

PHYSICAL LAND CONDITIONS  
AFFECTING  
USE, CONSERVATION, AND MANAGEMENT OF LAND RESOURCES

MARION COUNTY. KANSAS

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the  
United States Department of Agriculture, Soil Conservation Service  
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## TO THE READER

It will help you to read and use this condensed report and map if you will first learn the following arrangement of land classification. It is uniformly followed in both:

1. LAND CLASSES - Colors and Roman numerals are used to show whether land is suitable for cropland or permanent vegetation, and the relative degree of care or management required for safe and permanent use. These classes are identified and described in order in the report.
2. SOIL GROUPS - The patterns in which the colors of land classes appear on the map show whether, in general, the soils are tight, sandy, stony, etc. Explanation of these general soil groups appear on the front of the map and are discussed in the report under their respective land classes.
3. LAND TYPES - These are the mapped units of land based on uniformity of soil, slope, erosion, and parent soil material. They are separated on the map by thin red lines and identified by letter and numeral symbols in red. The order of symbols, meaning of each individual part of the symbol and their relation to the land classes and general soil groups are explained in detail on the back of the map. In the report, each land type is discussed under its respective land class and soil group. Specific recommendations for use, conservation, and management are based on the characteristics of the land type.

PHYSICAL LAND CONDITIONS AFFECTING US  
CONSERVATION, AND MANAGEMENT OF LAND RESOURCES

MARION COUNTY, KANSAS 1/

The agriculture of Marion County has undergone several changes since its beginning. Among the early crops grown, corn was the most important with oats being second in the farm acreage. Wheat was a crop of minor importance prior to the introduction of hard winter wheat in the early 70's. Corn, however, ranked first in acreage in production until about 1919; and since that time wheat has held first rank. In the 1880's and 1890's, there were large acreages of fruit such as peaches and apples. By 1929 however, these large orchards had almost disappeared due to the late spring frost hazards, prevailing high winds, and the fact that most of the Marion County soils are not sufficiently permeable in the subsoil for the best development of fruit trees. Alfalfa has also been a crop that has had a rise and fall in acreage due largely to the susceptibility of alfalfa to injury by insects, noxious weeds, grasses, and plant diseases such as bacterial wilt. However, varieties of alfalfa have been more recently developed which are more tolerant to disease and insects; and the acreage is again on the upswing.

Some sections of Marion County are due for more radical changes in the near future in the type of agriculture practiced. These changes are being brought about by soil erosion. Some lands in the eastern part of the county that were once considered good cropland have now been abandoned or reseeded to grass for hay or pasture. Many other small areas scattered throughout the county are fast becoming unproductive or unprofitable as farm lands and must soon be retired from cultivation. The success or failure of a permanent type of agriculture on these areas depends primarily on how the farmers use their land. They must control erosion by water and wind and maintain the fertility of the soil if they are to be successful. To do this, some understanding of the needs and capabilities of each land type on the farm is required. The farmers must also realize the effect of topography and climate on soil fertility, erosion, and crop production.

In the eastern portion of the county where the soils are generally only moderately deep over limestone or limy shales and in an area of about two townships in the northwest portion of the county, the soils are rapidly becoming depleted of their virgin topsoil and in many cases sheet erosion has removed over 75 per cent of this fertile topsoil. Numerous gullies have begun to appear in fields over most of the county with the exception of the flatter areas in the southern portion. The farmers must take steps to remedy this situation or their soils will be lost forever for crop production. If steps are not taken soon to stop soil erosion on all sloping uplands of the county farm by farm and field by field, many of them will be unsuitable for farming. This report, together

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1/ Field Survey, March 1940, by Ralph G. Dunmire, Soil Conservation Service, with inspection by Bureau of Plant Industry, Soils, and Agricultural Engineering, Soil Survey Division. Material for maps and report prepared and edited by Robert W. Eikleberry, Soil Scientist, Soil Conservation Service, and H. E. Myers, Agronomy Department, Kansas Agricultural Experiment Station, in collaboration with other specialists.

with the maps enclosed in the back, has been prepared to help the farmer understand the problems of soil and soil management as they relate to a long-time, stabilized agriculture.

Crop yields can be maintained at either a high or low level, depending on the treatment and management of the soils. Every farmer should strive to utilize his soil so that he may attain the most profitable results and at the same time maintain its maximum production. His success depends largely upon his knowledge and skill in supplying the proper treatment, cultural methods, or management system to his particular soil or soils and at the same time plan crops to which his land is adapted so far as the economic situation in which he lives will allow. In general, the farmers of Marion