	0.3
Farm land reported as needing drainage..... acres..	69,066	0.6
Needing drainage only..... acres..	23,837	0.2
Needing drainage and clearing..... acres..	45,229	0.4
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the state..... acres..	62,430,720	100.0
All land in operating drainage enterprises..... acres..	95,474	0.2
Improved land..... acres..	84,846	0.1
Per cent of all improved land in farms.....	4.0	.....
Unimproved land <sup>1</sup> ..... acres..	10,628	(?)
Swampy, subject to overflow, seeped, or alkali..... acres..	20,785	(?)
Suffering a loss of crops from defective drainage..... acres..	6,595	(?)
Improved land prior to drainage..... acres..	83,206	0.1
Increase since drainage began..... acres..	1,640	(?)
Land in nonoperating enterprises..... acres..	11,567	(?)
Open ditches in operating enterprises..... miles..	26.4	100.0
Completed..... miles..	25.1	95.1
Additional under construction..... miles..	1.3	4.9
Tile drains in operating enterprises..... miles..	186.0	100.0
Completed..... miles..	114.2	61.4
Additional under construction..... miles..	71.8	38.6
Total capital invested in and required for completion of operating enterprises..	\$1,667,367	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	1,175,962	70.5
Additional capital required to complete these enterprises.....	491,405	29.5
Average cost per acre when completed.....	17.46	.....

<sup>1</sup> No timber or cut-over land reported.

<sup>2</sup> Less than one-tenth of 1 per cent.



Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	107,041	100.0	\$1,182,362	100.0	\$901,873
Operating enterprises.....	95,474	89.2	1,175,962	99.5	491,405
With works completed.....	11,740	11.0	32,231	2.7	.....
With works under construction.	83,734	78.2	1,143,731	96.7	491,405
Nonoperating enterprises.....	11,567	10.8	6,400	0.5	410,468

<sup>1</sup> The inquiry asked for the "total cost of the enterprises to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Of the total area in operating drainage enterprises in Wyoming, 44 per cent is situated in Big Horn County, and nearly all is in the valley of Big Horn River in the north central part of the state. There are two enterprises in the eastern part, and a very small one in Fremont County.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	107,041	100.0	\$1,182,362	100.0	\$901,873
Operating enterprises.....	95,474	89.2	1,175,962	99.5	491,405
Platte River.....	3,264	3.0	18,896	1.6	4,224
Big Horn River.....	92,210	86.1	1,157,066	97.9	487,181
Nonoperating enterprises.....	11,567	10.8	6,400	0.5	410,468
Big Horn River.....	11,567	10.8	6,400	0.5	410,468

Condition of land in enterprises.—All the drainage enterprises in this state are reported as organized for the purpose of draining or protecting land injured or threatened with water-logging or the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. For the state, 19,622 acres of land in drainage districts are reported as not having needed drainage, but as having been assessed merely for contributing to the injury of the other land.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	95,474	100.0	11,740	83,734	11,567
Improved land.....	84,846	88.9	11,140	73,706	7,513
Unimproved land <sup>1</sup> .....	10,628	11.1	600	10,028	4,054
Swampy, seeped, or alkali.....	20,785	21.8	2,700	18,085	6,554
Suffering a loss of crops.....	6,696	6.9	2,165	4,430	1,000

<sup>1</sup> No timber or cut-over land reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 15 operating drainage enterprises are counted in Wyoming, with an average area of 6,365 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	95,474	95,474	100.0
Less than 200 acres.....	140	140	0.1
200 to 499 acres.....	.....	.....	.....
500 to 999 acres.....	500	500	0.5
1,000 to 4,999 acres.....	21,514	21,514	22.5
5,000 to 9,999 acres.....	27,400	27,400	28.7
10,000 to 49,999 acres.....	45,920	45,920	48.1

**Character of enterprises.**—The drainage enterprises in Wyoming comprise drainage districts organized under the general drainage law approved March 1, 1911 (ch. 95), irrigation projects of the United States Reclamation Service, and two very small enterprises under the United States Indian Service and under individual ownership, respectively.

Drainage districts under the statute of 1911 are established by the district court of any county in which a part of the land to be affected is located. The district may comprise separated areas, if the court finds that drainage of all parts will be of public benefit and can be accomplished most economically as one undertaking. A petition for establishment must be signed by a majority of the owners representing at least one-third of the acreage, or by the owners of more than one-half the acreage in the proposed district. A preliminary investigation as to the practicability, public utility, probable benefits, and cost of the project is made by three commissioners appointed by the court. These commissioners become the executive officers of the district when it is established, to prepare the plan of improvement works, to assess damages and benefits to the property in the district, and to secure construction of the drainage works. The court holds public hearings to determine the sufficiency of the petition before appointing the commissioners, to discuss the preliminary report of the commissioners before establishing the district, and to consider objections to the commissioners' final report before approving the work and confirming the assessments of benefits and damages. Appeals regarding the assessments may be taken to the supreme court of the state. Bonds of the district may be issued by the commissioners.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All drainage enterprises.....	107,041	100.0	\$1,182,362	100.0	\$901,873
Operating enterprises.....	95,474	89.2	1,175,962	99.5	491,405
Drainage districts.....	60,534	56.8	638,662	54.0	491,405
U. S. Reclamation projects <sup>1</sup> .....	34,640	32.4	537,300	45.4	.....
Nonoperating enterprises.....	11,567	10.8	6,400	0.5	410,468
Drainage districts.....	11,567	10.8	6,400	0.5	410,468

<sup>1</sup> Includes 140 acres under U. S. Indian Service and 500 acres under individual ownership.

The United States Reclamation Service may provide drainage and protection for the land in its irrigation projects as it may deem necessary. An act of the legislature, February 27, 1919 (ch. 142), author-

izes cooperation between drainage and irrigation districts and the United States Reclamation Service in the construction of drainage and irrigation works.

An amendment to the drainage law, made March 5, 1915 (ch. 155), does not affect the character of those enterprises as described, and is the only other law of the state relating to drainage enterprises.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 25.1 miles of open ditches and 114.2 miles of tile drains; the additional lengths under construction were 1.3 miles of open ditches and 71.8 miles of tile drains. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	95,474	100.0	\$1,175,962	100.0	\$491,405
Open ditches only.....	3,404	3.6	25,127	2.1	4,224
Tile drains only.....	54,650	57.2	590,039	50.2	269,133
Open ditches and tile drains.....	37,420	39.2	560,796	47.7	218,048

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	95,474	100.0
4.0 to 4.9 feet.....	500	0.5
8.0 to 8.9 feet.....	34,000	35.6
Not reporting branches.....	60,974	63.9

DRAINAGE—WYOMING.

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**Maintenance of works.**—The drainage law of 1911 provides for the maintenance of the drainage districts by the district commissioners, and authorizes assessments for such work to be levied against the land in the same proportion as the cost of original construction. It requires the commissioners to submit to the court each year a report stating the probable needs of the district for the next fiscal year, which is confirmed by the court at a hearing to determine objections.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	95,474	100.0	\$1,175,962	100.0	\$491,405
By district forces.....	45,390	47.5	697,300	59.3	259,775
By contract.....	8,400	8.8	8,000	0.7	.....
By method not specified.....	3,000	3.1	70,000	6.0	30,000
No maintenance provided.....	30,984	32.5	294,662	25.1	181,630
Not reported.....	7,700	8.1	106,000	9.0	20,000

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the district courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	95,474	100.0	95,474	100.0
1910 to 1914.....	50,000	64.7	50,000	64.7
1915 to 1919.....	45,474	35.3	45,474	35.3

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,175,962	100.0	\$491,405
1910 to 1914.....	684,069	58.2	231,775
1915 to 1919.....	491,893	41.8	259,630

TABLE 12.—DRAINS (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains.....	26.4	100.0	186.0	100.0
1910 to 1914.....	20.0	75.8	105.0	56.5
1915 to 1919.....	6.4	24.2	81.0	43.5

**Crops.**—The principal crops grown upon the drained land in drainage enterprises are alfalfa and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Big Horn.	Carbon.	Fremont.	Johnson.
1 Number of all farms in the state or county.....	15,748	998	413	960	624
2 Farms reporting land having drainage.....	433	108	7	20	8
3 Farms reporting land needing drainage.....	1,127	276	13	115	19
4 Farms in drainage and levee districts.....	337	120	.....	9	.....
<b>LAND AND FARM AREA.</b>					
5 Approximate land area of the state or county..... acres..	162,430,720	1,990,400	5,124,490	7,347,040	2,664,960
6 All land in farms..... acres..	11,809,351	190,445	843,520	449,331	472,611
7 Improved land in farms..... acres..	2,102,005	98,661	102,112	120,291	71,232
8 Woodland in farms..... acres..	421,806	7,830	14,566	8,750	5,163
9 Other unimproved land in farms..... acres..	9,285,540	88,954	726,841	320,290	396,216
10 Farm land reported as provided with drainage..... acres..	35,654	7,505	525	743	906
11 Farm land reported as needing drainage..... acres..	69,066	16,138	802	6,458	1,305
12 Drainage only..... acres..	23,837	10,992	377	3,295	765
13 Drainage and clearing..... acres..	45,229	5,146	426	3,163	650

<sup>1</sup> Includes 1,686,720 acres in Yellowstone National Park.



DRAINAGE—WYOMING.

COUNTY TABLE L—DRAINAGE ON FARMS: 1929—Continued.

	Lincoln	Park	Platte	Sheridan	Washakie	All other counties <sup>1</sup>
1 Number of all farms in the county.....	828	838	1,148	872	313	8,548
2 Farms reporting land having drainage.....	8	204	10	13	24	16
3 Farms reporting land needing drainage.....	218	188	25	87	65	123
4 Farms in drainage and levee districts.....			5	2	20	2
<b>LAND AND FARM AREA</b>						
5 Approximate land area of the county..... acres	5,724,900	3,322,400	1,383,000	1,647,300	1,424,200	20,413,200
6 All land in farms..... acres	441,312	288,198	974,420	625,738	88,378	7,421,026
7 Improved land in farms..... acres	182,081	88,063	130,308	113,365	27,807	1,111,639
8 Woodland in farms..... acres	10,025	7,613	61,377	8,741	2,354	285,137
9 Other unimproved land in farms..... acres	249,206	192,522	782,735	503,632	58,217	6,039,250
10 Farm land reported as provided with drainage..... acres	917	18,155	2,289	762	4,923	1,084
11 Farm land reported as needing drainage..... acres	18,738	2,673	736	2,185	2,919	10,310
12 Drainage only..... acres	988	2,334	682	591	1,021	1,382
13 Drainage and clearing..... acres	15,750	344	114	1,574	1,898	17,928

<sup>1</sup> No drainage on farms reported in Campbell, Carbon, Crook, Hot Springs, Natron, Niobrara, and Weston Counties.

COUNTY TABLE II—OPERATING DRAINAGE ENTERPRISES: 1929.

	Tom Slick	Big Horn	Park	Washakie	Other counties <sup>1</sup>
<b>LAND AREA</b>					
1 Approximate land area of the state or county..... acres	782,428,728	1,988,400	3,322,400	1,424,200	18,085,000
2 All land in operating drainage enterprises..... acres	95,574	41,738	22,938	20,400	1,494
3 Improved land..... acres	24,346	21,922	20,338	17,000	1,394
4 Per cent of all improved land in farms.....	4.0	24.2	21.4	21.5	0.7
5 Unimproved land..... acres	71,228	19,816	2,600	3,400	100
6 Swampy, wooded, or alkali in enterprises..... acres	22,785	18,782	598	1,400	100
7 Suffering a loss of crops from defective drainage..... acres	4,346	4,337	598	1,300	100
8 Assumed acreage..... acres	95,574	41,738	22,938	20,400	1,494
9 Known over all land in operating enterprises..... acres					
<b>DRAINAGE WORK</b>					
<b>Open ditches:</b>					
10 Completed..... miles	25.1	2.5	17.6		5.0
11 Additional under construction..... miles	1.3	0.8			0.5
12 Maximum completed in any enterprise..... miles	17.6	2.4	17.6		2.0
13 Maximum width at bottom of ditch..... feet	8	4	4		8
14 Maximum of a vertical depth of outlet ditches..... feet	12.0	8.5	8.5		12.0
15 Mean depth of branch ditches..... feet	2.9	2.0	2.0		4.0
<b>Tile drains:</b>					
16 Completed..... miles	124.2	48.0	42.1	22.2	
17 Additional under construction..... miles	71.8	32.8	27.7	11.2	
18 Maximum completed in any enterprise..... miles	42.1	18.0	42.1	10.0	
19 Maximum size of tile..... inches	24	24	15	15	
20 Area drained by open ditches only..... acres	2,494				2,494
21 Length of these ditches..... miles	5.5				5.5
22 Average length per acre..... feet	8.5				8.5
23 Area drained by tile only..... acres	54,628	24,328		20,400	
24 Length of these tile..... miles	28.1	26.7		24.4	
25 Average length per acre..... feet	9.0	9.0		9.0	
26 Area drained by open ditches and tile..... acres	57,122	24,328	22,938		
27 Length of these drains..... miles	113.9	31.4	39.4		
28 Average length per acre..... feet	14.1	15.1	14.3		
<b>DEVELOPMENT OF LAND</b>					
29 Improved land in operating enterprises, 1929..... acres	95,574	41,738	22,938	17,000	1,494
30 Improved land prior to drainage..... acres	24,346	21,922	20,338	17,000	1,394
31 Increase since drainage..... acres	1,600				100
32 Per cent of increase.....	2.0			0.3	4.3
33 Per cent increase as of all improved land in farms, 1929.....	0.1			0.3	
34 Unimproved land, 1929..... acres	18,085,000	7,421,026		2,000	
35 Unimproved land prior to drainage..... acres	17,585,000	7,421,026		4,000	100
36 Decrease since drainage..... acres	1,500			1,000	100
37 Per cent of decrease.....	13.4			25.0	100.0
38 Swampy, wooded, or alkali, 1929..... acres	18,738	18,738	18,738	1,400	
39 Swampy, wooded, or alkali prior to drainage..... acres	17,300	17,300	17,300	11,200	2,000
40 Decrease since drainage..... acres	1,438	1,438	1,438	2,800	1,000
41 Per cent of decrease.....	7.1	8.0	8.0	27.6	50.0
<b>CAPITAL INVESTED AND COST PER ACRE</b>					
42 Total capital invested in and required for completion of operating enterprises..... dollars	1,097,000	511,000	471,000	273,000	20,350
43 Capital invested in these enterprises in Dec. 31, 1929..... dollars	1,097,000	511,000	471,000	273,000	20,350
44 Additional capital required to complete these enterprises..... dollars	17,000	17,000	17,000	17,000	17,000
45 Average cost per acre when completed..... dollars	11.4	12.2	20.5	13.4	13.6
46 Enterprises constructing open ditches only..... dollars	24,940				24,940
47 Average cost per acre when completed..... dollars	10.0				10.0
48 Enterprises constructing open ditches and tile drains..... dollars	174,460	148,320	682,200		
49 Average cost per acre when completed..... dollars	14.9	14.3	29.8		
50 Enterprises constructing tile drains only..... dollars	888,100	362,680		271,600	
51 Average cost per acre when completed..... dollars	16.2	14.9		13.4	
<b>CROPS</b>					
Improved land in enterprises reported—					
52 Acreage as principal crop on drained land..... acres	54,300	4,000	24,300	17,000	2,200
53 Same acreage as principal crop on unimproved land..... acres	15,700	15,700			
54 Hay-crover acreage as principal crop on drained land..... acres	2,000	2,000			
55 Not reporting principal crop on drained land..... acres	11,000	11,000			100

<sup>1</sup> Includes only Fremont, Goshute, and Platte Counties.  
<sup>2</sup> Includes 1,000,000 acres in Yellowstone National Park.  
<sup>3</sup> No timber or sub-irrigated land reported.

<sup>4</sup> Where works under construction have been completed.  
<sup>5</sup> Less than one-fourth of 1 per cent.

## OTHER STATES.

The following pages present the statistics of drainage collected at the census of 1920 for those states not covered by the foregoing sections for separate states. Statistics for drainage on farms were collected by the census enumerators in all the states. Figures for organized drainage enterprises are given here for Arizona, Nevada, New Mexico, Oklahoma, and Oregon. The totals for these five states together are given in Tables 1 to 12 following, classified as the totals for individual states have been classified in the foregoing pages. Because no operating enterprises of a public nature for draining land for agriculture were found in Alabama, Virginia, and West

Virginia, those states have been omitted entirely from the census of drainage enterprises, except that the character of the public drainage enterprises authorized by law is stated on page 710. Before the census was begun, it was determined that very little drainage of land for agriculture had been undertaken by organized enterprises in most of the northeastern states, and that concerning the work which had been done sufficient information could not be secured to be of value for census purposes. Therefore, no attempt was made to canvass drainage enterprises in the region from Maine to and including Pennsylvania, Maryland, and Delaware.

TABLE 1.—SUMMARY FOR THESE STATES: 1920.

ITEM.	Amount.	Per cent of total.
<b>DRAINAGE ON FARMS.</b>		
Number of all farms in the states included <sup>1</sup> .....	1,454,769	100.0
Farms reporting land having drainage.....	124,195	8.5
Farms reporting land needing drainage.....	190,181	13.1
All land in farms.....acres.....	189,042,653	100.0
Improved land in farms.....acres.....	67,406,893	46.2
Farm land reported as provided with drainage.....acres.....	3,357,899	1.8
Farm land reported as needing drainage.....acres.....	6,045,287	3.2
Needing drainage only.....acres.....	1,085,224	0.6
Needing drainage and clearing.....acres.....	4,960,063	2.6
<b>DRAINAGE ENTERPRISES.</b>		
Approximate land area of the states included <sup>2</sup> .....acres.....	327,139,200	100.0
All land in operating drainage enterprises.....acres.....	211,949	0.1
Improved land.....acres.....	160,172	(3)
Per cent of all improved land in farms.....	0.2	.....
Timber and cut-over land.....acres.....	3,305	(3)
Other unimproved land.....acres.....	58,472	(3)
Swampy, subject to overflow, seeped, or alkali.....acres.....	30,243	(3)
Suffering a loss of crops from defective drainage.....acres.....	35,581	(3)
Improved land prior to drainage.....acres.....	111,942	(3)
Increase since drainage began.....acres.....	38,230	(3)
Land in nonoperating enterprises.....acres.....	32,345	(3)
Open ditches in operating enterprises.....miles.....	193.4	100.0
Completed.....miles.....	191.6	99.2
Additional under construction.....miles.....	1.6	0.8
Tile drains in operating enterprises.....miles.....	365.3	100.0
Completed.....miles.....	300.2	82.2
Additional under construction.....miles.....	65.1	17.6
Total capital invested in and required for completion of operating enterprises.....	\$4,327,967	100.0
Capital invested in these enterprises to December 31, 1919.....	2,519,467	58.2
Additional capital required to complete these enterprises.....	1,808,500	41.8
Average cost per acre when completed.....	20.42	.....

<sup>1</sup> Comprises Alabama, Arizona, Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia.  
<sup>2</sup> Comprises Arizona, Nevada, New Mexico, Oklahoma, and Oregon.  
<sup>3</sup> Less than one-tenth of 1 per cent.

**Operating and nonoperating enterprises.**—In Nevada and Oregon the drainage enterprises have completed construction of the drainage works, while in Arizona, New Mexico, and Oklahoma are enterprises that have completed the works authorized and others with works under construction. Nonoperating enterprises were reported only in Arizona.

**TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.**

CLASS.	LAND.		CAPITAL. <sup>1</sup>		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	244,294	100.0	\$2,519,987	100.0	\$2,493,500
Operating enterprises.....	211,949	86.8	2,519,487	100.0	1,808,500
With works completed.....	61,499	25.2	857,430	34.0	.....
With works under construction.	150,450	61.6	1,662,057	66.0	1,808,500
Nonoperating enterprises.....	32,345	13.2	500	(*)	685,000

<sup>1</sup> The inquiry asked for "the total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

\* Less than one-tenth of 1 per cent.

**Location of enterprises.**—The operating drainage enterprises for which statistics are given in the following pages are located in Graham, Maricopa, and Yuma Counties, Ariz.; in Churchill County, Nev.; in Chaves, Dona Ana, and Eddy Counties, N. Mex.; in Canadian, Kay, Johnston, and Muskogee Counties, Okla.; and in Malheur County, Oreg. The locations are indicated approximately on the map following page 346. The nonoperating enterprises are located in Maricopa and Sierra Counties, Ariz.

**TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.**

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	244,294	100.0	\$2,519,987	100.0	\$2,493,500
Operating enterprises.....	211,949	86.8	2,519,487	100.0	1,808,500
Snake River.....	4,000	1.6	200,000	7.9	.....
Gila River.....	9,640	3.9	101,425	4.0	.....
Colorado River.....	30,000	12.3	313,000	12.4	612,000
Great Basin.....	15,940	6.5	117,851	4.7	.....
Pecos River.....	66,219	27.1	1,135,706	45.1	195,500
Rio Grande.....	74,000	30.3	575,000	22.8	1,000,000
Red River.....	6,000	2.5	44,500	1.8	.....
Canadian River.....	2,900	1.2	4,250	0.2	1,000
Arkansas River.....	3,250	1.3	27,665	1.1	.....
Nonoperating enterprises.....	32,345	13.2	500	(*)	685,000
Gila River.....	25,345	10.4	500	(*)	535,000
Rio Grande.....	7,000	2.9	.....	.....	150,000

\* Less than one-tenth of 1 per cent.

**Condition of land in enterprises.**—The enterprises in Oklahoma were reported as organized to drain land subject to overflow from streams after storm periods, while all the enterprises in the other states were established for draining or protecting land injured or threatened by seepage or the accumulation of alkali in the surface soil as a result of irrigation.

In Arizona, Nevada, and New Mexico, 100,329 acres in projects of the United States Reclamation Service were reported as not to have needed drainage or protection, but to have been assessed for drainage merely on account of being responsible for injury to the other land. This acreage is not included in the statistics given for drainage enterprises.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

**TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.**

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	211,949	100.0	61,499	150,450	32,345
Improved land.....	150,172	70.9	47,730	102,442	24,026
Timber and cut-over land.....	3,395	1.6	3,025	280	.....
Other unimproved land.....	58,472	27.6	10,744	47,728	8,319
Swampy, subject to overflow, seeped, or alkali.....	30,243	14.3	8,571	21,672	1,069
Suffering a loss of crops.....	35,581	16.8	10,261	25,320	2,224

**Size of enterprises.**—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 18 operating drainage enterprises are counted in the five states named, with an average area of 11,775 acres. There are 3 enterprises having less than 1,000 acres each, 10 between 1,000 and 10,000 acres, and 5 having more than 10,000 acres each. There is no overlapping of the enterprises in any of these states.

**TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.**

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	311,949	211,949	100.0
200 to 499 acres.....	400	400	0.2
500 to 999 acres.....	1,390	1,390	0.7
1,000 to 4,999 acres.....	9,000	9,000	4.2
5,000 to 9,999 acres.....	49,579	49,579	23.4
10,000 to 49,999 acres.....	77,580	77,580	36.6
50,000 to 99,999 acres.....	74,000	74,000	34.9

**Character of enterprises.**—The enterprises in the states being considered here are drainage districts in Arizona, New Mexico, Oklahoma, and Oregon; projects of the United States Reclamation Service in

Arizona, Nevada, and New Mexico; one small undertaking by an incorporated town in Arizona; and one enterprise under individual ownership in Oklahoma.

The drainage districts in Arizona are organized under Chapter 5, Title 55, Civil Code, Revised Statutes of Arizona, 1913. That chapter authorizes the establishment of drainage districts by the boards of county supervisors in which the proposed districts are situated, upon petition from five or more owners of agricultural land to be benefited, if approved by the landowning voters of the district. These voters elect three directors to manage the enterprise. The cost of the drainage is paid by ad valorem taxes upon the real property in the district or, as authorized by an amendment of March 14, 1917 (ch. 57), according to benefits assessed against the land. In apportioning the benefits, no parcel of land is to be assessed less than one unit nor more than five units. The districts are financed by bonds issued for 11 to 20 years, authorized by vote of the electors and tested by proceedings in the superior court of the county. This statute was first enacted May 16, 1912 (ch. 38).

The drainage districts in New Mexico are organized under an act of June 14, 1912 (ch. 84). The statute provides that districts for the drainage of land for agriculture may be established by the district courts upon petition from a majority of the adult owners representing one-third of the area to be benefited. A district may comprise separated tracts of land. A preliminary investigation of the project is made by three commissioners appointed by the court. When the decree of establishment has been issued, these commissioners become the officers of the district to complete the plan of drainage, determine the boundaries of the district, assess benefits and damages, and secure construction of the works. The cost of the enterprise is apportioned against the land in proportion to the benefits. Public hearings are held upon the petition, the commissioners' preliminary report, and their final report with plan and assessments. Appeal regarding the confirmation of the final report may be taken to the state supreme court. Bonds of the district may be issued by the commissioners to finance the work. A state law of March 6, 1917 (ch. 22), authorizes the establishment of drainage districts in projects of the United States Reclamation Service, but no enterprises were reported as organized under that law. The act provides for establishment by the county commissioners upon petition from a majority of the resident owners representing one-third of the land in the proposed district, subject to vote of the landowners. The affairs of the district are to be administered by elected directors. The cost is to be apportioned according to benefits, and the enterprise may be financed by issuing bonds.

The drainage districts in Oklahoma are organized under an act approved May 29, 1908 (ch. 30). As amended to the census date, the law provides that the

districts may be established by the boards of county commissioners on petition from five or more landowners to be assessed for the improvement. A district shall be established upon petition from 50 per cent of the owners or from the resident owners of 50 per cent of the land. A preliminary survey and report are made by viewers appointed by the commissioners. The final plan of drainage works and the assessments of damages and benefits are made by viewers appointed by the judge of the district court of the county, and are equalized and confirmed by the county commissioners. The cost is apportioned according to the confirmed benefits. Public hearings are held by the commissioners upon the preliminary and final reports of the viewers. Appeals regarding assessments may be taken to the district court. Contracts for construction are let by a surveyor appointed by the commissioners. Bonds of the district may be issued by the commissioners.

Drainage districts in Oregon may be organized under an act of February 26, 1915 (ch. 340), which authorizes the establishment of such districts by the county courts upon petition from the record owners of 50 per cent of any contiguous body of swamp, wet, or overflowed land. Each district is governed by three supervisors elected by the landowners; each owner has one vote for each acre he owns in the district. After the plan of reclamation is prepared, benefits and damages are assessed against all land to be affected, by three commissioners appointed by the court. The cost is apportioned according to the benefits confirmed by the court at public hearing. The district may issue bonds running for 20 years. An act of February 23, 1911 (ch. 172), provides that three or more persons may incorporate as a district improvement company for draining land, by filing with the secretary of state and the county clerk articles of incorporation which must specify the land to be improved. All expenditures must be authorized and the plan of reclamation must be approved by the owners of the land to be improved. The corporation has power of eminent domain, and may issue bonds for 20 years. An act of February 21, 1889, authorized the county courts, except in five counties, to establish drainage districts upon petition from one-half the owners representing one-third of the land to be benefited. Trustees for the district were to be named by the petitioners. The act later was made applicable in all counties, and the proportion of landowners required to sign the petition was reduced. Right-of-way for a private drain across the land of an objecting owner may be secured through application to the county court and payment of damages assessed, under an act of October 24, 1868.

While no organized drainage enterprise was reported in Nevada except that by the United States Reclamation Service, the formation of drainage districts in that state is authorized by an act of March 31, 1913 (ch. 281). Such districts may be established by the

boards of county commissioners, upon petition from a majority of the owners controlling not less than one-third of the acreage to be benefited, or from one-third of the owners controlling a major part of the acreage, and after public hearing. To govern each district, the county commissioners appoint three supervisors and an engineer, who prepare the plan of drainage, assess benefits and damages, and secure construction of the works. The cost of the enterprise is apportioned according to the benefits as equalized by the county commissioners. The board of supervisors may issue bonds to mature in not more than 20 years, if approved by vote of the landowners.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Total.	Per cent of total.	
All organized enterprises..	244, 294	100. 0	\$2, 519, 987	100. 0	\$2, 493, 500
Operating enterprises.....	211, 949	86. 8	2, 519, 487	100. 0	1, 808, 500
Drainage districts <sup>1</sup> .....	84, 478	34. 6	1, 377, 032	54. 6	196, 500
U. S. Reclamation Service <sup>2</sup> ..	127, 471	52. 2	1, 142, 455	45. 8	1, 612, 000
Nonoperating enterprises.....	32, 345	13. 2	500	( <sup>3</sup> )	685, 000
Drainage districts.....	25, 345	10. 4	500	( <sup>3</sup> )	535, 000
U. S. Reclamation Service....	7, 000	2. 9	.....	.....	150, 000

<sup>1</sup> Includes 640 acres organized as a town drain.  
<sup>2</sup> Includes 2,500 acres under individual ownership.  
<sup>3</sup> Less than one-tenth of 1 per cent.

Alabama has two general drainage laws, though no public drainage enterprises. The statute of March 4, 1915 (No. 167), authorizes the establishment of drainage districts as corporate bodies by the courts of probate of the counties in which the districts are located, for the drainage of farm, wet, swamp, or overflowed land. A petition for the district must be signed by a majority, in either number or acreage, of the landowners to be assessed. When the district has been established, the court appoints three viewers to make the plan of drainage and to assess damages and benefits. Thereafter, the district is controlled by three commissioners appointed by the court. The cost is apportioned against the land according to the benefits. Bonds may be issued if the average cost will be 50 cents or more per acre. Drainage and flood protection districts for public health and welfare in counties containing cities of 50,000 to 125,000 population may be established as political subdivisions by the courts of county commissioners according to an act of September 30, 1919 (No. 742). The petition for establishment may be signed by a majority of the landowners affected, in number or acreage, or by a majority of the qualified voters of the district. An engineer appointed by the court makes a preliminary investigation and, after the district is established, the final plan of improvement and the assessments of benefits and damages. The court lets contract for construction and apportions the cost according to the benefits. Bonds may be issued if the average cost

will exceed \$1 per acre and if approved by a majority of the voters of the district.

Virginia enacted a law March 14, 1906 (ch. 188), authorizing the establishment of drainage districts by the circuit courts, but no enterprises in the state organized under that or succeeding drainage laws had begun actual construction by January 1, 1920. The statute of 1906 provided that upon petition from more than five landowners the court should hold a hearing and, by its commissioner in chancery, determine the size of the ditch and assess benefits and damages. Upon establishing the district, the court should appoint a commissioner to collect the assessments and let contract for the work. This act has been superseded by later statutes. An act of March 17, 1910 (ch. 312), provided for the establishment of drainage districts by the county circuit courts. It was amended and reenacted March 12, 1912 (ch. 159), and again March 27, 1914 (ch. 332). The three statutes are alike in their main provisions. A petition for the district must be signed by a majority of the resident landowners in the proposed district, or by the owners of three-fifths of the land. The district will not be established except upon favorable report from the viewers appointed by the court. After establishment, the viewers prepare the plan of drainage, divide the land into five classes according to benefits, and assess damages. When the plans, classification, and assessments have been approved, the court appoints a board of commissioners to have charge of the district. The cost is apportioned according to the classification of the land, the rates per acre being in the ratio 5:4:3:2:1. Bonds may be issued if the cost exceeds 25 cents per acre. An act of March 31, 1848 (ch. 110), authorized the courts of common pleas to condemn right of way for a private drain across the land of an owner who refused permission, the applicant first paying damages as assessed by jury or, since 1871 (ch. 205), by commissioners appointed by the court.

West Virginia has no organized drainage enterprises, though a general drainage law was enacted February 24, 1917 (ch. 26). The act provides that drainage, levee, and reclamation districts for the drainage of farm, wet, and overflowed land may be established by the circuit courts upon petition from three or more owners of real property in the proposed district, after preliminary investigation and public hearing. Three supervisors to manage the enterprise are elected by the landowners, who vote in proportion to their acreage assessed. Benefits and damages are assessed by appraisers appointed by the court, subject to confirmation at public hearing and to appeal for jury trial. The cost is apportioned according to the benefits, and the district may issue bonds to mature within 15 years. The legal code of West Virginia, in 1868, provided that right-of-way for a private drain across the land of an objecting owner might be se-

cured by application to the circuit court and payment of damages.

**Drainage works.**—The total works completed by drainage enterprises to December 31, 1919, comprised 191.8 miles of open ditches, 300.2 miles of tile drains, and 31.0 miles of levees; the additional lengths under construction were 1.6 miles of open ditches and 65.1 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one pumping district, in Arizona, in which all the drainage from 25,000 acres is removed by 2 screw pumps of 33,660 gallons per minute total capacity, which are operated by internal combustion engines capable of developing 175 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	211,949	100.0	\$2,519,487	100.0	\$1,808,500
Open ditches only.....	95,150	44.9	701,340	27.8	1,001,000
Open ditches and levees.....	30,000	14.2	357,500	14.2	612,000
Tile drains only.....	38,778	18.3	797,692	31.7	63,000
Open ditches and tile drains.....	48,021	22.7	662,955	26.3	142,500

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in each state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths of 10 feet and more were omitted, as they seemed not to represent so well the average depths of outlet provided for all the farms in the districts. To include all the enterprises reporting branch ditches would show the mean depth for the five states 10.0 instead of 8.0 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	211,949	100.0
9.0 to 9.9 feet.....	30,000	14.2
10 feet and more.....	85,031	40.1
Not reporting branches.....	96,918	45.7

**Maintenance of works.**—The drainage law of Arizona requires the directors of each drainage district to keep the works of the district in repair, and to include in their annual estimate of drainage taxes the probable cost of the repairs apportioned in the same manner as the cost of construction. The commissioners or directors of the districts in New Mexico are required to make annual estimates of funds needed for maintenance and repairs, which are to be apportioned like the cost of construction or last assessment of benefits but are reviewed by the court at public hearing before confirmation. The Oklahoma statute provides for a drainage commissioner to be appointed, who shall inspect the drains from time to time. Each landowner must keep the drains through his land free from vegetation, and the cost of other repair work not due to wilfulness or to negligence of some owner is assessed against all the district in proportion to the benefits assessed for original construction. The supervisors of drainage districts in Oregon are authorized to levy taxes for maintenance apportioned like the cost of original construction of the works. The drainage laws of Alabama (1915), Nevada, Virginia, and West Virginia provide for the maintenance and repair of the drainage works by the administrative boards of the districts, the cost of this work to be apportioned like the cost of original construction.

The drainage works installed by the United States Reclamation Service on its irrigation projects are maintained as a part of the irrigation works.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	211,949	100.0	\$2,519,487	100.0	\$1,808,500
By district forces.....	176,221	83.1	2,225,221	88.3	1,807,500
By method not specified.....	7,638	3.6	100,000	4.0	.....
By landowners.....	2,500	1.2	7,824	0.3	.....
No maintenance provided.....	2,500	1.2	4,000	0.2	.....
Not reporting.....	23,090	10.9	182,442	7.2	1,000

**Date of organization.**—The progress in drainage development is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county boards or the designated courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	211,949	100.0	211,949	100.0
1905 to 1909.....	21,940	10.3	21,940	10.3
1910 to 1914.....	64,059	30.2	64,059	30.2
1915 to 1919.....	111,540	52.6	111,540	52.6
Not reported.....	14,410	6.8	14,410	6.8

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$2,519,487	100.0	\$1,808,500
1905 to 1909.....	162,351	6.4	.....
1910 to 1914.....	1,096,562	43.5	143,000
1915 to 1919.....	1,133,074	43.8	1,613,000
Not reported.....	157,500	6.3	52,500

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	193.4	100.0	385.3	100.0	31.0	100.0
1905 to 1909.....	119.7	61.9	3.6	1.0	5.0	16.1
1910 to 1914.....	16.2	8.4	300.7	82.3	.....	.....
1915 to 1919.....	48.7	24.1	18.0	4.9	26.0	83.9
Not reported.....	10.8	5.6	43.0	11.8	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises were reported as cotton in Arizona, cotton and corn in Oklahoma, and alfalfa in Nevada, New Mexico, and Oregon. Statistics were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

# DRAINAGE.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

ALABAMA.

		THE STATE.	Autauga.	Baldwin.	Barbour.	Bibb.	Blount.	Bullock.	Butler.
1	Number of all farms in the state or county.....	250,099	2,481	2,122	4,268	1,844	4,019	3,700	3,627
2	Farms reporting land having drainage.....	19,967	218	50	187	225	419	90	89
3	Farms reporting land needing drainage.....	36,511	119	557	233	363	937	445	362
4	Farms in drainage and levee districts.....	352	2	3	1	1	6	7	1
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	32,818,560	373,760	1,020,800	583,680	405,760	415,360	390,400	488,320
6	All land in farms..... acres..	19,576,856	249,502	216,499	371,086	159,463	289,156	236,533	332,653
7	Improved land in farms..... acres..	9,893,407	121,359	54,541	218,258	61,566	125,652	177,044	154,957
8	Woodland in farms..... acres..	8,301,177	118,659	147,675	106,270	90,224	153,601	33,751	152,406
9	Other unimproved land in farms..... acres..	1,382,272	9,484	14,283	46,558	7,673	9,903	25,738	25,290
10	Farm land reported as provided with drainage..... acres..	415,293	9,651	3,497	8,158	2,325	3,938	1,541	803
11	Farm land reported as needing drainage..... acres..	1,610,136	12,634	40,139	12,768	23,121	26,702	13,466	19,512
12	Drainage only..... acres..	150,028	1,971	4,711	1,482	5,130	915	2,856	577
13	Drainage and clearing..... acres..	1,460,628	10,663	35,428	11,286	17,991	25,787	10,610	18,935

		Calhoun.	Chambers.	Cherokee.	Chilton.	Choctaw.	Clay.	Cleburne.	Colbert.
1	Number of all farms in the county.....	3,521	4,918	3,717	3,443	3,039	3,576	2,235	3,018
2	Farms reporting land having drainage.....	190	966	404	166	69	1,048	149	69
3	Farms reporting land needing drainage.....	710	1,890	999	1,010	281	1,423	567	460
4	Farms in drainage and levee districts.....	2	33	30	15	1	7	1	2
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	394,240	391,680	369,290	456,320	596,480	392,960	364,160	395,520
6	All land in farms..... acres..	240,591	313,049	269,982	236,654	310,993	243,023	189,520	225,218
7	Improved land in farms..... acres..	120,041	195,525	131,011	107,422	115,483	117,422	67,916	122,630
8	Woodland in farms..... acres..	106,111	85,326	126,586	123,264	173,067	104,274	113,187	92,485
9	Other unimproved land in farms..... acres..	14,439	32,198	12,385	5,968	22,423	21,327	8,417	10,093
10	Farm land reported as provided with drainage..... acres..	2,779	30,359	4,750	2,244	737	6,677	1,728	778
11	Farm land reported as needing drainage..... acres..	24,709	48,108	38,933	31,653	19,113	37,189	23,919	22,543
12	Drainage only..... acres..	682	6,611	1,644	829	1,214	2,472	621	1,208
13	Drainage and clearing..... acres..	23,826	41,297	37,289	30,824	17,899	34,712	22,298	21,335

		Coosa.	Covington.	Dale.	Dallas.	Dekalb.	Elmore.	Escambia.	Etowah.	Fayette.
1	Number of all farms in the county.....	1,980	4,264	3,438	7,124	5,636	3,726	2,069	3,832	2,825
2	Farms reporting land having drainage.....	475	69	42	507	310	351	88	304	634
3	Farms reporting land needing drainage.....	955	596	234	681	1,229	514	369	207	810
4	Farms in drainage and levee districts.....	2	1	1	11					2
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	419,200	666,850	360,320	612,460	503,040	408,320	612,480	344,960	411,520
6	All land in farms..... acres..	210,885	387,940	314,998	401,273	380,979	310,126	168,021	252,954	303,944
7	Improved land in farms..... acres..	81,222	172,670	171,185	263,528	184,715	144,806	67,359	120,923	100,117
8	Woodland in farms..... acres..	108,832	208,800	126,498	111,513	185,473	136,620	85,336	122,173	182,377
9	Other unimproved land in farms..... acres..	20,831	9,570	17,315	26,232	10,791	28,700	15,326	9,858	21,450
10	Farm land reported as provided with drainage..... acres..	4,269	935	757	21,103	6,886	5,013	956	3,477	10,216
11	Farm land reported as needing drainage..... acres..	31,671	67,122	7,996	25,136	39,376	20,679	20,859	13,469	37,837
12	Drainage only..... acres..	2,662	819	421	5,169	3,194	1,040	135	837	3,645
13	Drainage and clearing..... acres..	29,009	66,303	7,565	19,967	36,182	19,639	20,724	12,632	34,192

		Geneva.	Greene.	Hale.	Houston.	Jackson.	Lamar.	Lawrence.	Lowndes.
1	Number of all farms in the county.....	4,085	3,139	3,816	4,612	5,584	2,762	4,535	5,118
2	Farms reporting land having drainage.....	172	89	642	263	284	1,259	227	1,046
3	Farms reporting land needing drainage.....	647	109	717	484	323	1,050	439	255
4	Farms in drainage and levee districts.....		2	1	4	6	99		2
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	369,920	406,400	413,440	370,560	729,600	384,640	448,000	472,960
6	All land in farms..... acres..	292,784	239,054	267,920	320,801	428,391	286,126	312,656	292,495
7	Improved land in farms..... acres..	174,717	136,749	158,639	211,208	197,911	96,517	181,064	183,586
8	Woodland in farms..... acres..	111,447	80,975	78,019	97,964	194,715	150,064	112,708	56,261
9	Other unimproved land in farms..... acres..	6,620	21,930	31,262	11,629	35,765	39,545	18,884	52,648
10	Farm land reported as provided with drainage..... acres..	1,212	6,628	17,926	3,061	6,041	28,268	4,144	31,695
11	Farm land reported as needing drainage..... acres..	33,015	17,010	37,068	19,161	12,891	35,097	14,242	23,723
12	Drainage only..... acres..	2,838	2,182	4,452	1,626	5,857	6,052	1,774	8,421
13	Drainage and clearing..... acres..	30,177	14,828	32,616	17,535	7,534	29,045	12,468	15,302



AGRICULTURE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

ALABAMA—Continued.

		Macon.	Madison.	Marango.	Marion.	Marshall.	Mobile.	Monroe.	Montgomery.
1	Number of all farms in the county.....	3,956	6,158	6,004	3,531	5,399	1,240	4,437	4,560
2	Farms reporting land having drainage.....	848	368	743	687	69	51	58	121
3	Farms reporting land needing drainage.....	899	459	351	1,323	628	120	309	519
4	Farms in drainage and levee districts.....	2	5	1	1	24	1	1	5
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	392,960	519,040	618,240	475,520	385,280	784,640	647,680	512,640
6	All land in farms.....acres..	218,836	372,906	479,616	324,046	322,323	106,572	411,548	293,728
7	Improved land in farms.....acres..	145,692	249,495	271,903	119,407	170,621	38,004	169,088	210,999
8	Woodland in farms.....acres..	57,099	100,460	159,940	196,735	140,675	55,329	221,502	52,395
9	Other unimproved land in farms.....acres..	16,045	22,961	47,773	7,904	11,027	13,239	20,958	30,334
10	Farm land reported as provided with drainage.....acres..	25,814	7,546	20,355	8,336	935	2,298	2,318	7,302
11	Farm land reported as needing drainage.....acres..	32,141	9,678	20,916	70,002	13,035	7,714	41,392	26,394
12	Drainage only.....acres..	6,971	1,793	5,786	904	245	827	2,447	9,398
13	Drainage and clearing.....acres..	25,170	7,885	15,150	69,098	12,790	6,887	38,945	16,996

		Morgan.	Perry.	Pickens.	Pike.	Randolph.	Russell.	St. Clair.	Shelby.
1	Number of all farms in the county.....	4,344	4,302	3,321	4,472	4,181	3,306	2,706	2,469
2	Farms reporting land having drainage.....	414	146	730	138	829	403	57	221
3	Farms reporting land needing drainage.....	815	156	742	753	476	897	379	639
4	Farms in drainage and levee districts.....	6		1	2		1		2
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	375,680	471,680	560,000	429,440	377,600	419,200	414,720	524,160
6	All land in farms.....acres..	270,571	343,963	320,250	342,427	285,978	271,962	235,261	204,738
7	Improved land in farms.....acres..	154,111	179,357	130,085	217,308	137,557	169,961	99,462	98,478
8	Woodland in farms.....acres..	109,592	115,207	156,644	87,610	118,533	79,764	127,282	100,955
9	Other unimproved land in farms.....acres..	6,868	49,399	33,521	37,509	29,888	22,237	8,487	5,306
10	Farm land reported as provided with drainage.....acres..	7,799	5,501	10,283	2,556	12,982	7,656	610	3,330
11	Farm land reported as needing drainage.....acres..	22,660	12,731	45,349	27,628	9,493	43,778	18,215	19,732
12	Drainage only.....acres..	3,836	1,956	1,652	1,564	1,540	2,935	112	1,057
13	Drainage and clearing.....acres..	18,824	10,775	43,697	26,064	7,953	40,843	18,103	18,675

		Sumter.	Talladega.	Talla- pocosa.	Tusca- loosa.	Walker.	Wilcox.	Winston.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	3,747	4,115	3,940	4,335	2,949	5,461	2,172	46,931
2	Farms reporting land having drainage.....	410	85	1,219	426	192	157	258	236
3	Farms reporting land needing drainage.....	490	308	1,277	798	480	271	267	3,120
4	Farms in drainage and levee districts.....	2	3	7	3	16			26
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	581,120	453,200	488,320	861,440	506,880	573,440	403,200	6,039,040
6	All land in farms.....acres..	361,428	278,586	359,475	399,572	233,547	324,630	219,933	3,539,121
7	Improved land in farms.....acres..	218,875	167,490	172,170	148,096	86,191	203,318	71,204	1,732,095
8	Woodland in farms.....acres..	112,783	97,798	141,632	226,868	142,827	91,780	144,073	1,590,003
9	Other unimproved land in farms.....acres..	34,770	13,298	45,673	24,608	4,529	29,532	4,656	217,023
10	Farm land reported as provided with drainage.....acres..	14,281	1,982	15,346	5,520	2,289	4,589	6,485	3,647
11	Farm land reported as needing drainage.....acres..	60,836	9,257	48,355	41,690	12,542	17,767	11,376	138,124
12	Drainage only.....acres..	6,858	742	2,591	2,694	746	3,995	305	5,141
13	Drainage and clearing.....acres..	53,978	8,515	45,764	38,996	11,796	13,772	11,071	132,983

<sup>1</sup> Drainage on farms was reported in all counties in Alabama.

ARIZONA.

		THE STATE.	Cochise.	Graham.	Maricopa.	Pima.	All other counties. <sup>1</sup>
1	Number of all farms in the state or county.....	9,975	1,251	870	3,930	434	3,490
2	Farms reporting land having drainage.....	241	52	54	29	73	33
3	Farms reporting land needing drainage.....	435	110	26	34	71	194
4	Farms in drainage and levee districts.....	28		2	20		6
<b>LAND AND FARM AREA.</b>							
5	Approximate land area of the state or county.....acres..	72,338,400	3,948,800	2,963,200	5,090,240	6,983,200	54,152,000
6	All land in farms.....acres..	5,802,126	998,242	165,691	802,396	413,278	3,422,519
7	Improved land in farms.....acres..	712,808	120,229	88,632	279,334	35,785	238,823
8	Woodland in farms.....acres..	523,648	51,700	1,324	5,639	296	464,689
9	Other unimproved land in farms.....acres..	4,565,676	826,313	125,735	517,423	377,197	2,719,007
10	Farm land reported as provided with drainage.....acres..	9,651	1,596	2,320	3,328	849	1,558
11	Farm land reported as needing drainage.....acres..	41,951	27,434	799	2,280	2,084	9,364
12	Drainage only.....acres..	9,596	4,380	459	1,365	1,457	1,935
13	Drainage and clearing.....acres..	32,355	23,054	330	915	627	7,429

<sup>1</sup> No drainage on farms reported in Apache and Greenlee Counties.

DRAINAGE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

CONNECTICUT.

	THE STATE.	Fairfield.	Hartford.	Litchfield.	New Haven.	New London.	Windham.	All other counties. <sup>1</sup>	
1	Number of all farms in the state or county.....	22,655	3,874	4,700	3,041	2,687	2,747	2,217	3,389
2	Farms reporting land having drainage.....	1,203	212	468	146	151	83	83	60
3	Farms reporting land needing drainage.....	2,839	497	660	408	440	264	342	228
4	Farms in drainage and levee districts.....	36	6	10	4	4	2	2	8
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	3,084,800	403,840	466,560	692,000	385,920	421,760	320,000	494,720
6	All land in farms..... acres..	1,898,980	225,669	293,907	378,650	188,167	287,676	220,204	306,807
7	Improved land in farms..... acres..	701,086	108,393	142,506	135,616	75,880	79,839	70,471	88,331
8	Woodland in farms..... acres..	683,719	65,271	88,596	127,477	62,059	107,629	95,570	137,117
9	Other unimproved land in farms..... acres..	514,175	52,005	62,805	113,557	50,228	100,108	54,163	81,309
10	Farm land reported as provided with drainage..... acres..	14,646	2,749	5,553	1,657	1,469	1,922	795	501
11	Farm land reported as needing drainage..... acres..	56,462	8,302	10,654	9,105	7,541	8,405	8,624	3,831
12	Drainage only..... acres..	14,430	2,858	3,380	2,107	1,916	1,314	1,573	1,282
13	Drainage and clearing..... acres..	42,032	5,444	7,274	6,998	5,625	7,091	7,051	2,549

<sup>1</sup> Drainage on farms was reported in all counties in Connecticut.

DELAWARE.

	THE STATE.	Kent.	New Castle.	Sussex.	
1	Number of all farms in the state or county.....	10,140	2,911	1,825	5,404
2	Farms reporting land having drainage.....	4,246	1,540	673	2,133
3	Farms reporting land needing drainage.....	2,488	620	534	1,334
4	Farms in drainage and levee districts.....	1,321	766	10	545
<b>LAND AND FARM AREA.</b>					
5	Approximate land area of the state or county..... acres..	1,257,600	394,680	278,400	584,320
6	All land in farms..... acres..	944,511	315,141	215,857	413,513
7	Improved land in farms..... acres..	653,052	224,488	162,302	266,264
8	Woodland in farms..... acres..	222,658	65,839	27,140	129,679
9	Other unimproved land in farms..... acres..	68,801	24,816	26,415	17,570
10	Farm land reported as provided with drainage..... acres..	185,631	71,086	18,003	96,742
11	Farm land reported as needing drainage..... acres..	68,969	13,883	12,811	42,775
12	Drainage only..... acres..	7,667	1,467	2,948	3,552
13	Drainage and clearing..... acres..	61,002	11,916	9,863	39,223

DISTRICT OF COLUMBIA.

[All the statistics for drainage on farms for the District of Columbia appear in State Table I, page 372.]

MAINE.

	THE STATE.	Andros-coggin.	Aroostook.	Cumberland.	Franklin.	Hancock.	Kennebec.	Knox.	
1	Number of all farms in the state or county.....	48,227	2,235	6,741	3,740	1,849	2,442	4,442	1,427
2	Farms reporting land having drainage.....	2,068	144	87	312	34	73	145	72
3	Farms reporting land needing drainage.....	6,425	377	560	489	97	249	696	169
4	Farms in drainage and levee districts.....	25	1	4	4	3	3	1	1
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	19,132,800	293,760	4,129,920	545,920	1,144,960	974,080	562,560	224,640
6	All land in farms..... acres..	5,425,968	211,954	850,208	319,776	274,808	229,184	430,020	124,010
7	Improved land in farms..... acres..	1,977,329	90,483	450,783	129,454	96,284	44,896	173,835	34,048
8	Woodland in farms..... acres..	2,447,597	74,571	299,409	135,353	138,852	138,824	155,043	56,057
9	Other unimproved land in farms..... acres..	1,001,042	46,900	100,036	54,964	39,662	45,464	101,142	33,905
10	Farm land reported as provided with drainage..... acres..	26,302	2,189	667	4,291	263	761	1,884	703
11	Farm land reported as needing drainage..... acres..	142,053	5,604	21,126	10,373	2,173	5,914	14,681	3,207
12	Drainage only..... acres..	19,930	1,300	1,946	1,312	516	721	1,930	461
13	Drainage and clearing..... acres..	122,123	4,304	19,180	9,061	1,657	5,193	12,751	2,746

	Lincoln.	Oxford.	Penobscot.	Piscataquis.	Sagadahoc.	Somerset.	Waldo.	Washington.	York.	
1	Number of all farms in the county.....	2,024	3,078	5,188	1,424	852	3,645	3,234	2,561	3,344
2	Farms reporting land having drainage.....	97	302	182	42	119	102	243	62	152
3	Farms reporting land needing drainage.....	801	322	481	179	103	354	471	438	349
4	Farms in drainage and levee districts.....	1	7	1	4	1	1	1	3	1
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres..	292,480	1,267,200	2,085,120	2,412,800	160,000	2,325,120	463,360	1,617,920	632,960
6	All land in farms..... acres..	134,998	434,939	591,275	218,668	95,866	500,383	359,983	272,153	327,693
7	Improved land in farms..... acres..	51,524	134,722	219,485	67,880	33,868	180,315	117,424	56,347	95,991
8	Woodland in farms..... acres..	90,150	238,612	253,910	117,001	35,166	229,243	154,443	163,720	167,238
9	Other unimproved land in farms..... acres..	43,324	61,665	117,880	33,787	26,832	90,825	88,116	52,086	64,464
10	Farm land reported as provided with drainage..... acres..	975	2,000	2,364	526	1,570	1,793	3,629	686	2,001
11	Farm land reported as needing drainage..... acres..	6,414	5,769	15,102	4,756	2,232	9,846	10,000	17,061	7,795
12	Drainage only..... acres..	1,207	2,025	1,834	559	586	1,180	2,026	1,069	1,208
13	Drainage and clearing..... acres..	5,207	3,744	13,218	4,197	1,646	8,666	7,974	15,992	6,587

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

MARYLAND.

		THE STATE.	Alleghany.	Anne Arundel.	Balti- more.	Caroline.	Carroll.	Cecil.	Charles.
1	Number of all farms in the state or county.....	47,908	999	1,965	3,587	2,071	3,518	1,740	1,985
2	Farms reporting land having drainage.....	6,911	82	92	198	812	395	153	133
3	Farms reporting land needing drainage.....	6,658	206	381	281	563	421	165	346
4	Farms in drainage and levee districts.....	272	1	4	1	9			8
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	8,362,240	283,520	272,640	386,560	204,160	286,080	241,288	296,060
6	All land in farms..... acres..	4,757,999	152,974	179,133	280,618	174,225	273,777	174,561	235,476
7	Improved land in farms..... acres..	3,136,728	64,074	115,569	196,212	120,613	207,633	132,694	118,301
8	Woodland in farms..... acres..	1,327,221	77,998	51,934	66,334	47,711	39,815	37,994	105,475
9	Other unimproved land in farms..... acres..	294,050	10,902	11,630	18,072	5,901	26,329	16,873	11,700
10	Farm land reported as provided with drainage..... acres..	249,799	1,139	2,497	1,748	32,687	2,249	4,092	4,344
11	Farm land reported as needing drainage..... acres..	184,820	10,560	13,781	3,176	15,134	4,890	3,852	18,838
12	Drainage only..... acres..	38,267	1,150	2,170	879	2,816	1,552	1,706	2,370
13	Drainage and clearing..... acres..	151,553	9,404	11,611	2,297	12,318	3,338	2,176	16,468

		Dorchester.	Frederick.	Garrett.	Harford.	Howard.	Kent.	Mont- gomery.	Prince Georges.
1	Number of all farms in the county.....	2,019	3,817	1,810	2,399	1,297	1,032	2,145	2,457
2	Farms reporting land having drainage.....	889	483	198	133	105	32	182	150
3	Farms reporting land needing drainage.....	664	622	359	389	83	42	224	490
4	Farms in drainage and levee districts.....	6	2	1		1	5	17	3
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	368,640	424,320	438,400	282,880	160,000	180,480	333,440	308,450
6	All land in farms..... acres..	201,808	364,525	244,754	219,089	142,400	165,800	260,408	228,723
7	Improved land in farms..... acres..	117,094	283,509	112,811	154,905	104,682	132,726	199,728	143,438
8	Woodland in farms..... acres..	64,528	55,417	109,401	54,414	30,050	21,608	52,920	73,286
9	Other unimproved land in farms..... acres..	20,186	15,599	22,542	9,770	7,668	11,466	7,757	11,999
10	Farm land reported as provided with drainage..... acres..	48,450	5,868	2,990	1,097	1,650	869	3,889	3,301
11	Farm land reported as needing drainage..... acres..	14,476	7,286	10,464	8,449	1,419	766	6,871	15,354
12	Drainage only..... acres..	1,009	2,578	2,782	2,009	353	430	1,127	3,355
13	Drainage and clearing..... acres..	13,467	4,708	7,682	6,440	1,066	336	5,744	11,999

		Queen Annes.	St. Marys.	Somerset.	Talbot.	Washing- ton.	Wicomico.	Worcester.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,409	1,790	1,820	1,205	2,544	2,504	2,334	1,461
2	Farms reporting land having drainage.....	438	211	652	106	95	809	551	12
3	Farms reporting land needing drainage.....	210	353	347	81	129	178	185	39
4	Farms in drainage and levee districts.....	13		191	1	1	2	10	1
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	233,600	237,440	211,840	171,520	293,760	237,440	316,800	192,000
6	All land in farms..... acres..	214,378	190,387	131,253	160,450	239,298	167,840	206,826	136,299
7	Improved land in farms..... acres..	163,915	93,438	70,756	115,753	189,847	98,390	114,567	76,073
8	Woodland in farms..... acres..	39,551	84,849	45,376	37,239	37,691	57,669	81,785	54,176
9	Other unimproved land in farms..... acres..	10,912	12,100	15,121	7,458	11,760	11,781	10,474	6,050
10	Farm land reported as provided with drainage..... acres..	30,475	7,080	30,461	5,613	1,047	31,124	26,987	142
11	Farm land reported as needing drainage..... acres..	5,474	12,505	13,641	2,187	1,367	5,864	7,641	795
12	Drainage only..... acres..	622	1,431	1,303	67	735	738	1,730	299
13	Drainage and clearing..... acres..	4,852	11,074	12,278	2,130	632	5,126	5,911	496

<sup>1</sup> Drainage on farms was reported in all counties in Maryland.

MASSACHUSETTS.

		THE STATE.	Barnstable.	Berkshire.	Bristol.	Essex.	Franklin.
1	Number of all farms in the state or county.....	32,001	675	2,359	3,770	2,966	2,784
2	Farms reporting land having drainage.....	2,955	174	86	163	309	241
3	Farms reporting land needing drainage.....	4,112	51	178	625	402	301
4	Farms in drainage and levee districts.....	138	7		13	7	4
<b>LAND AND FARM AREA.</b>							
5	Approximate land area of the state or county..... acres..	5,144,960	261,760	618,240	382,880	318,080	446,080
6	All land in farms..... acres..	2,494,477	47,679	356,264	177,761	148,541	271,460
7	Improved land in farms..... acres..	906,834	13,619	139,744	68,061	64,429	75,307
8	Woodland in farms..... acres..	1,030,386	26,363	135,891	71,661	45,227	118,121
9	Other unimproved land in farms..... acres..	555,257	7,197	77,629	38,039	38,885	78,032
10	Farm land reported as provided with drainage..... acres..	39,022	1,430	1,748	2,828	3,346	2,237
11	Farm land reported as needing drainage..... acres..	80,883	423	5,968	12,716	7,178	4,393
12	Drainage only..... acres..	21,212	120	2,093	1,437	2,289	1,360
13	Drainage and clearing..... acres..	59,671	303	3,875	11,279	4,889	3,036

		Hampden.	Hampshire.	Middlesex.	Norfolk.	Plymouth.	Worcester.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,068	2,979	4,446	1,404	2,171	6,132	247
2	Farms reporting land having drainage.....	110	87	718	92	349	597	29
3	Farms reporting land needing drainage.....	246	111	777	236	356	800	29
4	Farms in drainage and levee districts.....	7	2	14	13	46	19	6
<b>LAND AND FARM AREA.</b>								
5	Approximate land area of the county..... acres..	407,040	374,400	532,480	259,840	432,000	995,840	136,320
6	All land in farms..... acres..	211,143	267,008	257,165	75,788	122,707	517,610	41,353
7	Improved land in farms..... acres..	73,825	90,083	117,290	30,183	44,101	181,167	11,025
8	Woodland in farms..... acres..	100,695	129,225	91,897	31,973	63,990	204,404	14,439
9	Other unimproved land in farms..... acres..	36,623	54,700	47,978	13,630	14,616	132,039	15,889
10	Farm land reported as provided with drainage..... acres..	1,202	1,519	8,280	1,121	6,674	8,054	585
11	Farm land reported as needing drainage..... acres..	5,370	3,425	13,734	4,846	7,504	14,597	726
12	Drainage only..... acres..	1,467	1,867	4,175	1,026	1,414	3,800	164
13	Drainage and clearing..... acres..	3,903	1,558	9,559	3,820	6,000	10,797	562

<sup>1</sup> Drainage on farms was reported in all counties in Massachusetts.

# DRAINAGE.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

## NEVADA.

		THE STATE.	Churchill.	Douglas.	Elko.	Eureka.
1	Number of all farms in the state or county.....	3,163	498	129	543	60
2	Farms reporting land having drainage.....	385	223	18	10	5
3	Farms reporting land needing drainage.....	321	187	10	15	2
4	Farms in drainage and levee districts.....	232	182	.....	4	1
<b>LAND AND FARM AREA.</b>						
5	Approximate land area of the state or county..... acres..	70,285,440	3,232,000	469,120	10,917,760	2,660,480
6	All land in farms..... acres..	2,357,163	108,307	119,211	718,102	86,197
7	Improved land in farms..... acres..	594,741	35,870	27,277	183,721	25,121
8	Woodland in farms..... acres..	28,637	1,651	11,703	6,530	230
9	Other unimproved land in farms..... acres..	1,733,785	70,786	80,231	527,851	60,846
10	Farm land reported as provided with drainage..... acres..	46,252	21,847	787	1,118	1,920
11	Farm land reported as needing drainage..... acres..	59,739	10,845	681	2,605	400
12	Drainage only..... acres..	38,095	2,643	391	155	100
13	Drainage and clearing..... acres..	21,644	8,202	300	2,650	300

		Humboldt.	Lincoln.	Nye.	Pershing.	Washoe.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	132	145	152	115	481	008
2	Farms reporting land having drainage.....	1	14	9	54	38	13
3	Farms reporting land needing drainage.....	1	19	12	10	20	45
4	Farms in drainage and levee districts.....	.....	.....	.....	41	.....	4
<b>LAND AND FARM AREA.</b>							
5	Approximate land area of the county..... acres..	6,274,560	6,727,040	11,708,160	3,873,920	4,000,640	20,421,760
6	All land in farms..... acres..	393,865	81,105	95,002	130,988	220,052	444,354
7	Improved land in farms..... acres..	76,788	9,264	19,759	50,141	45,036	121,764
8	Woodland in farms..... acres..	494	.....	1,097	200	2,449	4,283
9	Other unimproved land in farms..... acres..	316,583	21,841	74,146	80,627	182,607	318,307
10	Farm land reported as provided with drainage..... acres..	1,000	677	1,397	15,275	1,428	794
11	Farm land reported as needing drainage..... acres..	28,000	1,735	1,713	462	5,235	7,853
12	Drainage only..... acres..	24,000	995	946	25	8,816	5,024
13	Drainage and clearing..... acres..	4,000	740	767	437	1,419	2,829

<sup>1</sup> No drainage on farms reported in Clark and Storey Counties.

## NEW HAMPSHIRE.

		THE STATE.	Belknap.	Carroll.	Cheshire.	Grafton.
1	Number of all farms in the state or county.....	20,523	1,348	1,520	1,625	2,884
2	Farms reporting land having drainage.....	1,013	36	58	83	87
3	Farms reporting land needing drainage.....	1,794	75	100	146	190
4	Farms in drainage and levee districts.....	16	.....	.....	8	.....
<b>LAND AND FARM AREA.</b>						
5	Approximate land area of the state or county..... acres..	5,779,840	254,080	611,200	465,920	1,106,560
6	All land in farms..... acres..	2,603,806	169,327	207,253	221,298	462,416
7	Improved land in farms..... acres..	702,902	39,377	45,431	53,678	131,827
8	Woodland in farms..... acres..	1,299,838	76,018	137,062	121,570	240,235
9	Other unimproved land in farms..... acres..	601,066	53,937	24,760	46,050	90,354
10	Farm land reported as provided with drainage..... acres..	11,777	522	589	844	879
11	Farm land reported as needing drainage..... acres..	40,783	1,244	2,720	8,306	3,993
12	Drainage only..... acres..	9,914	591	491	1,037	1,076
13	Drainage and clearing..... acres..	30,869	653	2,229	7,269	2,916

		Hillsborough.	Merrimack.	Rockingham.	Strafford.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,563	2,837	3,438	1,421	2,887
2	Farms reporting land having drainage.....	205	161	236	89	58
3	Farms reporting land needing drainage.....	181	266	386	293	157
4	Farms in drainage and levee districts.....	1	2	3	1	1
<b>LAND AND FARM AREA.</b>						
5	Approximate land area of the county..... acres..	572,800	596,480	442,240	242,560	1,488,000
6	All land in farms..... acres..	308,991	367,600	273,361	151,989	443,571
7	Improved land in farms..... acres..	77,286	84,078	86,336	41,436	143,453
8	Woodland in farms..... acres..	140,473	175,725	138,737	69,586	200,437
9	Other unimproved land in farms..... acres..	89,232	107,797	46,288	40,967	99,681
10	Farm land reported as provided with drainage..... acres..	2,186	1,556	2,335	1,375	511
11	Farm land reported as needing drainage..... acres..	2,587	4,518	9,455	4,141	8,820
12	Drainage only..... acres..	1,137	1,630	2,468	690	894
13	Drainage and clearing..... acres..	1,450	2,888	6,987	3,551	2,926

<sup>1</sup> Drainage on farms was reported in all counties in New Hampshire.

AGRICULTURE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

NEW JERSEY.

	THE STATE.	Bergen.	Burlington.	Camden.	Cape May.	Cumberland.	Gloucester.	Mercer.	
1	Number of all farms in the state or county.....	29,702	1,012	2,172	1,035	629	3,094	2,319	1,330
2	Farms reporting land having drainage.....	4,903	94	1,081	138	31	152	404	190
3	Farms reporting land needing drainage.....	3,428	162	334	79	27	132	338	99
4	Farms in drainage and levee districts.....	136	7	3	1	1	47	16	1
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	4,808,960	151,630	521,600	142,080	169,600	320,000	212,490	144,640
6	All land in farms..... acres..	2,282,585	37,108	271,235	50,889	46,493	141,714	132,188	107,768
7	Improved land in farms..... acres..	1,555,607	21,789	153,678	39,442	18,582	90,676	97,990	88,416
8	Woodland in farms..... acres..	454,768	8,259	90,009	7,677	18,626	25,334	20,623	12,174
9	Other unimproved land in farms..... acres..	272,210	7,061	27,458	3,770	12,285	25,704	13,573	7,178
10	Farm land reported as provided with drainage..... acres..	174,260	1,920	54,963	4,527	775	7,410	8,394	7,817
11	Farm land reported as needing drainage..... acres..	77,881	1,861	8,951	1,515	1,217	5,853	5,700	1,832
12	Drainage only..... acres..	29,193	741	5,549	779	107	1,266	669	1,167
13	Drainage and clearing..... acres..	48,688	1,120	3,402	736	1,110	4,587	5,031	665

	Middlesex.	Monmouth.	Morris.	Ocean.	Salem.	Somerset.	Sussex.	Warren.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	1,383	2,445	1,333	666	1,802	1,454	1,503	5,859
2	Farms reporting land having drainage.....	386	963	176	64	710	208	96	102
3	Farms reporting land needing drainage.....	206	384	287	34	377	113	167	477
4	Farms in drainage and levee districts.....	1	7	3	3	31	1	5	8
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	199,680	306,560	304,000	407,680	219,520	195,200	338,560	944,000
6	All land in farms..... acres..	94,996	176,140	123,590	49,172	155,172	137,036	214,409	368,782
7	Improved land in farms..... acres..	70,318	132,037	71,814	23,768	113,013	113,021	136,945	256,336
8	Woodland in farms..... acres..	18,701	27,485	34,369	16,196	18,435	15,456	42,609	72,169
9	Other unimproved land in farms..... acres..	5,977	15,618	17,407	9,208	23,724	8,559	34,855	40,277
10	Farm land reported as provided with drainage..... acres..	12,615	30,796	3,951	3,502	24,010	7,465	1,570	905
11	Farm land reported as needing drainage..... acres..	4,679	6,420	6,252	1,392	8,218	1,820	4,940	11,032
12	Drainage only..... acres..	1,662	2,889	2,243	213	2,094	904	2,308	1,908
13	Drainage and clearing..... acres..	3,017	3,531	4,009	1,179	5,224	925	2,682	9,124

<sup>1</sup> Drainage on farms was reported in all counties in New Jersey.

NEW MEXICO.

	THE STATE.	Chaves.	Colfax.	Curry.	Dona Ana.	Eddy.	Guadalupe.	Mora.	
1	Number of all farms in the state or county.....	29,844	744	1,052	1,174	1,054	785	932	1,911
2	Farms reporting land having drainage.....	1,294	108	11	1	247	21	50	50
3	Farms reporting land needing drainage.....	998	13	34	1	319	36	7	32
4	Farms in drainage and levee districts.....	484	62	5	.....	248	16	.....	2
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	78,401,920	3,866,880	2,430,720	899,940	2,445,440	2,716,800	1,939,840	1,584,000
6	All land in farms..... acres..	24,409,633	1,824,179	1,952,760	740,969	195,316	794,543	986,406	1,013,981
7	Improved land in farms..... acres..	1,717,224	50,450	111,293	176,871	42,164	52,311	31,441	106,995
8	Woodland in farms..... acres..	1,817,460	16,123	205,190	8,773	7,653	1,608	53,507	105,449
9	Other unimproved land in farms..... acres..	20,874,949	1,857,606	1,636,277	555,325	145,499	740,624	901,458	801,537
10	Farm land reported as provided with drainage..... acres..	47,311	13,198	883	1,029	14,128	2,738	650	634
11	Farm land reported as needing drainage..... acres..	49,102	1,185	4,836	101	12,614	1,713	2,448	5,707
12	Drainage only..... acres..	29,016	740	4,719	101	5,109	1,478	2,428	4,789
13	Drainage and clearing..... acres..	20,086	445	117	.....	7,505	235	20	918

	Rio Arriba.	San Juan.	San Miguel.	Sandoval.	Sierra.	Socorro.	Taos.	All other counties. <sup>1</sup>	
1	Number of all farms in the county.....	2,063	874	1,643	1,110	395	1,191	1,116	13,750
2	Farms reporting land having drainage.....	350	38	151	43	28	46	121	19
3	Farms reporting land needing drainage.....	145	63	39	42	26	140	13	88
4	Farms in drainage and levee districts.....	1	7	95	1	.....	10	.....	37
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres..	3,757,440	3,504,640	3,132,160	2,477,440	1,995,520	9,644,800	1,441,280	36,565,120
6	All land in farms..... acres..	304,881	78,877	1,452,379	135,595	330,872	1,180,546	84,873	13,173,456
7	Improved land in farms..... acres..	41,625	30,231	58,534	24,258	7,712	32,770	23,497	927,073
8	Woodland in farms..... acres..	66,074	6,226	426,596	20,080	11,648	313,955	19,243	555,335
9	Other unimproved land in farms..... acres..	267,182	42,420	967,249	91,257	311,612	833,821	42,138	11,691,049
10	Farm land reported as provided with drainage..... acres..	6,887	721	1,209	811	541	673	2,978	731
11	Farm land reported as needing drainage..... acres..	5,002	1,445	2,093	973	810	2,612	2,466	5,097
12	Drainage only..... acres..	1,902	1,094	1,087	194	244	1,310	10	3,811
13	Drainage and clearing..... acres..	3,100	351	1,006	779	566	1,302	2,456	1,286

<sup>1</sup> No drainage on farms reported in Hidalgo, Lea, Lincoln, Luna, Roosevelt, Santa Fe, Torrance, and Valencia Counties.

# DRAINAGE.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

## NEW YORK.

		THE STATE.	Albany.	Allegany.	Broome.	Cattaraugus.	Cayuga.	Chautauqua.	Che-mung.
1	Number of all farms in the state or county.....	193,195	2,946	4,405	3,594	5,305	4,297	7,100	1,945
2	Farms reporting land having drainage.....	33,896	375	216	134	585	2,939	960	117
3	Farms reporting land needing drainage.....	38,523	385	508	533	827	2,293	1,348	278
4	Farms in drainage and levee districts.....	1,447	4	13	14	66	38	39	14
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county.....acres..	30,498,560	337,280	670,080	451,200	859,520	449,920	694,160	260,480
6	All land in farms.....acres..	20,632,803	278,231	556,280	384,832	645,088	396,264	593,606	208,813
7	Improved land in farms.....acres..	13,158,781	207,472	331,572	251,995	342,882	311,729	361,344	150,256
8	Woodland in farms.....acres..	4,160,567	43,177	116,205	90,741	161,760	45,499	118,623	45,588
9	Other unimproved land in farms.....acres..	3,313,455	27,582	118,503	42,096	140,446	89,036	113,639	12,971
10	Farm land reported as provided with drainage.....acres..	1,180,423	8,246	2,790	3,234	19,115	143,423	15,282	1,489
11	Farm land reported as needing drainage.....acres..	779,467	5,162	11,442	10,721	21,901	46,225	29,188	3,977
12	Drainage only.....acres..	318,965	2,447	2,410	3,645	7,250	24,814	7,688	2,433
13	Drainage and clearing.....acres..	460,602	2,715	9,032	7,076	14,651	21,411	21,602	1,544

		Che-nango.	Clinton.	Colum-bia.	Cort-land.	Dela-ware.	Dutchess.	Erie.	Essax.	Frank-lin.
1	Number of all farms in the county.....	3,838	3,402	2,580	2,315	4,613	3,114	7,486	1,978	3,299
2	Farms reporting land having drainage.....	186	241	225	127	195	327	1,291	72	226
3	Farms reporting land needing drainage.....	671	296	317	319	370	607	1,276	352	490
4	Farms in drainage and levee districts.....	5	4	2	2	9	6	24	1	.....
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	572,160	671,360	412,160	321,920	927,360	515,840	661,760	1,175,040	1,073,920
6	All land in farms.....acres..	512,586	445,629	340,387	282,382	745,026	436,730	538,052	310,566	408,135
7	Improved land in farms.....acres..	314,730	187,581	250,457	185,925	422,014	299,859	395,364	114,265	178,956
8	Woodland in farms.....acres..	100,832	116,175	56,699	57,096	220,683	80,544	76,325	135,412	85,713
9	Other unimproved land in farms.....acres..	97,024	141,873	33,231	39,381	102,329	56,327	66,363	60,919	143,466
10	Farm land reported as provided with drainage.....acres..	2,244	9,715	3,387	1,430	2,824	7,866	36,015	1,331	8,617
11	Farm land reported as needing drainage.....acres..	12,437	8,848	4,914	5,669	6,624	13,387	20,637	10,178	13,446
12	Drainage only.....acres..	5,188	1,016	2,294	3,049	2,836	6,653	8,322	1,830	2,295
13	Drainage and clearing.....acres..	7,249	7,832	2,620	2,620	3,788	6,734	12,315	8,348	11,151

		Fulton.	Genesee.	Greens.	Herki-mer.	Jeffer-son.	Lewis.	Living-ston.	Madis-on.	Monroe.
1	Number of all farms in the county.....	1,773	2,885	2,248	2,849	5,151	2,952	2,899	3,597	5,174
2	Farms reporting land having drainage.....	112	511	164	267	383	287	1,199	550	1,594
3	Farms reporting land needing drainage.....	243	501	187	475	798	617	753	697	1,166
4	Farms in drainage and levee districts.....	1	14	3	7	3	8	77	123	62
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	330,240	317,440	411,520	933,760	815,360	812,800	403,840	416,000	424,320
6	All land in farms.....acres..	196,260	276,617	282,749	334,277	696,145	437,208	353,170	382,459	359,877
7	Improved land in farms.....acres..	88,858	219,248	164,162	220,825	453,252	223,637	278,622	249,562	315,083
8	Woodland in farms.....acres..	67,032	30,847	88,128	51,012	81,244	100,680	51,978	53,413	31,247
9	Other unimproved land in farms.....acres..	40,370	26,522	30,459	62,440	161,649	112,891	22,570	59,484	13,547
10	Farm land reported as provided with drainage.....acres..	3,145	16,695	2,615	6,514	23,964	7,976	48,784	13,446	45,270
11	Farm land reported as needing drainage.....acres..	4,732	10,619	2,633	8,542	18,260	15,992	17,118	13,578	16,394
12	Drainage only.....acres..	2,464	5,812	1,400	4,863	7,107	4,413	8,818	5,644	7,929
13	Drainage and clearing.....acres..	2,238	4,807	1,233	3,679	11,153	11,579	8,300	7,934	8,465

		Mont-gomery.	Niagara.	Oneida.	Onon-daga.	Ontario.	Orange.	Orleans.	Oswego.	Otsego.
1	Number of all farms in the county.....	2,015	4,068	6,233	5,652	4,062	3,591	2,579	5,539	4,770
2	Farms reporting land having drainage.....	886	1,150	1,174	1,627	2,412	856	522	1,015	278
3	Farms reporting land needing drainage.....	475	470	1,469	1,368	1,684	934	637	1,798	858
4	Farms in drainage and levee districts.....	55	399	25	36	38	9	145	35	18
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county.....acres..	254,720	334,080	300,000	499,840	415,360	533,760	253,440	618,240	645,760
6	All land in farms.....acres..	227,035	289,691	611,634	429,831	368,940	350,268	230,877	462,522	573,287
7	Improved land in farms.....acres..	183,346	265,431	379,557	334,712	296,566	230,405	196,664	271,502	388,679
8	Woodland in farms.....acres..	24,120	16,459	97,524	47,135	48,568	59,880	16,772	100,325	117,134
9	Other unimproved land in farms.....acres..	19,569	7,801	134,653	48,034	23,806	59,983	17,441	90,695	67,474
10	Farm land reported as provided with drainage.....acres..	25,721	73,337	24,904	52,239	104,332	18,491	19,337	18,211	3,378
11	Farm land reported as needing drainage.....acres..	6,537	4,685	33,147	21,742	34,609	25,139	12,923	37,145	11,634
12	Drainage only.....acres..	3,910	1,084	15,589	10,747	19,034	8,616	2,265	13,691	6,194
13	Drainage and clearing.....acres..	2,627	3,601	17,558	10,995	15,575	16,523	10,658	23,454	5,440

AGRICULTURE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

NEW YORK—Continued.

	Putnam.	Rensselaer.	St. Lawrence.	Saratoga.	Schenectady.	Schoharie.	Schuyler.	Semeca.	Steuben.
1	767	3,078	7,652	2,178	983	2,791	1,639	1,957	6,132
2	56	408	888	555	149	150	524	1,473	330
3	213	666	1,876	571	102	314	507	922	992
4	4	6	11	10	1	21	2	14	11
<b>LAND AND FARM AREA.</b>									
5	149,120	424,320	1,728,640	528,720	131,840	410,880	215,040	215,040	894,720
6	113,010	307,630	1,047,151	236,846	102,542	344,841	176,002	188,210	759,384
7	45,675	199,536	488,105	200,961	75,789	234,750	132,932	160,286	627,134
8	40,864	65,800	188,493	76,013	14,210	66,176	28,163	18,807	158,717
9	26,471	42,294	872,553	59,872	12,563	43,915	14,907	9,117	73,513
10	1,319	7,174	44,252	16,970	4,220	2,004	21,557	104,395	6,241
11	4,402	8,461	66,074	10,263	1,427	3,297	9,903	17,360	18,949
12	1,583	5,052	19,868	4,294	623	2,013	3,476	7,051	6,751
13	2,819	3,409	46,206	5,969	804	1,284	6,427	10,309	12,189

	Tioga.	Tompkins.	Ulster.	Washington.	Wayna.	Westchester.	Wyoming.	Yates.	All other counties. <sup>1</sup>
1	2,541	2,550	4,311	3,334	4,930	1,538	3,165	2,041	19,404
2	119	999	400	342	1,824	200	835	1,308	159
3	371	848	693	611	1,196	218	1,185	660	527
4	9	4	7	11	16	2	4	2	8
<b>LAND AND FARM AREA.</b>									
5	332,800	304,640	727,680	535,680	383,360	286,720	384,640	219,520	3,362,560
6	281,272	253,781	408,798	434,187	346,205	104,022	349,728	198,613	945,087
7	194,101	186,967	200,250	238,408	283,888	58,521	231,948	156,956	418,082
8	58,819	38,592	149,604	92,366	32,471	22,627	58,262	30,081	385,934
9	28,352	28,222	58,944	43,393	29,846	22,874	59,518	11,576	141,071
10	1,247	40,170	6,576	7,946	48,570	4,631	29,067	57,538	2,190
11	7,101	18,350	10,929	9,929	19,189	3,950	22,948	14,730	12,029
12	3,276	10,569	4,525	5,644	8,356	2,159	9,065	7,286	3,996
13	3,825	7,781	6,404	4,285	10,833	1,791	13,883	7,444	8,033

<sup>1</sup> No drainage on farms reported in New York County.

OKLAHOMA.

	THE STATE.	Beaver.	Canadian.	Cherokee.	Cleveland.	Delaware.	Garvin.	Grady.
1	191,988	2,518	2,269	2,753	2,216	2,176	3,623	3,494
2	2,032	1	33	345	20	43	35	16
3	8,065	3	31	341	19	127	93	9
4	834	1	23	1	13	.....	7	8
<b>LAND AND FARM AREA.</b>								
5	44,424,960	1,160,320	570,240	506,240	354,560	508,160	525,440	711,680
6	31,951,934	1,099,058	481,675	221,658	300,397	251,671	437,827	573,272
7	18,125,321	508,103	349,052	121,463	171,483	138,207	263,454	388,763
8	4,206,171	6,653	27,503	78,848	73,668	104,663	81,976	75,765
9	9,620,442	584,302	105,120	21,347	55,216	8,802	72,397	108,744
10	107,014	900	2,391	608	766	4,757	1,650	1,292
11	268,786	820	1,320	7,928	432	2,553	2,900	578
12	39,788	.....	763	1,023	70	385	287	408
13	225,998	320	557	6,905	262	2,168	2,613	170

	Grant.	Johnston.	Kay.	Kingfisher.	Kiowa.	LeFlore.	Lincoln.	McCur-tain.
1	2,713	2,385	2,595	2,463	2,880	4,931	4,545	4,511
2	19	25	22	8	19	78	191	25
3	5	192	31	140	29	725	167	734
4	18	22	15	12	6	3	170	6
<b>LAND AND FARM AREA.</b>								
5	636,160	421,120	597,760	569,600	679,680	1,032,960	613,760	1,214,080
6	618,972	313,083	554,326	501,691	578,366	843,661	561,515	313,018
7	460,861	150,231	403,131	352,854	348,026	203,677	308,742	160,877
8	6,522	81,538	16,593	48,053	6,896	115,356	167,282	142,632
9	151,599	81,264	134,662	100,784	223,444	24,428	86,491	9,509
10	1,123	1,102	989	1,121	590	1,728	12,316	537
11	172	9,688	2,020	6,316	2,129	22,271	5,317	21,139
12	173	175	1,010	916	1,774	896	985	903
13	.....	9,513	1,010	5,400	355	21,375	4,332	20,236

DRAINAGE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

OKLAHOMA—Continued.

	McIntosh.	Mayes.	Murray.	Muskogee.	Okfuskee.	Oklahoma.	Oklmulgee.	Osage.	Pittsburg.
1 Number of all farms in the county.....	3,449	2,223	1,189	3,531	3,416	2,960	1,865	1,380	3,817
2 Farms reporting land having drainage.....	87	9	16	26	143	63	10	41	65
3 Farms reporting land needing drainage.....	60	245	7	111	178	160	26	13	212
4 Farms in drainage and levee districts.....			1	8		45	1	1	
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county.....acres..	453,120	432,640	271,360	520,960	398,720	458,890	446,080	1,457,280	676,800
6 All land in farms.....acres..	303,754	282,725	198,956	347,884	328,951	402,543	209,062	542,923	446,555
7 Improved land in farms.....acres..	223,944	196,018	82,993	260,461	207,651	234,639	126,854	177,031	214,208
8 Woodland in farms.....acres..	53,439	46,484	23,854	42,078	79,702	121,730	39,723	128,407	155,838
9 Other unimproved land in farms.....acres..	26,371	40,222	92,079	45,345	41,598	46,174	42,485	237,485	76,509
10 Farm land reported as provided with drainage.....acres..	1,785	544	1,056	882	1,607	2,963	785	26,685	6,685
11 Farm land reported as needing drainage.....acres..	1,554	7,450	355	3,297	4,954	5,154	779	385	12,222
12 Drainage only.....acres..	105	2,311	200	1,735	619	1,659	71	60	1,743
13 Drainage and clearing.....acres..	1,449	5,139	155	1,562	4,335	3,495	708	325	10,479

	Pontotoc.	Pottawatomia.	Seminole.	Sequoyah.	Tillman.	Tulsa.	Wagoner.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	3,057	4,531	3,507	3,540	2,209	1,625	2,453	100,914
2 Farms reporting land having drainage.....	14	350	55	21	8	6	38	198
3 Farms reporting land needing drainage.....	180	380	247	176	4	54	82	3,284
4 Farms in drainage and levee districts.....		318	27	42	4	3	44	35
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	465,920	507,520	405,120	443,520	544,000	374,400	348,800	25,918,080
6 All land in farms.....acres..	318,162	453,270	300,470	237,144	450,084	223,367	281,566	19,474,328
7 Improved land in farms.....acres..	193,780	275,329	182,027	168,847	328,196	162,706	205,565	10,537,958
8 Woodland in farms.....acres..	74,010	125,096	110,603	59,582	8,187	30,796	35,268	2,037,317
9 Other unimproved land in farms.....acres..	60,372	52,845	7,840	8,715	115,701	29,855	40,733	6,899,053
10 Farm land reported as provided with drainage.....acres..	600	15,023	1,498	1,122	672	533	4,903	5,801
11 Farm land reported as needing drainage.....acres..	5,184	10,888	5,328	5,313	235	1,583	2,484	113,536
12 Drainage only.....acres..	122	1,865	715	1,793	185	618	266	16,054
13 Drainage and clearing.....acres..	5,062	9,023	4,613	3,520	50	1,065	2,218	97,484

<sup>1</sup> No drainage on farms reported in Blaine, Cimarron, Jefferson, Love, and Pawnee Counties.

OREGON.

	THE STATE.	Baker.	Benton.	Clackamas.	Clatsop.	Columbia.	Coos.	Curry.	Douglas.	Grant.
1 Number of all farms in the state or county.....	50,208	1,509	1,320	3,838	448	991	1,178	339	2,275	728
2 Farms reporting land having drainage.....	6,618	42	192	806	59	129	411	15	193	24
3 Farms reporting land needing drainage.....	9,982	202	182	1,217	100	366	570	26	358	162
4 Farms in drainage and levee districts.....	573	3	4	6	37	23	63	1	12	6
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the state or county.....acres..	61,188,480	1,975,040	440,320	1,195,520	525,440	423,680	1,041,920	1,081,680	3,194,240	2,892,800
6 All land in farms.....acres..	13,542,318	493,145	233,427	235,910	52,017	80,889	208,565	103,057	566,305	750,160
7 Improved land in farms.....acres..	4,913,851	163,317	103,175	118,858	14,179	22,182	38,530	16,655	136,553	74,729
8 Woodland in farms.....acres..	2,309,596	47,464	75,235	86,035	22,839	39,312	89,649	26,653	271,414	82,430
9 Other unimproved land in farms.....acres..	6,318,871	282,364	55,017	81,217	14,999	28,395	80,386	49,749	158,338	592,951
10 Farm land reported as provided with drainage.....acres..	229,582	1,027	8,033	14,133	1,880	1,941	10,679	544	5,176	824
11 Farm land reported as needing drainage.....acres..	471,396	6,535	13,316	43,683	9,903	18,958	31,745	1,928	17,302	6,701
12 Drainage only.....acres..	75,063	1,355	2,415	1,748	1,201	2,945	3,457	156	1,686	411
13 Drainage and clearing.....acres..	396,333	5,180	10,900	41,935	8,702	16,013	28,288	1,772	15,616	6,380

	Harney.	Hood River.	Jackson.	Josephine.	Klamath.	Lake.	Lane.	Lincoln.	Linn.	Malheur.
1 Number of all farms in the county.....	589	878	1,720	727	902	549	3,279	767	3,041	1,322
2 Farms reporting land having drainage.....	10	177	125	85	123	2	417	43	331	79
3 Farms reporting land needing drainage.....	41	96	273	194	141	39	1,137	95	946	14
4 Farms in drainage and levee districts.....	11	1	12	5	96	6	9	5	16	55
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the county.....acres..	6,357,120	345,600	1,788,160	1,047,680	3,839,360	5,068,800	2,935,680	645,120	1,445,120	6,325,120
6 All land in farms.....acres..	524,678	38,075	312,938	97,299	357,333	528,218	496,917	118,758	472,469	465,851
7 Improved land in farms.....acres..	176,934	19,664	92,310	29,537	152,742	183,396	172,952	19,946	258,591	129,365
8 Woodland in farms.....acres..	20,689	9,541	113,445	55,804	56,792	65,849	157,323	60,175	115,064	6,232
9 Other unimproved land in farms.....acres..	327,055	8,870	107,181	11,958	147,799	278,973	166,642	38,637	98,814	230,254
10 Farm land reported as provided with drainage.....acres..	10,397	1,431	2,643	1,528	13,764	28,100	11,834	933	13,403	7,327
11 Farm land reported as needing drainage.....acres..	11,630	2,021	12,269	10,869	11,888	18,439	57,190	3,815	47,245	288
12 Drainage only.....acres..	1,523	146	188	1,408	5,661	10,167	10,967	261	9,472	77
13 Drainage and clearing.....acres..	10,157	1,875	12,081	9,461	3,227	8,322	46,223	3,534	37,773	211



AGRICULTURE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

OREGON—Continued.

	Marion.	Multnomah.	Polk.	Tillamook.	Umatilla.	Union.	Wallowa.	Washington.	Yamhill.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	3,681	1,828	1,761	797	2,353	1,379	1,149	3,090	2,592	5,188
2 Farms reporting land having drainage.....	882	163	401	111	77	54	29	1,153	462	23
3 Farms reporting land needing drainage.....	776	201	580	303	89	71	83	926	542	72
4 Farms in drainage and levee districts.....	62	8	11	32	30	21	3	24	2	4
<b>LAND AND FARM AREA.</b>										
5 Approximate land area of the county.....acres..	763,520	277,760	453,760	720,000	2,049,920	1,284,480	2,028,160	467,840	456,960	10,167,680
6 All land in farms.....acres..	367,788	100,485	239,621	91,827	1,075,400	441,735	524,028	223,406	256,184	4,030,824
7 Improved land in farms.....acres..	214,653	46,148	137,949	26,663	621,660	178,021	141,404	121,325	139,025	1,365,588
8 Woodland in farms.....acres..	95,130	23,653	75,002	40,491	90,490	83,975	78,765	65,439	73,025	271,631
9 Other unimproved land in farms.....acres..	58,005	30,694	26,670	24,673	263,250	179,739	303,860	36,642	44,134	2,393,605
10 Farm land reported as provided with drainage.....acres..	27,030	5,127	13,124	2,012	1,267	4,179	919	26,419	13,330	568
11 Farm land reported as needing drainage.....acres..	28,223	10,300	33,494	11,995	2,836	2,572	2,223	26,258	24,113	3,466
12 Drainage only.....acres..	4,429	2,529	3,139	1,497	393	712	740	2,178	941	240
13 Drainage and clearing.....acres..	23,794	7,771	30,355	10,499	2,443	1,860	1,483	24,080	23,172	3,226

<sup>1</sup> No drainage on farms reported in Sherman County.

PENNSYLVANIA.

	THE STATE.	Adams.	Allegheny.	Armstrong.	Beaver.	Bedford.	Berks.	Bradford.
1 Number of all farms in the state or county.....	202,250	3,451	3,972	3,771	2,514	3,462	6,089	5,290
2 Farms reporting land having drainage.....	22,750	711	224	106	54	430	196	555
3 Farms reporting land needing drainage.....	27,265	455	207	40	35	980	296	194
4 Farms in drainage and levee districts.....	238	1	7			1	1	3
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the state or county.....acres..	23,692,480	337,920	464,000	417,920	274,560	656,640	553,600	732,800
6 All land in farms.....acres..	17,657,513	279,103	252,553	323,878	219,813	459,841	427,053	610,361
7 Improved land in farms.....acres..	11,847,719	218,288	192,113	241,601	158,318	253,128	354,810	440,164
8 Woodland in farms.....acres..	4,043,902	43,599	37,166	69,363	38,487	178,904	47,686	122,212
9 Other unimproved land in farms.....acres..	1,765,892	17,276	23,274	22,914	23,008	27,809	24,557	47,925
10 Farm land reported as provided with drainage.....acres..	318,955	8,048	4,257	1,157	700	4,729	1,471	6,949
11 Farm land reported as needing drainage.....acres..	554,690	5,104	3,176	673	630	29,810	2,263	2,553
12 Drainage only.....acres..	157,852	2,036	1,108	653	383	5,199	1,390	2,422
13 Drainage and clearing.....acres..	396,838	3,068	2,068	20	247	24,611	873	131

	Bucks.	Butler.	Cambria.	Centre.	Chester.	Clarion.	Clearfield.	Clinton.
1 Number of all farms in the county.....	5,714	5,274	2,396	2,295	5,508	2,931	3,158	1,065
2 Farms reporting land having drainage.....	373	1,000	304	281	493	737	61	115
3 Farms reporting land needing drainage.....	353	1,290	450	446	627	626	31	151
4 Farms in drainage and levee districts.....	6	2	10	6	24	3		4
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	389,120	505,600	458,880	733,440	497,280	384,640	730,880	561,920
6 All land in farms.....acres..	332,530	410,555	198,544	268,250	424,016	272,426	238,778	115,370
7 Improved land in farms.....acres..	274,302	295,634	114,841	175,301	343,785	179,881	137,224	60,473
8 Woodland in farms.....acres..	38,501	74,710	58,676	75,573	52,471	68,052	80,754	48,636
9 Other unimproved land in farms.....acres..	19,727	36,211	25,027	17,376	27,790	24,493	20,800	6,262
10 Farm land reported as provided with drainage.....acres..	4,313	12,844	3,134	3,375	3,976	12,225	544	1,288
11 Farm land reported as needing drainage.....acres..	3,222	22,504	11,401	7,349	6,506	12,191	294	2,349
12 Drainage only.....acres..	1,466	7,910	2,302	3,353	3,024	4,031	289	695
13 Drainage and clearing.....acres..	1,756	14,594	9,099	3,996	3,482	8,160	5	1,654

	Columbia.	Crawford.	Cumberland.	Dauphin.	Delaware.	Elk.	Erle.	Fayette.
1 Number of all farms in the county.....	2,608	6,521	3,115	2,517	1,287	856	5,485	3,267
2 Farms reporting land having drainage.....	507	1,263	181	269	88	59	1,253	378
3 Farms reporting land needing drainage.....	592	1,739	132	310	183	139	1,287	332
4 Farms in drainage and levee districts.....	4		11	2	6	2	50	
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	806,560	664,320	337,920	334,080	118,400	515,840	499,840	509,440
6 All land in farms.....acres..	216,060	569,444	264,097	217,785	75,835	65,470	438,524	281,984
7 Improved land in farms.....acres..	156,636	341,133	222,060	170,213	59,580	28,773	255,597	179,393
8 Woodland in farms.....acres..	51,342	118,658	28,147	37,827	9,908	20,603	75,265	76,003
9 Other unimproved land in farms.....acres..	8,082	109,653	13,890	9,745	6,347	16,094	107,662	26,588
10 Farm land reported as provided with drainage.....acres..	6,080	18,042	1,991	2,066	780	586	26,741	5,845
11 Farm land reported as needing drainage.....acres..	11,405	42,728	1,341	2,935	2,457	4,971	29,933	5,929
12 Drainage only.....acres..	1,903	10,245	1,061	864	1,259	1,190	8,214	2,029
13 Drainage and clearing.....acres..	9,603	32,483	280	1,971	1,198	3,781	21,769	3,900

# DRAINAGE.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

PENNSYLVANIA—Continued.

		Franklin.	Fulton.	Greene.	Huntingdon.	Indiana.	Jefferson.	Juniata.	Lackawanna.
1	Number of all farms in the county.....	3,884	1,350	3,168	2,111	2,935	2,947	1,572	1,688
2	Farms reporting land having drainage.....	314	45	99	251	806	499	181	152
3	Farms reporting land needing drainage.....	231	339	225	519	1,069	663	270	502
4	Farms in drainage and levee districts.....	2	1	.....	14	6	1	.....	5
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county..... acres.....	480,640	257,920	367,360	587,520	530,590	426,240	250,880	288,640
6	All land in farms..... acres.....	404,506	185,169	348,940	325,840	392,939	243,716	172,102	134,486
7	Improved land in farms..... acres.....	288,460	100,568	300,840	172,682	277,956	154,062	99,739	63,460
8	Woodland in farms..... acres.....	76,495	76,457	37,963	127,424	90,112	66,203	64,257	30,266
9	Other unimproved land in farms..... acres.....	39,551	8,145	10,107	25,784	24,871	28,451	8,106	40,760
10	Farm land reported as provided with drainage..... acres.....	2,942	611	1,444	2,825	12,855	5,937	1,736	1,544
11	Farm land reported as needing drainage..... acres.....	8,559	10,019	4,695	11,255	21,108	15,890	4,119	9,648
12	Drainage only..... acres.....	2,165	872	1,147	3,187	5,064	3,452	946	1,578
13	Drainage and clearing..... acres.....	1,394	9,147	3,548	8,068	16,044	12,408	3,173	8,070

		Lancaster.	Lawrence.	Lebanon.	Lehigh.	Luzerne.	Lycoming.	McKean.	Mercer.	Mifflin.
1	Number of all farms in the county.....	11,307	2,484	2,372	2,969	2,965	3,273	1,580	4,499	1,108
2	Farms reporting land having drainage.....	175	863	211	126	304	552	94	2,277	176
3	Farms reporting land needing drainage.....	276	479	165	221	552	830	315	1,835	186
4	Farms in drainage and levee districts.....	3	.....	1	.....	1	6	1	4	.....
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	602,240	230,400	230,400	220,160	570,880	780,800	631,680	448,000	254,720
6	All land in farms..... acres.....	554,776	186,097	166,087	180,397	222,448	329,825	152,340	378,460	130,971
7	Improved land in farms..... acres.....	469,662	131,685	142,532	154,456	127,471	198,081	87,409	245,036	87,695
8	Woodland in farms..... acres.....	48,417	23,047	13,295	16,868	70,949	112,094	43,035	62,048	34,261
9	Other unimproved land in farms..... acres.....	36,697	31,365	10,260	9,073	24,028	19,650	41,896	70,776	9,015
10	Farm land reported as provided with drainage..... acres.....	1,072	19,496	1,980	577	3,089	5,146	936	45,719	1,713
11	Farm land reported as needing drainage..... acres.....	2,009	8,853	1,424	1,467	10,231	13,364	11,905	40,226	2,021
12	Drainage only..... acres.....	743	6,509	644	643	2,749	2,944	990	20,028	791
13	Drainage and clearing..... acres.....	1,266	2,344	780	824	7,482	10,420	10,915	20,198	1,230

		Montgomery.	Montour.	Northumberland.	Perry.	Schuylkill.	Snyder.	Somerset.	Sullivan.	Susquehanna.
1	Number of all farms in the county.....	4,840	774	2,589	2,105	2,813	1,753	3,630	836	3,526
2	Farms reporting land having drainage.....	216	288	621	808	229	450	1,056	71	40
3	Farms reporting land needing drainage.....	287	189	472	343	109	194	1,140	225	192
4	Farms in drainage and levee districts.....	4	1	1	1	.....	4	4	2	.....
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	309,760	83,200	290,560	360,960	497,280	199,040	661,760	293,120	527,360
6	All land in farms..... acres.....	244,933	76,036	211,533	231,315	209,949	147,397	444,148	87,151	446,229
7	Improved land in farms..... acres.....	212,124	59,539	163,368	139,864	138,592	108,741	234,798	35,999	279,961
8	Woodland in farms..... acres.....	19,553	13,093	41,198	79,978	59,044	34,398	166,798	28,011	113,857
9	Other unimproved land in farms..... acres.....	13,246	3,404	6,967	11,473	12,313	4,258	42,552	23,441	52,411
10	Farm land reported as provided with drainage..... acres.....	2,407	7,901	7,027	2,815	1,700	5,023	16,783	666	968
11	Farm land reported as needing drainage..... acres.....	2,889	3,108	6,130	3,639	980	1,659	39,098	3,404	2,599
12	Drainage only..... acres.....	1,513	993	1,705	959	496	659	8,083	630	1,289
13	Drainage and clearing..... acres.....	1,376	2,116	4,425	2,680	484	930	21,015	7,774	1,310

		Tioga.	Union.	Venango.	Warren.	Washington.	Westmoreland.	Wyoming.	York.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	3,702	1,411	2,869	2,353	4,482	5,593	1,543	7,818	14,378
2	Farms reporting land having drainage.....	193	334	455	154	276	483	58	467	288
3	Farms reporting land needing drainage.....	732	185	417	440	410	467	232	519	1,139
4	Farms in drainage and levee districts.....	3	1	2	3	7	3	.....	2	12
<b>LAND AND FARM AREA.</b>										
5	Approximate land area of the county..... acres.....	730,880	195,200	423,040	577,280	551,680	664,960	254,080	577,920	3,349,760
6	All land in farms..... acres.....	449,428	109,370	218,872	226,485	472,460	486,160	160,859	513,789	1,449,970
7	Improved land in farms..... acres.....	282,419	86,243	127,723	102,675	399,630	351,862	94,977	414,595	679,270
8	Woodland in farms..... acres.....	105,129	18,586	67,323	87,371	45,346	91,945	42,831	77,355	512,312
9	Other unimproved land in farms..... acres.....	61,880	4,541	23,826	36,439	27,484	42,353	23,051	21,839	258,388
10	Farm land reported as provided with drainage..... acres.....	2,321	4,427	7,050	2,131	2,968	8,400	583	2,743	2,288
11	Farm land reported as needing drainage..... acres.....	17,693	2,687	12,685	14,771	6,896	7,927	3,464	4,133	42,431
12	Drainage only..... acres.....	4,894	981	5,626	1,423	1,281	2,799	1,050	1,473	4,390
13	Drainage and clearing..... acres.....	12,799	1,706	7,059	13,348	5,615	5,128	2,414	2,660	38,041

<sup>1</sup> Drainage on farms was reported in all counties in Pennsylvania.

## AGRICULTURE.

## COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

## RHODE ISLAND.

		THE STATE.	Newport.	Providence.	All other counties. <sup>1</sup>
1	Number of all farms in the state or county.....	4,083	823	1,639	1,621
2	Farms reporting land having drainage.....	116	28	52	36
3	Farms reporting land needing drainage.....	359	69	131	159
4	Farms in drainage and levee districts.....	2	1	.....	1
<b>LAND AND FARM AREA.</b>					
5	Approximate land area of the state or county..... acres..	682,880	72,060	275,200	334,720
6	All land in farms..... acres..	331,600	42,639	122,825	166,136
7	Improved land in farms..... acres..	132,855	29,794	41,646	61,415
8	Woodland in farms..... acres..	130,462	7,412	50,489	72,561
9	Other unimproved land in farms..... acres..	68,283	5,433	30,690	32,160
10	Farm land reported as provided with drainage..... acres..	2,403	607	1,233	563
11	Farm land reported as needing drainage..... acres..	8,174	1,430	2,810	3,934
12	Drainage only..... acres..	2,240	594	889	757
13	Drainage and clearing..... acres..	5,934	836	1,921	3,177

<sup>1</sup> Drainage on farms was reported in all counties in Rhode Island.

## VERMONT.

		THE STATE.	Addison.	Bennington.	Caledonia.	Chittenden.	Franklin.	Grand Isle.
1	Number of all farms in the state or county.....	29,075	2,375	1,366	2,313	1,992	2,444	501
2	Farms reporting land having drainage.....	1,728	124	63	89	104	261	160
3	Farms reporting land needing drainage.....	3,042	137	112	191	120	392	138
4	Farms in drainage and levee districts.....	35	6	1	1	7	1	5
<b>LAND AND FARM AREA.</b>								
5	Approximate land area of the state or county..... acres..	5,839,360	433,840	423,040	395,520	347,520	417,250	53,120
6	All land in farms..... acres..	4,235,811	373,122	207,234	339,548	280,868	359,249	48,013
7	Improved land in farms..... acres..	1,691,595	217,796	81,691	129,997	140,453	150,287	33,141
8	Woodland in farms..... acres..	1,428,309	93,250	77,291	118,514	71,075	97,788	7,598
9	Other unimproved land in farms..... acres..	1,115,907	62,076	48,252	91,037	69,340	111,174	7,274
10	Farm land reported as provided with drainage..... acres..	35,649	5,377	2,309	1,122	1,943	6,221	6,696
11	Farm land reported as needing drainage..... acres..	68,912	4,342	1,898	3,377	3,432	13,256	3,328
12	Drainage only..... acres..	19,265	1,297	949	1,218	1,625	2,295	1,950
13	Drainage and clearing..... acres..	49,647	3,045	940	2,150	1,857	10,991	1,378

		Orange.	Orleans.	Rutland.	Washington.	Windham.	Windsor.	All other counties. <sup>1</sup>
1	Number of all farms in the county.....	2,687	2,543	2,649	2,564	2,103	3,268	2,270
2	Farms reporting land having drainage.....	103	166	212	79	121	182	64
3	Farms reporting land needing drainage.....	414	272	263	260	211	288	244
4	Farms in drainage and levee districts.....	.....	1	4	2	.....	1	6
<b>LAND AND FARM AREA.</b>								
5	Approximate land area of the county..... acres..	432,640	440,320	593,040	460,160	508,800	606,720	687,360
6	All land in farms..... acres..	378,431	368,105	436,558	316,799	331,638	467,601	828,645
7	Improved land in farms..... acres..	123,999	173,646	165,368	106,639	96,904	159,310	112,364
8	Woodland in farms..... acres..	126,413	120,399	148,339	115,989	137,629	166,550	147,274
9	Other unimproved land in farms..... acres..	128,019	74,060	122,851	94,171	97,105	141,541	69,007
10	Farm land reported as provided with drainage..... acres..	1,858	2,080	3,661	765	1,179	1,936	502
11	Farm land reported as needing drainage..... acres..	8,790	6,784	4,682	5,801	3,991	2,953	6,198
12	Drainage only..... acres..	2,582	1,172	1,489	781	956	1,634	1,267
13	Drainage and clearing..... acres..	6,208	5,612	3,193	5,020	3,035	1,269	4,931

<sup>1</sup> Drainage on farms was reported in all counties in Vermont.

## VIRGINIA.

		THE STATE.	Accomac.	Albemarle.	Alleghany.	Appomattox.	Augusta.	Bedford.	Bland.
1	Number of all farms in the state or county.....	186,242	3,206	3,165	621	1,329	3,759	4,245	778
2	Farms reporting land having drainage.....	9,899	832	197	20	58	162	71	51
3	Farms reporting land needing drainage.....	27,740	97	406	20	167	279	380	348
4	Farms in drainage and levee districts.....	140	1	23	3	.....	.....	.....	8
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the state or county..... acres..	25,767,680	321,280	478,080	292,480	218,880	641,920	506,240	230,400
6	All land in farms..... acres..	18,561,112	150,788	388,941	95,795	169,239	415,425	420,455	121,726
7	Improved land in farms..... acres..	9,460,492	79,397	215,880	31,643	72,668	299,401	231,813	61,457
8	Woodland in farms..... acres..	7,907,352	70,506	150,333	62,357	84,197	104,154	155,699	57,914
9	Other unimproved land in farms..... acres..	1,193,268	6,885	22,728	1,795	12,374	11,870	32,943	2,355
10	Farm land reported as provided with drainage..... acres..	226,068	16,447	3,636	549	564	2,817	1,404	636
11	Farm land reported as needing drainage..... acres..	1,172,680	1,271	15,135	458	7,763	4,347	9,252	19,330
12	Drainage only..... acres..	77,199	209	483	294	813	811	536	1,062
13	Drainage and clearing..... acres..	1,096,388	1,062	14,652	164	6,950	3,536	8,716	18,268

DRAINAGE.

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COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

VIRGINIA—Continued.

		Botetourt.	Brunswick.	Buckingham.	Campbell.	Carolina.	Carroll.	Charles City.	Charlotte.
1	Number of all farms in the county.....	1,666	2,842	2,273	2,686	2,595	3,569	614	2,792
2	Farms reporting land having drainage.....	63	107	67	142	17	193	14	22
3	Farms reporting land needing drainage.....	14	471	323	482	726	992	105	102
4	Farms in drainage and levee districts.....	1				6	1		
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	350,720	356,480	373,760	353,280	338,560	293,120	120,320	317,440
6	All land in farms.....acres..	187,137	266,010	263,225	275,677	267,444	278,624	73,811	265,114
7	Improved land in farms.....acres..	107,356	103,629	98,669	117,023	101,509	173,407	28,615	100,038
8	Woodland in farms.....acres..	75,180	151,108	151,108	131,973	119,338	96,463	40,559	140,617
9	Other unimproved land in farms.....acres..	4,601	11,231	13,448	26,676	46,597	8,754	4,637	24,459
10	Farm land reported as provided with drainage.....acres..	1,063	2,046	1,275	1,273	503	1,594	1,821	716
11	Farm land reported as needing drainage.....acres..	175	27,662	20,404	13,764	80,804	23,369	5,871	4,173
12	Drainage only.....acres..	131	1,523	490	1,335	2,440	1,041	420	1,159
13	Drainage and clearing.....acres..	45	26,134	19,914	12,429	28,364	22,328	5,451	3,017

		Chesterfield.	Culpeper.	Cumberland.	Dinwiddie.	Elizabeth City.	Fairfax.	Fauquier.	Fluvanna.
1	Number of all farms in the county.....	1,827	1,719	1,314	2,165	297	2,253	2,640	1,419
2	Farms reporting land having drainage.....	48	69	30	28	243	65	123	40
3	Farms reporting land needing drainage.....	396	111	496	85	99	128	161	233
4	Farms in drainage and levee districts.....						1		5
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	299,520	245,760	187,520	331,520	34,560	266,880	420,240	182,400
6	All land in farms.....acres..	172,064	209,549	160,399	226,436	16,665	174,183	379,779	151,807
7	Improved land in farms.....acres..	59,279	147,839	66,822	71,860	9,616	102,298	279,563	58,067
8	Woodland in farms.....acres..	101,888	59,298	77,330	132,765	4,461	65,387	92,397	79,436
9	Other unimproved land in farms.....acres..	10,897	2,412	16,247	21,811	1,588	6,498	7,819	14,284
10	Farm land reported as provided with drainage.....acres..	2,168	1,804	604	533	7,337	799	6,859	1,067
11	Farm land reported as needing drainage.....acres..	28,752	4,064	32,890	3,841	2,051	2,730	3,695	14,852
12	Drainage only.....acres..	950	946	910	246	448	269	3,967	747
13	Drainage and clearing.....acres..	27,832	3,119	31,980	3,595	1,603	2,461	4,728	14,105

		Franklin.	Gloucester.	Goochland.	Grayson.	Greene.	Halifax.	Hanover.	Henrico.
1	Number of all farms in the county.....	4,205	1,811	1,349	2,625	834	5,745	2,647	1,666
2	Farms reporting land having drainage.....	190	22	61	301	125	30	101	69
3	Farms reporting land needing drainage.....	1,553	39	482	1,109	143	1,022	903	168
4	Farms in drainage and levee districts.....	6	1	9	6			4	4
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	446,080	142,720	183,680	272,000	99,200	520,960	327,680	163,840
6	All land in farms.....acres..	398,845	92,395	141,039	249,896	82,153	455,726	243,999	114,009
7	Improved land in farms.....acres..	171,445	45,008	60,035	163,973	47,165	226,807	108,034	55,917
8	Woodland in farms.....acres..	180,445	43,749	66,355	80,742	28,528	223,251	117,324	51,510
9	Other unimproved land in farms.....acres..	46,955	3,638	14,649	5,181	6,460	35,668	18,641	6,582
10	Farm land reported as provided with drainage.....acres..	1,325	813	2,233	2,844	2,116	1,328	1,975	2,332
11	Farm land reported as needing drainage.....acres..	48,880	494	28,001	32,458	3,277	37,980	32,912	5,254
12	Drainage only.....acres..	1,514	131	326	449	209	3,840	1,751	1,845
13	Drainage and clearing.....acres..	47,375	363	22,675	32,009	3,068	34,140	31,161	3,409

		Highland.	Isle of Wight.	Lancaster.	Loudoun.	Madison.	Mathews.	Mecklenburg.	Nansemond.
1	Number of all farms in the county.....	744	1,779	1,256	1,962	1,354	1,385	4,376	2,133
2	Farms reporting land having drainage.....	58	293	13	94	107	599	341	145
3	Farms reporting land needing drainage.....	152	411	24	293	193	406	380	291
4	Farms in drainage and levee districts.....				7		1		4
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county.....acres..	270,080	200,960	83,200	332,160	207,360	60,160	428,160	260,440
6	All land in farms.....acres..	197,484	152,367	57,923	305,906	170,235	40,091	368,282	165,936
7	Improved land in farms.....acres..	82,439	63,968	27,880	247,673	107,525	23,352	162,251	70,558
8	Woodland in farms.....acres..	87,366	67,792	26,651	54,095	57,368	14,581	189,224	89,737
9	Other unimproved land in farms.....acres..	27,679	20,607	3,392	4,138	5,342	2,158	16,787	5,641
10	Farm land reported as provided with drainage.....acres..	1,128	4,585	682	1,960	2,481	11,430	5,787	3,683
11	Farm land reported as needing drainage.....acres..	5,693	11,696	2,369	12,138	5,829	7,704	12,823	14,930
12	Drainage only.....acres..	402	638	215	1,049	343	3,045	1,044	442
13	Drainage and clearing.....acres..	5,291	11,258	2,154	11,089	5,486	4,659	11,479	14,488

AGRICULTURE.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

VIRGINIA—Continued.

	Nelson.	Norfolk.	Northampton.	Northumberland.	Notto-way.	Orange.	Page.	Patriek.
1 Number of all farms in the county.....	2,066	1,316	1,259	1,534	1,058	1,394	1,280	2,844
2 Farms reporting land having drainage.....	85	890	140	60	73	142	61	60
3 Farms reporting land needing drainage.....	78	463	201	96	255	81	49	88
4 Farms in drainage and levee districts.....	1	4	.....	1	1	2	.....	.....
<b>LAND AND FARM AREA.</b>								
5 Approximate land area of the county.....acres..	302,720	257,280	152,960	131,200	198,400	229,760	206,080	310,400
6 All land in farms.....acres..	240,442	103,211	82,892	92,532	126,407	177,155	133,103	252,812
7 Improved land in farms.....acres..	99,643	62,647	47,998	46,164	37,834	106,273	73,017	97,782
8 Woodland in farms.....acres..	117,730	32,465	28,901	39,836	70,585	63,039	50,481	126,767
9 Other unimproved land in farms.....acres..	23,169	8,199	5,993	6,532	17,988	7,843	9,625	28,263
10 Farm land reported as provided with drainage.....acres..	831	44,492	3,516	1,389	1,811	2,643	616	592
11 Farm land reported as needing drainage.....acres..	448	20,329	5,103	1,555	12,553	3,305	478	414
12 Drainage only.....acres..	241	1,626	1,489	224	1,578	862	369	187
13 Drainage and clearing.....acres..	207	18,703	3,614	1,331	10,975	2,443	109	227

	Pittsylvania.	Powhatan.	Prince Edward.	Prince George.	Prince William.	Princess Anne.	Roanoke.	Russell.	Scott.
1 Number of all farms in the county.....	7,025	1,048	1,843	1,014	1,271	1,317	1,631	2,557	3,698
2 Farms reporting land having drainage.....	97	39	60	162	67	540	62	41	70
3 Farms reporting land needing drainage.....	959	539	126	198	498	194	43	59	387
4 Farms in drainage and levee districts.....	1	4	1	.....	.....	.....	.....	2	.....
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county.....acres..	647,680	174,720	227,840	188,032	220,800	178,560	189,440	317,440	347,520
6 All land in farms.....acres..	582,496	125,641	177,522	119,895	162,245	94,544	130,089	292,535	279,536
7 Improved land in farms.....acres..	269,741	47,117	71,373	53,315	97,592	60,325	75,338	196,709	164,058
8 Woodland in farms.....acres..	267,717	67,178	92,288	60,983	59,187	28,734	52,621	81,615	107,525
9 Other unimproved land in farms.....acres..	45,038	11,346	13,861	5,597	6,486	5,485	2,130	14,211	7,953
10 Farm land reported as provided with drainage.....acres..	1,775	1,330	1,151	2,677	1,465	20,192	550	554	638
11 Farm land reported as needing drainage.....acres..	14,993	40,172	3,655	8,460	25,508	6,398	432	1,559	12,137
12 Drainage only.....acres..	2,557	1,703	938	1,530	1,334	204	108	458	989
13 Drainage and clearing.....acres..	12,436	38,469	2,117	6,930	24,174	6,194	324	1,101	11,148

	Shenandoah.	Southampton.	Spotsylvania.	Sussex.	Tazewell.	Warren.	Westmoreland.	York.	All other counties. <sup>1</sup>
1 Number of all farms in the county.....	2,388	3,550	1,668	1,433	1,602	772	1,455	894	52,712
2 Farms reporting land having drainage.....	58	841	121	168	94	78	56	135	498
3 Farms reporting land needing drainage.....	140	714	748	645	274	119	441	215	5,942
4 Farms in drainage and levee districts.....	7	4	4	2	1	1	.....	.....	13
<b>LAND AND FARM AREA.</b>									
5 Approximate land area of the county.....acres..	328,400	386,560	263,680	329,600	339,840	138,240	181,280	87,040	8,279,168
6 All land in farms.....acres..	220,984	295,787	178,705	197,553	252,247	122,752	122,112	38,616	5,559,740
7 Improved land in farms.....acres..	139,603	119,519	71,078	69,321	119,590	78,441	60,384	16,913	2,897,020
8 Woodland in farms.....acres..	68,631	171,393	96,592	124,447	88,046	39,956	56,810	19,477	2,311,155
9 Other unimproved land in farms.....acres..	12,750	4,875	9,037	3,785	44,611	4,355	4,918	2,286	351,665
10 Farm land reported as provided with drainage.....acres..	724	13,580	1,605	3,092	1,731	959	4,068	2,027	6,953
11 Farm land reported as needing drainage.....acres..	4,500	46,307	33,003	34,802	8,201	2,784	17,851	4,919	324,290
12 Drainage only.....acres..	790	805	3,229	2,225	1,097	736	80	117	13,239
13 Drainage and clearing.....acres..	3,710	45,502	29,774	32,577	7,104	2,048	17,771	4,802	311,051

<sup>1</sup> No drainage on farms reported in Pulaski County nor in Alexandria, Buena Vista, Clifton Forge, Danville, Fredericksburg, Hopewell, Lynchburg, Radford, and Suffolk cities.

WEST VIRGINIA.

	THE STATE.	Barbour.	Greenbrier.	Hampshire.	Hardy.	Harrison.	Jackson.
1 Number of all farms in the state or county.....	87,269	1,837	2,439	1,663	1,228	2,271	2,798
2 Farms reporting land having drainage.....	1,949	78	87	63	84	55	70
3 Farms reporting land needing drainage.....	10,304	373	419	344	183	174	245
4 Farms in drainage and levee districts.....	33	.....	1	5	2	1	1
<b>LAND AND FARM AREA.</b>							
5 Approximate land area of the state or county.....acres..	15,374,080	222,720	638,720	414,720	367,360	266,240	295,040
6 All land in farms.....acres..	9,569,790	175,966	314,830	322,380	269,689	232,681	283,710
7 Improved land in farms.....acres..	5,520,308	130,879	149,038	134,645	104,257	200,992	204,108
8 Woodland in farms.....acres..	3,469,444	35,533	136,129	163,694	153,171	23,174	61,476
9 Other unimproved land in farms.....acres..	580,038	9,554	29,663	24,041	12,261	8,815	18,127
10 Farm land reported as provided with drainage.....acres..	38,464	1,304	1,885	1,090	2,225	1,048	809
11 Farm land reported as needing drainage.....acres..	310,868	7,813	14,351	15,551	10,139	4,335	4,032
12 Drainage only.....acres..	32,263	1,915	3,214	859	1,311	524	613
13 Drainage and clearing.....acres..	378,615	5,898	11,137	14,692	8,828	3,811	3,419

# DRAINAGE.

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## COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

### WEST VIRGINIA—Continued.

		Lewis.	Marshall.	Mason.	Mercer.	Mineral.	Monroe.	Nicholas.
1	Number of all farms in the county .....	1,644	1,712	2,415	1,927	789	1,834	1,670
2	Farms reporting land having drainage .....	121	14	121	58	78	63	35
3	Farms reporting land needing drainage .....	223	11	282	203	239	126	304
4	Farms in drainage and levee districts .....				1	1	3	
<b>LAND AND FARM AREA.</b>								
5	Approximate land area of the county .....	251,520	198,400	304,000	268,160	223,360	292,480	435,200
6	All land in farms .....	235,198	178,961	258,044	187,845	170,845	236,776	153,726
7	Improved land in farms .....	179,966	128,243	181,016	100,166	70,755	140,747	83,873
8	Woodland in farms .....	49,123	38,623	62,276	81,050	83,451	80,773	62,136
9	Other unimproved land in farms .....	4,109	12,095	14,752	6,629	16,439	15,256	7,717
10	Farm land reported as provided with drainage .....	1,214	606	9,147	904	2,481	873	1,299
11	Farm land reported as needing drainage .....	5,244	211	8,794	7,562	13,123	2,147	8,237
12	Drainage only .....	952	33	3,007	536	1,584	1,419	1,262
13	Drainage and clearing .....	4,292	178	5,787	7,026	11,539	728	6,975

		Ohio.	Pocahontas.	Preston.	Putnam.	Randolph.	Upshur.	Wood.	All other counties. <sup>1</sup>
1	Number of all farms in the county .....	516	1,283	2,406	1,956	1,774	2,148	2,472	50,527
2	Farms reporting land having drainage .....	26	65	99	34	132	190	54	422
3	Farms reporting land needing drainage .....	16	57	236	380	305	787	417	4,931
4	Farms in drainage and levee districts .....						1	5	12
<b>LAND AND FARM AREA.</b>									
5	Approximate land area of the county .....	68,480	578,560	416,000	215,040	663,040	234,640	232,960	8,797,440
6	All land in farms .....	48,085	266,346	274,984	182,341	302,327	183,636	196,516	5,098,804
7	Improved land in farms .....	37,762	92,174	151,721	117,807	134,865	126,563	142,948	2,907,783
8	Woodland in farms .....	5,616	140,689	95,850	61,967	152,154	44,429	47,247	1,890,884
9	Other unimproved land in farms .....	2,707	33,483	27,413	2,567	15,308	12,644	6,321	300,137
10	Farm land reported as provided with drainage .....	676	817	926	989	2,487	1,964	593	5,127
11	Farm land reported as needing drainage .....	205	1,048	5,470	13,137	11,112	15,044	7,441	155,872
12	Drainage only .....	123	626	1,876	1,145	2,420	1,767	552	6,485
13	Drainage and clearing .....	82	422	3,594	11,992	8,692	13,277	6,889	149,387

<sup>1</sup> No drainage on farms reported in Logan, McDowell, and Wyoming Counties.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.<sup>1</sup>

	ARIZONA.				NEW MEXICO.				OKLAHOMA.			
	THE STATE.	Graham.	Mari-copa.	Yuma.	THE STATE.	Chaves.	Dona Ana.	Eddy.	THE STATE.	John-ston.	Other coun-ties. <sup>2</sup>	
<b>LAND AREA.</b>												
1	Approximate land area of the state or county.....acres..	72,838,400	2,963,200	5,690,240	6,391,680	78,401,920	3,866,880	2,445,440	2,716,800	44,424,960	421,120	1,688,960
2	All land in operating drainage enterprises.....acres..	39,640	640	9,000	30,000	140,219	53,983	74,000	12,236	12,150	6,000	6,150
3	Improved land.....acres..	36,880	640	7,740	28,500	92,477	46,843	37,000	8,634	8,845	3,600	5,245
4	Per cent of all improved land in farms.....	5.2	1.7	2.8	69.6	5.4	92.9	87.8	16.5	( <sup>3</sup> )	2.4	0.5
5	Timber and out-over land.....acres..	2,760		1,260	1,500	47,742	7,140	37,000	3,602	3,305	2,400	905
6	Other unimproved land.....acres..	2,160		1,260	900	20,572	1,352	18,500	720	2,250	1,800	450
7	Swampy or subject to overflow, in enterprises.....acres..	2,160		1,260	900	20,572	1,352	18,500	720	2,250	1,800	450
8	Suffering a loss of crops from defective drainage.....acres..	2,160		1,260	900	20,572	1,352	18,500	720	2,250	1,800	450
9	Assessed acreage.....	69,640	640	9,000	30,000	140,219	53,983	74,000	12,236	12,150	6,000	6,150
10	Excess over all land in operating enterprises.....acres..											
<b>DRAINAGE WORKS.</b>												
Open ditches:												
11	Completed.....miles	32.6		8.5	24.1	124.0	7.4	100.0	16.6	18.6	8.5	10.1
12	Additional under construction.....miles									1.6		1.6
13	Maximum completed in any enterprise.....miles	24.1		8.5	24.1	100.0	5.4	100.0	6.0	8.5	8.5	4.0
14	Maximum width at bottom of ditch <sup>4</sup> .....feet	24		8	24	12	8	12	10	100	15	100
15	Maximum of average depths of outlet ditches <sup>4</sup> .....feet	8.0		8.0	8.0	10.0	8.0	10.0	10.0	30.0	30.0	8.0
16	Mean depth of branch ditches <sup>4</sup> .....feet	8.0			8.0							
Tile drains:												
17	Completed.....miles	1.0	1.0			282.2	283.8		18.4			
18	Additional under construction.....miles					65.1	58.4		6.7			
19	Maximum completed in any enterprise.....miles	1.0	1.0			120.1	120.1		14.8			
20	Maximum size of tile <sup>4</sup> .....inches	12	12			30	30		24			
Accessory levees and dikes:												
21	Completed.....miles	26.0			26.0					5.0	5.0	
22	Additional under construction.....miles											
Pumping plants:												
23	Engine capacity.....horsepower	175			175							
24	Pump capacity.....gallons per minute	33,660			33,660							
25	Area served by pumps.....acres	25,000			25,000							
26	Area drained by open ditches only <sup>4</sup> .....acres	9,000		9,000		74,000		74,000		6,150		6,150
27	Length of these ditches.....miles	8.5		8.5		100.0		100.0		11.7		11.7
28	Average length per acre.....feet	5.0		5.0		7.1		7.1		10.0		10.0
29	Area having open ditches and levees <sup>4</sup> .....acres	30,000			30,000					6,000	6,000	
30	Length of these ditches.....miles	24.1			24.1					8.5	8.5	
31	Average length per acre.....feet	4.2			4.2					7.5	7.5	
32	Length of the accessory levees.....miles	26.0			26.0					5.0	5.0	
33	Area drained by tile only <sup>4</sup> .....acres	640	640			34,138	34,138					
34	Length of these tile.....miles	1.0	1.0			199.7	199.7					
35	Average length per acre.....feet	8.3	8.3			30.9	30.9					
36	Area drained by open ditches and tile <sup>4</sup> .....acres					32,081	19,845		12,236			
37	Length of these drains.....miles					171.6	129.9		41.7			
38	Average length per acre.....feet					28.2	34.6		18.0			
<b>DEVELOPMENT OF LAND.</b>												
39	Improved land in operating enterprises, 1920.....acres..	36,880	640	7,740	28,500	92,477	46,843	37,000	8,634	8,845	3,600	5,245
40	Improved land prior to drainage.....acres..	19,112	512	3,600	15,000	77,265	35,404	37,000	4,861	3,595	600	2,995
41	Increase since drainage.....acres..	17,768	128	4,140	13,500	15,212	11,439		3,773	5,250	3,000	2,250
42	Per cent of increase.....	93.0	25.0	115.0	90.0	19.7	32.3		77.6	146.0	500.0	75.1
43	Per cent increase is of all improved land in farms, 1920.....	2.5	0.3	1.5	33.0	0.9	22.7		7.2	( <sup>3</sup> )	2.0	0.2
44	Timber and out-over land, 1920.....acres..									3,305	2,400	905
45	Timber and out-over land prior to drainage.....acres..									6,930	5,400	1,530
46	Decrease since drainage.....acres..									3,625	3,000	625
47	Per cent of decrease.....									52.3	55.6	40.8
48	Other unimproved land, 1920.....acres..	2,760		1,260	1,500	47,742	7,140	37,000	3,602			
49	Other unimproved land prior to drainage.....acres..	20,528	128	5,400	15,000	62,954	18,579	37,000	7,375	1,625		1,625
50	Decrease since drainage.....acres..	17,768	128	4,140	13,500	15,212	11,439		3,773	1,625		1,625
51	Per cent of decrease.....	86.6	100.0	78.7	90.0	24.2	61.6		51.2	100.0		100.0
52	Swampy or subject to overflow, 1920.....acres..	2,160		1,260	900	20,572	1,352	18,500	720	2,250	1,800	450
53	Swampy or subject to overflow prior to drainage.....acres..	6,428	128	5,400	900	44,919	2,705	37,000	5,214	7,050	3,600	3,450
54	Decrease since drainage.....acres..	4,268	128	4,140		24,347	1,353	18,500	4,494	4,800	1,800	3,000
55	Per cent of decrease.....	66.4	100.0	78.7		54.2	50.0	50.0	86.2	68.1	50.0	87.0
<b>CAPITAL INVESTED AND COST PER ACRE.</b>												
56	Total capital invested in and required for completion of operating enterprises.....dollars..	1,026,426	7,000	94,425	925,000	2,906,296	1,093,692	1,575,000	237,604	77,415	44,500	32,915
57	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	414,426	7,000	94,425	313,000	1,710,796	924,442	575,000	211,354	76,415	44,500	31,915
58	Additional capital required to complete these enterprises.....dollars..	612,000			612,000	1,195,500	169,250	1,000,000	26,250	1,000		1,000
59	Average cost per acre when completed.....dollars..	25.89	10.94	10.49	30.83	20.73	21.26	21.28	19.42	6.37	7.42	5.35
60	Enterprises constructing open ditches only.....dollars..	94,425		94,425		1,575,000		1,575,000		32,915		32,915
61	Average cost per acre when completed.....dollars..	10.49		10.49		21.28		21.28		5.35		5.35
62	Enterprises constructing open ditches and levees.....dollars..	925,000			925,000					44,500	44,500	
63	Average cost per acre when completed.....dollars..	30.83			30.83					7.42	7.42	
64	Enterprises constructing tile drains only.....dollars..	7,000	7,000			643,692	643,692					
65	Average cost per acre when completed.....dollars..	10.94	10.94			18.86	18.86					
66	Enterprises constructing open ditches and tile drains.....dollars..					687,604	450,000		237,604			
67	Average cost per acre when completed.....dollars..					21.43	22.68		19.42			
<b>CROPS.</b>												
Improved land in enterprises reporting—												
68	Allalfa as principal crop on drained land.....acres..	640	640			85,603	30,969	37,000	8,634			
69	Cotton as principal crop on drained land.....acres..	36,240		7,740	28,500					3,600	3,600	
70	Grain as principal crop on drained land.....acres..					6,874	6,874			750		750
71	Corn as principal crop on drained land.....acres..									2,500		2,500
72	Hay as principal crop on drained land.....acres..									1,965		1,965

<sup>1</sup> Churchill County, Nev., and Malheur County, Oreg., comprise all the enterprises in those states, and the statistics are given in State Table V, p. 379.  
<sup>2</sup> Includes only Canadian, Kay, and Muskogee Counties.  
<sup>3</sup> Less than one-tenth of 1 per cent.  
<sup>4</sup> When works under construction have been completed.

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# APPENDIX

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## INSTRUCTIONS AND SCHEDULES



## INSTRUCTIONS AND SCHEDULES.

For the purpose of making inquiries with regard to irrigation and drainage of lands for agriculture in connection with the Fourteenth Decennial Census of the United States, as provided by the act of Congress approved March 3, 1919, the accompanying instructions were issued for the guidance of special agents and enumerators. These instructions relate in particular to the special schedule for irrigation enterprises and the special schedule for drainage enterprises, copies of which appear herein, and set forth the pro-

cedure which was followed in obtaining reports of irrigation and drainage enterprises on these schedules.

The data relating to irrigated crops, as well as certain information concerning drainage, were obtained on the general farm schedule by the census enumerators. The instructions pertaining to irrigation and drainage which were used in connection with the general farm schedule, together with the inquiries concerning these subjects as they appeared on the schedule, are also shown herein.

### INSTRUCTIONS TO SPECIAL AGENTS.

[NOTE.—These instructions were not on the schedules themselves but in a separate pamphlet.]

#### GENERAL INSTRUCTIONS.

**Supervision.**—The inquiries regarding irrigation and drainage are a part of the Census of Agriculture and therefore under the general supervision of the Chief Statistician for Agriculture.

**To whom special agents doing field work should report.**—In sections where both irrigation and drainage are practiced, the same field agents will canvass both irrigation and drainage enterprises. All special agents doing field work on irrigation or drainage will report to the Chief Statistician for Agriculture. If for any reason arising during the canvass any other arrangement shall become necessary in any individual case, the special agent in the field will be given instructions by the Chief Statistician for Agriculture.

**Obligation to secrecy.**—Special agents engaged in field work, in common with other employees of the Census Bureau, are prohibited by law from communicating to anyone, without authority of the Director of the Census, any information coming into their possession by reason of their employment in the Census Bureau. Attention is called to the penal provision of the Census act.

**Answers to inquiries to be based upon records.**—Agents may occasionally find a disposition on the part of persons furnishing information to give general statements or estimates. In no case should such estimates be accepted when it is possible to secure more exact information directly from records. It is not expected that special agents will spend much time in compiling figures from the records of independent enterprises, but they should try to get from the officials of enterprises exact information based on records, rather than general statements. In many cases, particularly with small enterprises, full records do not exist; in such cases, of course, estimates should be accepted.

In cases where one public officer has the records for a large number of enterprises, the special agent should assist as far as practicable in securing the data from the books or other records.

**Date to which information should relate.**—Where inquiries are made with regard to present conditions, the information given should represent conditions on January 1, 1920, rather than on the (later) date when the schedule is filled out.

**General reports.**—Before completing his work each special agent should prepare a brief report on conditions within the territory covered by him, showing in a general way, not in detail, the opportunities for further reclamation of land by irrigation or drainage, or both; attempts which have been made to bring about such reclamation; and proposed plans for reclamation. It is not expected that special agents will make extensive studies as a basis for these reports, but they should keep the matter in mind during their work and make notes as information of the kind desired comes to their notice. These reports are not intended for publication, but for use in discussing the results of the definite data collected.

**Mapping of irrigated areas.**—Agents will be furnished with maps of their districts. These maps have been subdivided sufficiently

to permit of indicating 40-acre tracts, and in some cases smaller tracts. When enumerating a farm on which irrigation is practiced agents should locate the ground on the map, and block in with pencil the land irrigated. This should be attended to when the farm is enumerated.

#### THE CENSUS OF IRRIGATION.

**Data from general farm schedules.**—The acreage of farm land irrigated and the data regarding irrigated crops, as well as the acreage supplied with artificial drainage, are to be obtained on the general farm schedule by the census enumerators. The general farm schedule also calls for the name of the irrigation enterprise supplying water (Inquiry 56) and for the name of the company, district, etc., affording drainage (Inquiry 33).

**Special schedule for irrigation enterprises.**—A special irrigation schedule is to be obtained for each irrigation enterprise, whether it supplies water for a single farm or for many farms. Schedules are not to be returned, however, for small plants used for watering lawns or home gardens. Note that while the unit for the general farm schedule is the individual farm, the unit for the special irrigation schedule is the enterprise or organization supplying water for irrigation. Schedules should be returned for enterprises which have been organized and have begun work, although no land is yet irrigated; or in case the enterprise is a going concern with plans for proceeding with construction, even if construction has not yet begun. In such cases answer the questions which apply, and explain the facts in some blank space or on the margin of the schedule.

**Drainage schedules to be secured in connection with irrigation census.**—As indicated above, special agents engaged primarily in work on the irrigation census in the arid and semiarid regions will be expected also to secure drainage schedules for all drainage enterprises in their respective territories.

**How special schedules are to be secured.**—Most of the irrigation schedules for large enterprises will be secured by special agents, as indicated below. Irrigation schedules for enterprises supplying less than five farms, however, are to be obtained by enumerators at the same time that they secure the population and general farm schedules.

In enumeration districts which are difficult of access and in which most of the enterprises are small, even though some may supply more than four farms, the enumerator will be instructed to get schedules for all enterprises regardless of size.

**Special agents assigned to supervisors' districts.**—A special agent will be stationed in each supervisor's district in which irrigation is extensively practiced. It will be the duty of such special agent to instruct the enumerators in his district with regard to the irrigation schedules, to check over the irrigation schedules turned in by the enumerators, to return these schedules to the enumerators for correction when necessary, and to make additions to the lists of irrigation and drainage enterprises sent him from Washington by comparing them with the names of the irrigation and drainage en-

terprises shown on the general farm schedules (Inquiries 56 and 33, respectively).

**Relations between special agents and supervisors.**—Since the enumerators in a given district are responsible to the supervisor, and not directly to the special agent, the special agent must deal with them through the supervisor. In each district, therefore, the special agent must arrange to instruct the enumerators, to return schedules for correction, and to carry on all his dealings with the enumerators in a manner that is satisfactory to the supervisor of the district. He must also arrange to use the general farm schedules for purposes of comparison with his list of irrigation and drainage enterprises at such times and in such manner as may be agreeable to the supervisor. If there is any difficulty in making satisfactory arrangements, the matter should be referred to the Chief Statistician for Agriculture, at Washington.

**Lists of irrigation enterprises.**—The special agent in each supervisor's district will be supplied with lists of irrigation enterprises in his district made up from the returns of the last preceding census, and from other available sources of information. A typewritten list is provided for the agent's use as a permanent record, and a card list, containing the same names, to be returned to Washington card by card, with the schedules as they are secured. These lists may not be complete, and they will probably contain names of enterprises which are now inactive or have changed hands since the last census.

For the purpose of completing and correcting the lists, an inquiry has been placed on the general farm schedule calling for the name of the enterprise supplying water for irrigation, in case a farm, or any part of it, is irrigated.

**Lists to be checked with general farm schedules.**—The first duty of the special agent will be to examine all the general farm schedules as they are received from the enumerators by the supervisors; to check against his list the names of enterprises reported under Inquiry 56 on these schedules; and to add to the list the names of any such enterprises which it does not already contain. New names and corrections should be promptly reported to the Washington office on the daily report card or on a memorandum attached thereto.

**Additional names to be placed on lists.**—The names of all enterprises which are to be added to the list should be inserted in their proper alphabetical places, and should be provided with the numbers by adding *a*, *b*, *c*, etc., to the last preceding number. Thus, two new names inserted between No. 16 and No. 17 would be numbered 16*a* and 16*b*, respectively.

Where the irrigation enterprise is reported as "private" in answer to Inquiry 56 on the general farm schedule, the enterprise should be entered on the lists in the name of the farm operator.

**Lists of drainage enterprises in irrigation areas.**—Lists of drainage enterprises, as well as of irrigation enterprises, will be supplied to special agents in the arid and semiarid regions. The names of drainage enterprises reported under Inquiry 33 on the general farm schedule should be checked against these lists, and the names of any drainage enterprises not already on the list should be inserted in their proper places and numbered, as already directed for additional irrigation enterprises.

**Lists to serve as records of work accomplished.**—The lists, as revised, are to be used as a guide in making the canvass, and as irrigation or drainage schedules are received, this fact should be indicated on the cards and on the typewritten lists, with the date of receipt. As the schedules are returned for correction, or are forwarded to Washington, the dates of returning or forwarding should also be recorded on the cards and on the typewritten lists.

There should be a report of some kind for every enterprise on the list. If the enterprise has ceased to operate, or if it has changed hands, or if there is any other good reason why a schedule should not be obtained, this reason should be clearly stated. When such facts are ascertained they should be entered on the cards and on the typewritten lists and also reported at once to the Chief Statistician for Agriculture, at Washington.

**Schedules to be obtained by enumerators.**—As stated in these instructions, the enumerators are to secure irrigation schedules for irrigation enterprises supplying water to less than five farms, at the same time that they get general farm schedules from the occupants of the farms which these enterprises serve. It will be the duty of the special agents to examine these schedules as they come in from the enumerators; to return them to the enumerators for completion or correction, if necessary; to check them up with the list, after the new enterprises found on the general farm schedules have been added; to see that the enumerators are making out irrigation schedules in all cases where they should; and to make proper records of the dates of receipt, return, and forwarding of schedules. In general, it will be the duty of the special agent in each supervisor's district to see that the canvass of small enterprises by the enumerators in his district is completed in a satisfactory manner.

**Duplicate schedules.**—Special agents stationed in supervisors' districts should check carefully the names of farmers reported on the irrigation schedules turned in by enumerators, as well as the names of the enterprises, to see that only one schedule is turned in for a canal supplying more than one farm. If duplicates are discovered, that fact should be brought to the attention of the supervisor, in order that he may take it into consideration in computing the pay of the enumerators turning in the duplicates.

**Schedules to be obtained by special agents.**—The special agents are to get schedules for all enterprises not covered by enumerators. The work of the enumerators is to be completed in 30 days, and after that time the special agents should devote themselves to completing the canvass in their districts.

**Forwarding of schedules.**—As soon as schedules are received, numbered, examined, and found to be complete, they should be transmitted to the Director of the Census at Washington.

#### THE IRRIGATION SCHEDULE.

The following paragraphs give detailed explanations and instructions relative to the inquiries on the irrigation schedule. Items not specifically referred to in these paragraphs are assumed to be self-explanatory.

**Questions requiring additional space.**—If the reply to any question on the schedule requires additional space, or needs explanation, use any blank spaces on the schedule (with appropriate reference marks), or, if necessary, attach a separate sheet to the schedule. If an extra sheet is used, explanations should be numbered to correspond with the inquiries to which they refer, and all explanations relating to one schedule should be written on a single sheet, if possible.

**Inquiry 1. Information concerning management.**—The first entry under this inquiry should be the name of the irrigation enterprise or canal to which the schedule relates.

**When names of farmers are to be given.**—Next should be given the name of the individual or company controlling the enterprise. Then, in case of an enterprise supplying less than five farms, the names of the farmers who are supplied with water should be given on the extra blank lines. The names of the farmers supplied are *not* to be given for enterprises supplying five farms or more.

**Farms supplied by two or more ditches.**—If a farm is supplied with water by more than one ditch, and these ditches supply water to other farms, a schedule should be made out for each ditch; but if a farm is supplied with water by more than one ditch and these ditches supply no other farm or farms, all such ditches should be included on a single schedule, the names, if the ditches are named, being written on the blank lines under Inquiry 1.

**Separate organizations controlling laterals.**—If the laterals distributing water from a main canal are controlled by separate organizations, rather than by the organization controlling the main canal, this fact should be stated on the blank lines under Inquiry 1, or on a separate sheet, but the information regarding the laterals should be included on the schedule for the main enterprise.

If there is a question whether the organization controlling the main canal and those controlling the laterals should be reported as separate enterprises (see note on schedule under Inquiry 6), the special agent should exercise his best judgment, but, in every case he should state the facts clearly and report all data in such a way that correct totals for the main and subsidiary canals will be given, without duplication.

**Inquiry 2. Source of water supply.**—If water is secured from more than one source, all should be marked and the principal source indicated by underscoring. Similarly, if water is secured from two or more streams or other sources, the names of all should be given.

**Stored storm water.**—"Stored storm water" refers to reservoirs filled by storing storm water from drainage channels that carry water only during storms, and are not classed as streams. When water is obtained from a reservoir filled from a stream, the stream should be given as the source. The other designations are self-explanatory.

**Drainage basins.**—Under "Drainage basin" the name of the smallest stream that is well known and which is shown on ordinary maps should be given, rather than that of the large river system to which the valley where the enterprise is located is tributary. For example, an enterprise in Wyoming or Montana should not be reported as in the Missouri, Colorado, or Columbia drainage basin, as the case may be, but in the drainage basin of some such stream as the Big Horn, Bitter Root, or Green River, or some of their larger tributaries.

This inquiry should be answered, even if water is not obtained from a stream.

**Inquiry 3. Class of enterprise.**—The classes into which irrigation enterprises are divided for census purposes are defined on the schedule. This is one of the most important classifications to

be made and great care should be exercised to report enterprises correctly, and to explain, in the blank spaces provided for that purpose, any changes in form of organization which may have taken place. This is particularly important in the case of Carey Act, United States Reclamation Service, and commercial enterprises which have been reorganized as irrigation districts or cooperative enterprises.

**Public records of irrigation enterprises.**—Irrigation districts are organized under public supervision, in most states that of the county commissioners, and in most states annual reports must be made to some county official. Consequently it is possible to get much of the information regarding districts from county records, and if there is difficulty in getting it from district officials, resort should be had to the public records.

Carey Act enterprises operate under more or less close supervision of state land boards, and information regarding them can be obtained from state records.

**Inquiry 4. Water rights.**—This inquiry relates to the rights of the enterprise to take water from the stream or other source from which it is obtained. (See note on schedule.) If the right does not fall into any of the classes given, state the nature of the right on the blank line.

**Units of measure for water.**—If rights have been defined by a court, a state board, or a state official, the amounts should be given in the units in which they are defined. Otherwise, rights to flowing water should be expressed in cubic feet per second, and rights to store water in acre-feet.

**Inquiry 5. Description of works.**—Under "General description of system" should be given such information as will make clear the general character of the water supply and the works for diverting, conveying, storing, or lifting it, and distributing it to farms. In this description any important items of equipment not called for on the schedule should be noted.

Definitions of main and lateral ditches are given in the note at the head of this inquiry.

If drainage works have been built either by the organization controlling the irrigation enterprise or by a separate organization, secure a drainage schedule covering the drainage works.

**Laterals.**—Laterals should be reported here whether they form a part of the main enterprise or not, but the description should show the extent to which they are built and controlled by the agency controlling the main enterprise.

**Pipe lines.**—If pipe lines of more than one size are used, the length of pipe of each size should be given, by writing between the lines on the schedule, or on an extra sheet.

**Reservoirs.**—If capacity of reservoir is not known, it should be estimated by multiplying the area of the water surface when reservoir is full, expressed in acres, by the average depth above the level of the bottom of the outlet, expressed in feet.

**Wells.**—If capacities of either flowing or pumped wells are not known, agents should get the best estimates possible. In the case of pumped wells, where capacities are not known, and have not been determined beyond the capacities of the pumps used, the capacities of the pumps should be given as the capacities of the wells.

**Total capacity to be reported.**—In every case give the total capacity of all reservoirs, wells, or pumps belonging to the enterprise being reported—not the capacity of individual reservoirs, wells, etc.

**Kind of power.**—Under "Kind of power" state whether pumps are run by wind, water, steam, electricity, or internal-combustion engines. If electric power is obtained from a power company, report electricity, regardless of how the power is developed.

**Windmills.**—If windmills are used, under capacity give diameters of wheels rather than horsepower.

**Kind of pumps.**—Under "Kind of pumps" state whether pumps are centrifugal, rotary, plunger, or other kind. If some unusual type of pump or other water-lifting device is used, describe it briefly under "General description," or on a separate sheet to be attached to the schedule.

**Average lift.**—Under "Average lift" give the average vertical distance between the level of the water in the source of supply when the pumps are running and the point to which the water is lifted. Do not consider friction and velocity heads or horizontal distances.

**Inquiry 6. Lands.**—Particular attention should be paid to the note at the head of this inquiry. If the enterprise controls a canal or reservoir which supplies water to lands covered by other enterprises, this fact should be stated, and the names of the enterprises to which water is supplied should be given, but no acreage which is reported by another enterprise should be included. See instructions under Inquiry 1 for treatment of enterprises under which laterals are controlled by separate organizations.

**Acreage in project.**—Under "Total acreage in project" only the acreage to which it is definitely planned to supply water should be reported. Possible extensions not yet definitely planned should not be included.

**Area irrigated in 1919.**—The "Area actually irrigated during 1919" should be limited to land to which water was actually applied during that season. It should not include land which is under ditch and sometimes irrigated, but which was not watered in 1919, nor land not yet cropped and irrigated on farms that are in process of reclamation. If water is supplied to canals rather than directly to land, the names of the canals to which water is supplied should be given.

**Land watered from two or more enterprises.**—If the same land received water from more than one enterprise, the acreage should be divided among the enterprises approximately in proportion to the quantity of water received from each, except that in case land receives its main supply from a canal and gets additional water from a reservoir controlled by another enterprise the entire acreage should be reported under the enterprise controlling the canal, with a statement that the land receives stored water from the enterprise controlling the reservoir. The total must not in any case exceed the total acreage actually irrigated. Agents need not spend much time in trying to determine exactly the relative amounts of water received from different sources for the purpose of distributing the acreage, but should estimate it roughly from statements of officials of enterprises.

**Area which works are capable of irrigating in 1920.**—This item should include all land to which the enterprise is ready and able to supply water, whether land is settled or not.

**Lands available for settlement covered by this enterprise.**—This item should be limited to land for which water is available or is to be made available, and which is not yet settled. Land already settled should not be included even if it is for sale, unless the holdings are to be subdivided, when only the parts of such holdings that are to be sold for new farms should be reported as available for settlement. If the management of an enterprise is itself farming land pending its settlement, the land should be reported as available for settlement.

**Price of unimproved lands suitable for agriculture covered by this enterprise.**—This item relates strictly to land covered by the enterprise being reported, and not to other land in the vicinity. If no unimproved land is included in the enterprise this inquiry should not be answered. If land and water rights are sold together for a specified price and it is not possible to segregate the part representing land from that representing water rights, this fact should be stated and the part representing land should be estimated. If land is not for sale at a uniform price, the average price prevailing at the time of the canvass should be given.

**Average cost of preparing land for irrigation.**—Under this heading should be given the best estimate obtainable from the officials of the enterprise being reported or from farmers operating under the enterprise. Frequently this amount will vary so much from farm to farm that a strictly accurate reply to this inquiry can not be obtained; yet for any enterprise it should be possible to make a fairly representative estimate.

**Inquiry 7. Capital invested.**—For the purpose of this inquiry, "capital invested" is defined as "cost," and the original cost plus the cost of extensions and improvements should be reported, if this can be obtained. If irrigation works have been purchased by the present owners the original cost, rather than the purchase price, should be determined or estimated; but if this can not be done the purchase price plus the cost of improvements and extensions since the works came into the present ownership should be given, with a note stating that this is what the figures represent.

If drainage works have been built, report the cost of these works separately on a drainage schedule.

**Irrigation works and equipment.**—Under "Irrigation works and equipment" should be reported the cost of dams, canals, structures, pipe lines, etc., including extensions and permanent improvements; the cost of land and buildings used for maintenance and operation, such as gatekeepers' houses, roadways, etc.; the cost of machinery, tools, and work animals used principally for maintenance and operation; and all legal and administrative expenditures connected with original construction (or acquisition) or with improvements and extensions. Engineering equipment and live stock used principally for other purposes and only incidentally for canal maintenance and operations should not be included.

If laterals were not built and are not controlled as a part of the main enterprise, this fact should be stated and their cost should be obtained from the parties controlling them and reported separately.

**Water rights.**—Under "Water rights" include filing and legal fees connected with the acquisition of such rights, and if rights have been purchased give the purchase price. If canals or lands have been purchased for the purpose of acquiring the rights belonging to their former holders, that part of the purchase price properly chargeable to the water rights should be estimated and included in capital invested in water rights.

**Cost to include value of property given in exchange.**—If other property of any kind has been exchanged for either irrigation works or water rights, the fair market value of this property at the time

of the exchange should be included in computing cost. If old canals or their rights have been taken over in exchange for rights in a new enterprise, the value of the rights in the new enterprises given in exchange should be included in the cost.

**Cost to include value of owner's labor.**—If there are no records of cost, or if the owners have done all or part of the construction, the best estimate of cost obtainable should be reported, including the estimated value of the work done by the owner.

**Inquiry 8. Maintenance and operation.**—Under this inquiry only the cost of maintenance, operation, and ordinary cleaning and repairs should be reported. The cost of enlargements, rebuilding of structures, and other permanent improvements, although paid for from current assessments, should not be included here but under "Capital invested," in Inquiry 7.

**Inquiry 9. Cost of water to farmers.**—This inquiry relates to the prices at which water rights are sold to farmers by the enterprise reported, and to the current charges for water. For enterprises the plans for which do not include the sale of water rights, this inquiry should not be answered.

If there is no charge for water rights, as is sometimes the case, this fact should be stated on the schedule. For such enterprises the rates charged for supplying water should be reported under the inquiries relating to annual charges.

**Irrigation districts.**—For irrigation districts the average amount of the district bonds issued per acre should be given as the cost of water rights. If this bond issue is not spread equally on all lands in the district this fact should be explained. For annual charges in districts, the amount of the tax levy for operation, maintenance, and general expenses should be given, but levies for the payment of bonds or interest should not be included.

**Cooperative companies.**—For cooperative companies, most of which are stock companies, the price of stock should be given, if any is for sale, and if none is for sale the prevailing estimate of current value should be given, with the average per acre served. Under enterprises of this type current charges usually are in the form of assessments on stock. In such cases the total of all assessments per share should be given, with an estimate of the average amount per acre.

**Carey Act enterprises.**—Under Carey Act enterprises the prices at which rights were sold or are now for sale by the construction companies should be given. If a Carey Act enterprise has been turned over to the water users organized as a stock company, the prevailing present price of stock and the average per acre should be given.

**Reclamation Service enterprises.**—For United States Reclamation Service enterprises the cost per acre fixed by the Secretary of the Interior should be given, and if the price has not been fixed this fact should be stated. If a project has been turned over to the water users organized as a stock company, the prevailing estimate of present value of stock and average per acre should be given. If organized as a district, the average amount of the bond issue per acre in the project should be reported. If the current charge for water is a mixed flat rate and quantity rate, the facts should be stated and the average amount per acre estimated.

**Where no specific annual charge is made.**—If an enterprise supplies water at rates which can not be considered an annual charge, the rates charged, with an estimate of the average annual charge per acre irrigated, should be given.

**Inquiry 10. Quantity of water used in 1919.**—The two "Yes or No" questions under this inquiry should be answered for every enterprise, and the length of the irrigation season should be given. The questions relating to the actual quantities of water are put in two forms, only one of which need be answered. That is, if average volume is given, it is not necessary also to give total quantity, either for water received by canal or for water delivered to individual irrigators. These alternative forms have been given in order that the officials of enterprises and special agents may not be called on to make computations in the field. If records are kept in some unit other than those given on the schedule, report the quantities as found, with explanatory notes. All necessary conversions to a common unit will be made after the schedules reach Washington.

**Inquiry 11. Drainage of irrigated land.**—Particular attention is called to the note under this inquiry on the schedule, stating that the inquiry relates only to land that has been irrigated, is now irrigated, or is to be irrigated by the enterprise being reported. The "Additional area in need of drainage" and the distribution of this area under the subordinate inquiries will necessarily be estimated. The special agent should make the best estimates possible, based on information furnished him by the officials of the enterprise and by others in the community, and on his own observation. He should not attempt to make surveys or extended observations. (See instructions regarding the drainage schedule on the following pages.)

If the drainage work is being done by the organization controlling the irrigation enterprise or by a separate organization, a drainage schedule must be prepared. A drainage schedule must also be prepared for drainage work being done by an individual when the area drained is 500 acres or over.

#### THE CENSUS OF DRAINAGE.

**Scope of the drainage census.**—The purpose of the census of drainage is to obtain statistics relating to enterprises or undertakings having for their object the drainage of land for agricultural uses.

**Definition of drainage.**—Drainage of agricultural lands, as defined for census purposes, is the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground for the purpose of improving the condition of the soil and crops. In this connection the area drained does not include land from which water flows without artificial aid into natural water courses; nor does it include land protected from overflow by levees, dikes, or embankments, nor areas guarded by trenches from the run-off from higher lands, unless some form of drainage works has been constructed on the protected land.

The name of an organization, or even the title of the law under which it was established, is not a reliable guide as to whether it is a drainage enterprise as defined for the purpose of this census; only the character of the works will determine whether a drainage schedule should be made out.

**Drainage enterprise.**—A drainage enterprise is that area (1) organized in one drainage district, or (2) assessed for the same public drain, or (3) under corporate or private ownership, drained by works operated or constructed as one undertaking. The term "enterprise" is also used, incidentally, to refer to the organization which has undertaken the drainage work.

**Special schedule for drainage enterprises.**—A special drainage schedule is to be obtained for each organized drainage enterprise and for each private enterprise draining 500 acres or more.

**Drainage primarily for nonagricultural purposes.**—For such an undertaking as one draining marsh lands for mosquito control, a schedule will be made out if the undertaking has drained lands used or usable for agricultural purposes, or lands that will be so usable when the drainage works have been completed in accordance with the plans already adopted and which the enterprise has authority to finance and carry out.

A drainage enterprise may include town or city property, but a city sewer system is not an enterprise to be reported.

**Land relieved from excess moisture by diversion drains.**—A drainage enterprise may comprise an area relieved by an intercepting or diversion drain that collects the water at the border of the area and carries it around instead of across the land to be drained; but an area is not a drainage enterprise if it is merely benefited by terraces or hillside ditches upon adjoining lands.

**Levees and dikes.**—Earthen embankments, concrete walls, etc., to protect lands against overflow from stream floods or other surface waters, are not strictly drainage works, but they are to be counted as such when and only when the enterprise includes both levee and drain (or pumping plant)<sup>1</sup> construction.

**Enterprises in more than one county.**—Where one enterprise embraces land in more than one county, the part in each county will be reported upon a separate schedule. However, each schedule not only must show to what county the schedule applies, but also must bear the full name of the enterprise with the names of all counties in which any part of the enterprise is located.

**Subdistricts.**—An area wholly or only partly within an organized drainage district may be organized as a subdistrict in some states. Each such subdistrict should be considered an enterprise separate from the drainage district in which the subdistrict is situated, and should be reported upon a separate schedule, if the records of the subdistricts have been kept separately.

The schedule for each enterprise (whether main district or sub-district) should show the facts regarding that enterprise, and supplementary statements should be made, on the schedules or on accompanying sheets, to make perfectly clear the relation between two or more enterprises that overlap in any respect.

**Reconstruction or extension as separate enterprise.**—Where reconstruction or extension of the drainage works has been made as a separate undertaking, it will be treated as a separate enterprise, and reported upon a separate schedule, but with notation of the relation to earlier enterprises where there is any overlap. The proper acreage (Inquiry 2) and the proper amounts of drainage works (Inquiries 4, 5, 6, and 7) should be shown for the enterprise scheduled, and additional statement should be made to show what

<sup>1</sup> Schedules received for enterprises constructing only levees and pumping plants were eliminated before the statistics were compiled.

portions are not a duplication of earlier enterprises. For example: With the name of the enterprise (Inquiry 1) would be the note, "Partial reconstruction and extension of ——— Drainage District No.—". Inquiry 2 would state the total number of acres assessed for the enterprise being reported, also "—— acres not included in earlier enterprises." Inquiry 5 should state the total length of the open ditches, both new construction and enlargement of earlier undertakings, also "—— miles of new work."

**Two or more enterprises under the same ownership.**—The same corporate or private ownership may cover two or more drainage enterprises, for each of which a separate schedule should be made out. All lands drained by the same outlet constructed or improved by the owner (or owners) of these lands should be reported as one enterprise. All lands in one continuous body under one ownership should be reported as one enterprise, unless different parts were constructed separately and are operated independently, in which case each part should be reported as an enterprise. Separate tracts of less than 500 acres each, with drainage works under private ownership, should not be reported upon, unless drainage facilities serving a total of 500 acres or more were constructed or are now operated as a unit.

**Enterprises that have not begun construction.**—For enterprises that have been organized but have not begun construction, a schedule should be made out if the enterprise is a going concern, answering those questions that apply to the case in hand.

**Method of making canvass.**—In the arid and semiarid regions the work in connection with the drainage census will be handled in conjunction with the irrigation census by special agents assigned to the supervisors' districts. The general plan of this work has already been outlined.

Each special agent doing field work in connection with the census of drainage outside these regions will be assigned a definite territory, in which he will be held responsible for securing complete information regarding all drainage enterprises. Within this territory the special agent will arrange his itinerary so as to secure the reports as economically as possible.

**Lists of drainage enterprises.**—Each of the special agents stationed in supervisors' districts in the arid and semiarid regions will be supplied with lists of the drainage enterprises in his district. These lists should be corrected and completed by comparison with the entries under Inquiry 33 on the general farm schedule, in the same way that the irrigation lists are completed by comparison with the entries under Inquiry 56.

Lists of drainage enterprises will also be supplied special agents in other districts and these agents should use every available means to make their lists complete and to correct any errors. New names and corrections are to be reported to the Washington office each day, on the daily report cards or on a memorandum attached thereto. If two or more districts or drains have been combined into one enterprise, this should be reported, with the names of the separate enterprises and of the present organization.

The names of all additional enterprises should be entered on the typewritten list in their proper alphabetical location and should be provided with numbers by adding letters *a, b, c, etc.*, as needed, to the last preceding number. Thus, if a new name is inserted between No. 27 and No. 28, it should be numbered 27*a*. Records of schedules received and forwarded should be kept.

**Drainage schedules to be obtained by enumerators.**—While most of the drainage schedules are to be obtained directly by the special agents, the enumerators will be asked in some instances to obtain schedules for isolated drainage enterprises.

**Irrigation schedules to be secured in connection with drainage census.**—In certain areas special agents assigned primarily to work on the drainage census will be expected also to secure schedules for such irrigation enterprises as may be found in their respective territories.

#### THE DRAINAGE SCHEDULE.

**Drainage work authorized but not yet constructed.**—The inquiries regarding drainage works (Inquiries 4, 5, 6, and 7) relate to works constructed or for which plans have been adopted; works that probably will be constructed, even for which plans and estimates have been made, should not be included unless their construction has been formally approved by the officers of the enterprise authorized to raise funds for the undertaking, on or before January 1, 1920.

Unavoidable duplication between schedules to be indicated.—In making out the schedules it is essential not only to secure correct information regarding each enterprise but also that the sum of the figures reported shall represent the true total for all enterprises combined. Duplication between schedules must be avoided, therefore, wherever possible; but when two or more districts overlap and the areas, or the works, or the costs can not be separated, the schedule for each enterprise should show the names of the overlapping districts and the amount of duplication under the different inquiries in each case.

**Inquiry 1. Management and location.**—The name of the enterprise is for identification, and should be given exactly as it appears on the county or other public records, if the enterprise is a legally organized drain or district, or a corporation; if it is under private ownership, the correct name of the individual, firm, or company should be stated.

**Name of official or other person in control of enterprise.**—Under the section calling for "Name of individual, company, or board controlling enterprise" should be entered: (1) For an enterprise owned by an individual or by a private firm or company, the name of such individual or firm; (2) for an organized drainage district or any other drainage enterprise under direct public or quasi-public supervision, both name and official title of the officer immediately in charge; or, (3) for a cooperative association organized under a general law, both the name of the association and the name of the secretary or the chairman of the executive committee. One purpose of this item is to secure the name and address of the official or other person responsible for directing the affairs of the enterprise, from whom authoritative information regarding the enterprise may later be obtained.

**Location.**—The locations of enterprises comprising not more than a few square miles should be indicated more definitely than by merely the township name or number. The sections of the townships should be given, or the general location within the township should otherwise be made clear.

**Outlet.**—The stream used as outlet is the watercourse or lake into which the water flows from the lower end of the drainage construction or improvement made by the enterprise. If the lake or stream used as outlet is not shown on ordinary maps, the name of the stream into which the water flows next should be stated also.

**Map of enterprise.**—A map of the enterprise should be secured if available, showing the boundaries of the drainage district or other area comprising the enterprise, and the location and extent of the works undertaken, in order that the enterprise may be definitely located upon a map of the county. Care should be taken to see that the name of the enterprise, and the names of the state and the counties in which it is located, are plainly written upon every map, and that each map is securely attached to the proper schedule. A special authorization must be secured for the purchase of any map.

**Inquiry 2. Character of enterprise.**—Reference should be made, in the first section under this inquiry, to the law under which the enterprise was first organized, and if it has since been reorganized under another law this statute also should be indicated. Some states have more than one general drainage law, and some drainage districts have been created by special acts of the legislature. Drainage enterprises are sometimes operated by commercial concerns, such as land-development companies, organized under general incorporation laws; for such, the states where incorporated must be shown. Where the enterprise is not organized or incorporated under any law, this fact should be stated.

**Conditions necessitating artificial drainage.**—Among the conditions that may have made it necessary or desirable to construct artificial drains are: A very flat topography from which the rainfall flows into the natural drains very slowly; small, crooked, and obstructed natural watercourses; surface water from hill lands flowing upon flat areas; overflow from stream floods; tidal overflow and, in irrigated sections, rise of the ground-water table and lateral seepage at the foot of a bench.

**Duplication in acreage to be clearly indicated.**—If the acreages stated here include any lands that are included in other drainage enterprises (as might be for land assessed both in an organized drainage district and in a subdistrict), the amounts of such lands and the names of the other enterprises must be clearly stated.

**Year of organization.**—The year in which an enterprise was organized will be that of the decree establishing the district, in the case of one established by petition to the court or to some designated public official. It will be the date of incorporation for an incorporated company. This question refers to the year when the enterprise was first organized, not to the later date on which the form of organization may have been changed to conform to a new or more convenient statute.

In some instances the date of organization of a company or district does not represent the date of beginning the drainage undertaking. For example, in an irrigation district organized in 1887, need of drainage may not have become apparent until 1909; then the district made plans and installed a system of drains. Under such circumstances both the date of organization of the enterprise and the date of beginning drainage should be stated in answer to the last question under Inquiry 2, thus: "Year in which organized 1887; drainage begun 1909."

**Inquiry 3. Financing and assessments.**—The information which is wanted regarding the method of financing is that which will show how funds were raised with which to pay contractors' bills and other expenses when due. Answers should distinguish between district bonds issued by the drainage district and county bonds



issued by the county. Sometimes farm owners have paid their total assessments as soon as the amounts have been determined, the bond issues being reduced accordingly; under such circumstances, the percentage of the cost raised by immediate cash payments and the percentage raised by bond issue should be stated. The contractor constructing the drains sometimes has had to finance the work, and wait for his pay until the assessments have been collected, or he has had to accept warrants that he might sell to get the money with which to pay his debts.

**Method of apportioning cost.**—While the law usually specifies the basis on which the cost of construction shall be distributed over the lands or property in the district, such is not always the case, and the method actually used should be stated for each enterprise.

Often the assessments of the cost against railroads, county roads, irrigation works, etc., have been made on a basis different from those against the farm lands. The statement here should show, as definitely as possible, just how the amounts assessed against such public utilities were determined.

If a considerable part of the area is assessed on some other basis than benefits to agriculture, the part so assessed and the basis of assessment should be stated. If any considerable part of the cost is paid from some other funds than those raised by assessment against the lands benefited, the amount of that part and the source of those funds should be stated.

**Inquiry 4. Type of drainage.**—The drainage is part by gravity and part by pumping if pumps are used at all, but not for all of the drainage from all of the area. Any device for lifting the water is to be classed as a pump, in this inquiry.

**Power.**—Where a drainage enterprise purchases electricity from a company selling power, electric power should be reported.

**Pumps.**—Note that the kind of pump called for is the type, as centrifugal, rotary, or reciprocating, not the maker's name.

**Average lift.**—The average lift of the pumps is the actual average height from the water level in the sump or fore-bay to the point where the water is discharged from the pump, *not* including friction head or horizontal distance; if the end of the discharge pipe is below water level in the outlet stream or discharge bay, the lift is the average difference between the water level in the sump and that in the outlet stream.

**Area served.**—The area served is the maximum area from which water flows to the pumps.

**Inquiry 5. Open ditches.**—This inquiry refers only to those ditches constructed by or for the enterprise, not including private drains. The dimensions to be given are those of the ditches as constructed, or as last opened if they have been enlarged artificially.

**Outlet ditch.**—The outlet ditch, in this inquiry, is the main drain installed by the enterprise, and may be either an entirely new ditch or a natural watercourse that the enterprise has enlarged or cleared of obstructions; it is not the "stream used as outlet" mentioned in Inquiry 1.

**Branch ditches.**—The branch ditches referred to are those which carry the discharge from the individual farm systems to the outlet ditch defined in the preceding paragraph; they do not include the drains installed by individual farm owners, but only those paid for by the enterprise.

If all the farm drains discharge directly into the outlet ditch, the fact that there are no branch ditches should be stated.

**Inquiry 6. Tile drains.**—This inquiry, like Inquiry 5, relates only to those drains that are a part of the district system and does not include the private drains. The sizes to be stated are the inside dimensions, not the lengths of the pieces; if the shape is not circular, state the shape and give the principal dimensions.

**Inquiry 7. Levees and dikes.**—This inquiry relates only to the embankments constructed by this enterprise to protect its lands from overflow by stream floods or surface water from other lands. Works built by some other agency (e. g., by the Mississippi River Commission) should not be reported, even though lands in this drainage enterprise may have contributed toward the cost.

**Inquiry 8. Maintenance.**—Under this heading should be shown what provision is made for regular inspection and repair of the drainage works; whether the maintenance work (clean out, repair, etc.) is let by contract or is done by labor employed directly by the enterprise, either regularly or temporarily; whether funds for this work are raised by regular or by special assessments, or by what other method; and what amount and what kinds of machinery, tools, work animals, etc., are owned by the enterprise and used principally for maintenance work. Equipment used principally for other work and only incidentally for maintenance of the drainage works should not be reported.

**Inquiry 9. Capital invested.**—For the purpose of this inquiry, the capital invested is cost, including all expenditures properly chargeable to this work and paid by the enterprise. If some or all of the works were constructed by an earlier enterprise and purchased by the present district or company, the original cost should be stated, not the price for which the works were purchased by the present owners. If exact figures are not obtainable, the best possible estimate should be secured.

The cost of the enterprise includes expenses for surveys and plans; attorneys' fees and court costs; land, buildings, machinery, and tools for building, maintaining, and operating the drainage works; labor and other items for constructing and installing these works, including supervision and administration. The cost figure wanted is for the drainage undertaking only, and in reporting upon such enterprises as land-development companies, expenditures not properly pertaining to the drainage should be eliminated. Cost of the rights of way should be given at the actual cost, and not at the price of improved land in the district.

Note that the first part of this inquiry relates to the work actually done previous to January 1, 1920, and that the second part asks for the *additional* expenditure required to carry out the drainage work for which plans have been adopted.

**Inquiry 10. Crops.**—The principal crops grown on the drained land should be listed in the order of their importance as determined by the acreage.

**Inquiry 11. Results secured.**—The percentage of the area in the drainage enterprise which still suffers from defective drainage should indicate the injury suffered in years of normal rains and floods. The carefully considered opinion of some one conversant with the conditions is all that is desired. The cause of inadequate drainage need not be considered here, nor whether it is inside or outside the area embraced in the enterprise.

Where the drainage works were under construction or newly completed in 1919, a statement of conditions in that year should be given, supplemented with a brief statement to indicate whether rains or floods were normal in that season or were greater or less than usual.

The two statements regarding the general condition of the lands before drainage and on January 1, 1920, should furnish a direct comparison to show the effect of the drainage construction, and show the progress of development of the reclaimed lands. The statements should be as complete as possible, yet definite and concise.

**Inquiry 12. Flood protection by outside agencies.**—This inquiry relates to works which furnish protection to this drainage enterprise but which were constructed by some outside agency or organization.

## INSTRUCTIONS TO ENUMERATORS.

[NOTE.—The following instructions were printed in a pamphlet containing instructions pertaining to inquiries on the general farm schedule.]

### IRRIGATION.

**Inquiry 55. Acreage irrigated.**—Report the number of acres in the farm enumerated which were irrigated in 1919. The following definition of irrigated land has been adopted for census purposes: "Land should be classed as irrigated which has water supplied to it for agricultural purposes by artificial means or by seepage from canals, reservoirs, or other irrigated lands; but land which has natural ground water sufficiently near the surface to grow crops should not be classed as irrigated unless water is actually applied. Land which is flooded during high water should be classed as irrigated, if water is caused to flow over the land by dams, canals, or otherwise, but should not be classed as irrigated, if the overflow is due to natural causes alone."

In this connection, you should observe the note at the head of the section on "Crops grown on this farm in 1919," which requires that a cross (X) be placed before the *name of each crop irrigated.*

**Inquiry 56. Irrigation enterprises.**—If the water used was supplied by a company, a corporation, or any other organization, you should enter the name of such organization or enterprise on the blank line. If water was supplied by a canal or other works belonging to the owner of the farm, the word "*Private*" should be written on this line.

The note under this inquiry calling for the securing of an irrigation schedule in certain cases applies only in the arid and semi-arid regions of the West, and enumerators in other sections should ignore this note unless instructed otherwise by the supervisor.

**Inquiry 57. Payments for water.**—The total amount of payments for water for the season of 1919 should be given in answering this inquiry. This amount should not include any part of the purchase price for equipment or water rights. If the payment for the use of the land included the cost of water to the farm operator, the cost of the water alone should be estimated and reported. For individual enterprises there should be reported the cost of pumping, maintenance, cleaning main ditches, and all other items which could reasonably be charged as a part of the cost of bringing water to the land.

## IRRIGATION AND DRAINAGE.

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### DRAINAGE.

**Inquiry 30. Area drained.**—Report the acreage which is actually benefited or made of more value for agricultural purposes by artificial drainage. This will often be less than the total area from which water flows to the drains. Do not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

**Inquiry 31. Area needing drainage.**—Under inquiry 31 report the area of land in the farm not now suitable for crops which could be made available for cultivation by drainage. Report under section 1, "By drainage only," the acreage which needs no clearing or which is merely covered with grass, weeds, or other annual growth, and under section 2, as needing both "drainage and clearing," the acreage which is covered with trees, stumps, or perennial woody shrubs.

The purpose of inquiries 32 and 33 is to establish a complete list of drainage and flood-protection enterprises, such as drainage districts, levee districts, county drains, irrigation districts doing drainage work, and development companies, and to determine the number of farms in each drainage enterprise.

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### IRRIGATION AND DRAINAGE SECTIONS FROM GENERAL FARM SCHEDULE.

#### IRRIGATION, JANUARY 1, 1920.

55. If any part of this farm is irrigated, give total number of acres irrigated in 1919..... (Acres.)
56. Name of irrigation enterprise supplying water:.....  
(If enterprise supplies less than 5 farms, secure irrigation schedule.)
57. Amount expended in 1919 for irrigation water, exclusive of payment for equipment or rights..... \$
58. Were any crops grown on this farm in 1919 without irrigation?..... (Answer Yes or No.)

#### DRAINAGE, JANUARY 1, 1920.

30. Area of land in this farm which is provided with artificial drainage (tile, ditches, etc.)..... (Acres.)
31. Additional area of land in this farm which could be made suitable for crops:
1. By drainage only..... (Acres.)
2. By drainage and clearing..... (Acres.)
32. Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, county, or by a private company or individual?..... (Answer Yes or No.)
33. If answer is "Yes," give name of company, district, etc.:.....

<p style="text-align: center;">9-124</p> <p style="text-align: center;"><b>UNITED STATES CENSUS OF IRRIGATION</b></p> <p style="text-align: right;">(A4-577)</p> <hr/> <p style="text-align: center;"><b>EXTRACT FROM FOURTEENTH CENSUS ACT.</b></p> <p>Section 8 of the act to provide for the Fourteenth Census includes the following provision:</p> <p>"Inquiries shall be made as to the quantity of land reclaimed by irrigation and drainage and the crops produced; also as to the location and character of irrigation and drainage enterprises, and the capital invested in such enterprises."</p> <p style="text-align: center;">SAM. L. ROGERS, <i>Director of the Census.</i></p>	<p style="text-align: center;"><b>DEPARTMENT OF COMMERCE</b> <b>BUREAU OF THE CENSUS</b> SAM. L. ROGERS, DIRECTOR</p> <hr/> <p style="text-align: center;"><b>FOURTEENTH CENSUS OF THE UNITED STATES</b> <b>IRRIGATION</b></p> <hr/> <p style="text-align: center;">WILLIAM L. AUSTIN CHIEF STATISTICIAN FOR AGRICULTURE</p>	<p style="text-align: center;"><b>ENUMERATOR'S RECORD.</b></p> <p>State _____</p> <p>County _____</p> <p>Supervisor's District No. _____</p> <p>Enumerator's District No. _____</p> <p>Enumerated by me this _____ day of _____, 1920.</p> <p style="text-align: right;">_____ <i>Enumerator.</i></p>
<p style="text-align: center;"><b>EXPLANATIONS AND INSTRUCTIONS.</b></p> <p><b>Census of Irrigation.</b>—The plan to be followed in the irrigation census covered by this schedule is to secure one of these schedules for each independent irrigation enterprise, whether it supplies a single farm or many farms. <i>Enumerators</i> are to secure schedules for enterprises supplying less than five farms and should report under Inquiry 56 on the General Farm Schedule the name and address of each enterprise supplying five or more farms operating within their districts. <i>Special agents</i> are to secure schedules for enterprises supplying five or more farms.</p> <p><b>Confidential.</b>—The information reported on this schedule will under all circumstances be treated as strictly confidential.</p> <p><b>Not connected with taxation.</b>—The information reported on this schedule will not be used as a basis of taxation, nor communicated to any assessor.</p> <p><b>All questions to be answered.</b>—If exact information is not obtainable in answer to any question, give the best information obtainable, indicating that it is estimated by marking it "est." If any question can not be answered in the space allotted on the schedule in such a way as to be entirely clear, explain the facts on the margin or on a separate sheet and attach it to the schedule.</p> <p><b>Definition.</b>—An irrigation enterprise, for the purpose of the census, is a canal or canal system, pumping plant, or reservoir supplying water for irrigation, or any combination of these operated under a single management by either an individual, a partnership, a company, or other organization. If a city, through its water department or its sewage department, makes a business of supplying water for irrigation, it should be reported as an irrigation enterprise, and a schedule should be returned for it. For classification of enterprises see note under Inquiry 3.</p> <p>Land should be classed as irrigated which has water supplied to it for agricultural purposes by artificial means or by seepage from canals, reservoirs, or irrigated lands, but land which has natural ground-water sufficiently near the surface to support plant life should not be classed as irrigated. Land which is flooded during high-water periods should be classed as irrigated if water is caused to flow over the land by dams, canals, or otherwise, but should not be classed as irrigated if the overflow is due to natural causes alone.</p>		
<p><b>1. Information concerning management:</b></p> <p>Name of canal or enterprise _____</p> <p>Name of individual or company controlling enterprise _____ <small>(If supplying less than five farms, give names of farmers. If two or more ditches are used for a single farm, state this last and give names of ditches.)</small></p> <p>_____</p> <p>_____</p> <p>Post-office address { Main office _____ Local office _____</p> <p>Location of enterprise: State _____ County _____</p> <p>Section _____ Township _____ Range _____ <small>(Give location of head of canal, well, spring, or reservoir. If located on unsurveyed land, describe by direction and distance from some nearby town or place.)</small></p>	<p><b>2. Class of enterprise.</b>—The types of enterprises recognized by the census are as follows:</p> <p><b>Individual or partnership enterprises</b>, which belong to individual farmers or to groups of farmers associated without formal organization. It is not always possible to distinguish between partnership and cooperative enterprises, but as the difference is slight this is unimportant.</p> <p><b>Cooperative enterprises</b>, which are controlled by the water users combined in some organized form of cooperation under state laws. The most common form of organization is the stock company, the stock of which is owned by the water users. In Arizona and New Mexico many of the cooperative enterprises are operated under laws regulating "community" ditches.</p> <p><b>Irrigation districts</b>, which are public corporations established under state laws and empowered to issue bonds to obtain funds for the purchase or construction of irrigation works, and to levy and collect taxes for the payment of bonds and interest thereon and for the payment of the cost of operation and maintenance.</p> <p><b>Carey Act enterprises</b>, established under the Federal law of August 18, 1894, granting each of the states in the arid region 1,000,000 acres of land on condition that the state provide for its irrigation, and under amendments to that law granting additional areas to Idaho and Wyoming.</p> <p><b>Commercial enterprises</b>, incorporated or otherwise, which supply water for compensation to parties who own no interest in the works. Persons obtaining water from such enterprises are usually required to pay for the right to receive water and to pay, in addition, annual charges based in some instances on the acreage irrigated and in others on the quantity of water received.</p> <p><b>United States Indian Service enterprises</b>, established under various acts of Congress providing for the construction by that service of works for the irrigation of land in Indian reservations.</p> <p><b>United States Reclamation Service enterprises</b>, established under the Federal law of June 17, 1902, providing for the construction of irrigation works with the receipts from the sale of public lands.</p> <p><b>State enterprises.</b>—In a few instances the states themselves have carried out irrigation enterprises under special legislation.</p> <p><b>City water or sewage disposal enterprises.</b>—This class is self-explanatory.</p> <p style="text-align: center;"><i>(Indicate class of enterprise by X.)</i></p> <p>Individual or partnership _____ U. S. Indian Service _____</p> <p>Cooperative _____ U. S. Reclamation Service _____</p> <p>Irrigation district _____ State _____</p> <p>Carey Act _____ City _____</p> <p>Commercial _____</p> <p>Many enterprises were organized under one form and later changed to another form. In such cases, state the facts on the blank lines below.</p> <p>_____</p> <p>_____</p>	
<p><b>2. Source of water supply (indicate class by X):</b></p> <p><small>NOTE.—If water is obtained from more than one source, mark both.</small></p> <p>Stream _____ Spring _____</p> <p>Pumped well _____ Stored storm water _____</p> <p>Flowing well _____ City water _____</p> <p>Lake _____ Sewage _____</p> <p>Name of stream or other source _____</p> <p>Drainage basin _____ <small>(Give name of river system which drains the region where enterprise is located.)</small></p>	<p><b>4. Water rights (indicate class by X):</b></p> <p><small>NOTE.—Many rights will fall in more than one of the classes named. For instance: A right may have been acquired originally by appropriation and use; later the owner may have filed and posted a notice of his claim; still later the right may have been adjudicated by a court or board; and, finally, a certificate may have been issued by the state. Or a right may have been initiated on a permit from the state and the owner may have received later a certificate from the state. In each instance the right should be reported in the class in which it stands at the time of the enumeration.</small></p> <p>Notice filed and posted _____ Riparian right _____</p> <p>Right adjudicated by court _____ Certificate or license from state _____</p> <p>Permit from state _____ Appropriation and use _____</p> <p>_____</p> <p>_____</p> <p>Dates and amounts of rights _____</p> <p>_____</p>	



# IRRIGATION AND DRAINAGE.

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[Page 2 of the Special Schedule for Irrigation.]

<p><b>5. Description of works</b></p> <p><small>Note.—Under "general description" give the character of the water supply; the type of diverting, conveying, storing, or water-lifting works, and their relation to each other. Report also any important items of equipment not called for specifically in the list. A main ditch is any irrigating channel conveying water from the source of supply to the tract of land to be irrigated. A lateral is a branch of a main ditch conveying water from a main ditch to one or more farms. A farm ditch is a ditch conveying water from a lateral to an individual farm and distributing water on the farm.</small></p> <p>General description of system .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Date of construction: Begun ..... Finished ..... (Year.) (Year.)</p> <p>Diversion dams: Number ..... Material .....</p> <p>Storage dams: Number ..... Material .....</p> <p>Main ditches: Capacity (cubic feet per second) .....</p> <p>Number ..... Length (miles) .....</p> <p>Lateral ditches:</p> <p>Number ..... Length (not including farm ditches) (miles) .....</p> <p>Pipe lines: Size ..... Length .....</p> <p>Material .....</p> <p style="text-align: center;"><small>(As wood-stave, concrete, metal, etc.)</small></p> <p>Reservoirs: Number ..... Capacity (acre-feet) .....</p> <p>Flowing wells: Number ..... Capacity (gallons per minute) .....</p> <p>Pumped wells: Number ..... Capacity (gallons per minute) .....</p> <p>Pumping plants: Kind of power .....</p> <p style="text-align: center;"><small>(Wind, water, steam, electric, etc.)</small></p> <p>Capacity (horsepower) .....</p> <p>Kind of pumps .....</p> <p style="text-align: center;"><small>(Centrifugal, rotary, reciprocating, etc.)</small></p> <p>Number of pumps ..... Capacity (gallons per minute) .....</p> <p>Average lift (feet) .....</p> <p><b>6. Lands:</b></p> <p><small>Note.—If this enterprise supplies water to other enterprises, and not directly to land, so that reporting the acreage here would cause duplication, state the facts on the blank lines below; and do not report the acreage here.</small></p> <p>Number of farms supplied by this enterprise .....</p> <p>Total acreage in project (acres) .....</p> <p>Area actually irrigated during 1919 (acres) .....</p> <p><small>(Actual area irrigated, not area for which water was available nor total holdings of persons entitled to water.)</small></p> <p>Area which the works are capable of irrigating in 1920 (acres) .....</p> <p>Lands available for settlement covered by this enterprise (acres) .....</p> <p>Price of unimproved lands suitable for agriculture covered by this enterprise, exclusive of water rights (per acre) ..... \$ .....</p> <p>Terms of payment and rates of interest .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Average cost of preparing land for irrigation (per acre) ..... \$ .....</p> <p><small>(Include clearing and grading land and building farm ditches and farm irrigation structures.)</small></p>	<p><b>7. Capital invested:</b></p> <p>Irrigation works and equipment ..... \$ .....</p> <p><small>(Include irrigation works, and also equipment, buildings, and land used for maintenance and operation, but not water rights. If works are not completed, give investment to December 31, 1919.)</small></p> <p>If works are not completed, estimate additional investment required for completion ..... \$ .....</p> <p>Water rights ..... \$ .....</p> <p><b>8. Maintenance and operation:</b></p> <p>Cost of maintenance and operation in 1919 ..... \$ .....</p> <p><small>(If work was done by owner, estimate cost of labor and material.)</small></p> <p><b>9. Cost of water to farmers:</b></p> <p>What is the basis of the charge for water rights? .....</p> <p><small>(Area to be served, quantity of water to be delivered, or proportional cost of enterprise.)</small></p> <p>.....</p> <p>Price of water rights: Unit ..... \$ .....</p> <p>If price is based on something other than area, give approximate price per acre irrigated ..... \$ .....</p> <p>What is the basis of annual charges? .....</p> <p><small>(By area, by share of stock, or by quantity of water.)</small></p> <p>.....</p> <p>If charges are fixed by public authority, give name of body: .....</p> <p><small>(County commissioners, court, railway commission, etc.)</small></p> <p>Is annual charge fixed or variable? (state which) .....</p> <p>Amount of annual charge per acre, share, or other unit, in 1919. \$ .....</p> <p>If charge is based on something other than area, give approximate average charge per acre served ..... \$ .....</p> <p><b>10. Quantity of water used in 1919:</b></p> <p>Was the water measured as it was received by the canal? .....</p> <p style="text-align: right;"><small>(Answer Yes or No.)</small></p> <p>Average volume of water entering canal during season of 1919 (cubic feet per second) .....</p> <p>Total quantity of water entering canal during season of 1919 (acre-feet) .....</p> <p>Length of season during which water was run for irrigation in 1919:</p> <p>From ..... 1919, to ..... 1919.</p> <p>Is water measured as it is delivered to each irrigator? .....</p> <p style="text-align: right;"><small>(Answer Yes or No.)</small></p> <p>Average head of water delivered to individual irrigators in 1919 (cubic feet per second) .....</p> <p>Total quantity of water delivered to irrigators during season of 1919 (acre-feet) .....</p> <p><b>11. Drainage:</b></p> <p><small>Note.—This inquiry relates only to lands that have been irrigated, are now irrigated, or are to be irrigated by this enterprise.</small></p> <p>Area for which drains have been installed (acres) .....</p> <p>Additional area in need of drainage (acres) .....</p> <p>Wholly unproductive (acres) .....</p> <p>Available for pasture only (acres) .....</p> <p>Producing partial crop (acres) .....</p> <p style="text-align: center;"><b>CERTIFICATE.</b></p> <p style="text-align: center;">This is to certify that the information contained in this schedule is complete and correct to the best of my knowledge and belief.</p> <p style="text-align: center;">.....</p> <p style="text-align: center;"><small>(Signature of person furnishing information.)</small></p> <p style="text-align: center;">.....</p> <p style="text-align: center;"><small>(Title and address.)</small></p> <p style="text-align: center;">.....</p> <p style="text-align: center;"><small>(Signature of Special Agent.)</small></p>
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<p>9-214</p> <p style="text-align: center;"><b>UNITED STATES CENSUS OF DRAINAGE, 1920</b></p> <p style="text-align: right;">[AG-563]</p> <p style="text-align: center;"><b>EXTRACT FROM FOURTEENTH CENSUS ACT.</b></p> <p>Section 8 of the act to provide for the Fourteenth Census includes the following provision:          "Inquiries shall be made as to the quantity of land reclaimed by irrigation and drainage and the crops produced; also as to the location and character of irrigation and drainage enterprises, and the capital invested in such enterprises."</p> <p style="text-align: center;">SAM. L. ROGERS, Director of the Census.</p>	<p><b>DEPARTMENT OF COMMERCE</b>  <b>BUREAU OF THE CENSUS</b>          SAM. L. ROGERS, DIRECTOR</p> <hr/> <p><b>FOURTEENTH CENSUS OF THE UNITED STATES</b>  <b>DRAINAGE</b></p> <hr/> <p>WILLIAM L. AUSTIN          CHIEF STATISTICIAN FOR AGRICULTURE</p>	<p style="text-align: center;"><b>ENUMERATOR'S RECORD.</b></p> <p>State .....</p> <p>County .....</p> <p>Supervisor's District No. ....</p> <p>Enumerator's District No. ....</p> <p>Enumerated by me this ..... day          of ....., 1920.</p> <p style="text-align: right;">.....  <i>Enumerator or Special Agent.</i></p>
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**EXPLANATIONS AND INSTRUCTIONS.**

**Confidential.**—The information reported on this schedule will be treated under all circumstances as strictly confidential.

**Not connected with taxation.**—The information reported on this schedule will not be used as a basis of taxation, nor communicated to any assessor.

**All questions must be answered.**—If exact information is not obtainable, get the best estimate possible and write "est." beside the answer. Use the margin of the schedule or a separate sheet when additional space is necessary to make the answers clear, definite, and complete.

**Drainage of agricultural lands** is the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground for the purpose of improving the condition of the soil and crops. In this connection the *area drained does not include* land from which water flows without artificial aid into natural water courses; nor does it include land protected from overflow by levees, dykes, or embankments, nor areas guarded by trenches from the run-off from higher lands, unless some form of drainage works has been constructed on the protected land.

**Drainage enterprise** is defined, for the purpose of this census, as comprising that area (1) organized in one drainage district, or (2) assessed for the same public drain, or (3) in corporate or in private ownership drained by works operated as one undertaking. This census relates only to the drainage of agricultural lands. A report is to be secured, on one of these schedules, for each such drainage enterprise organized under a general or a special drainage law, or as a corporation, and for each drainage enterprise under private ownership draining as much as 500 acres.

**Drainage works** of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dykes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

**Tile** as here used includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

**Ditches** include all open artificial trenches usually with sloping sides—the width is that of the bottom.

**Pumping district** is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

**Kind of pumps** is intended to bring out the facts as to the kind of machinery or other device for lifting the drainage water.

**INQUIRIES ON DRAINAGE.**

**1. Management and location:**

Name of drainage district or enterprise .....

Name of individual, company, or board controlling enterprise .....

Post-office address { Main office .....

Local office .....

Location of enterprise: State .....

County .....

Townships, ranges, or other minor political subdivisions .....

Name of lake or stream used as outlet .....

Map secured (to be obtained if possible) .....  
(Answer Yes or No.)

**2. Character of enterprises:**

Give dates of laws or references to acts under which enterprise was organized .....

State nature of enterprise (as "Land development corporation," "Drainage district," "County drain," etc.) .....

State conditions that necessitated artificial drainage .....

Number of acres in enterprise .....

Number of acres assessed .....

Year in which organized .....

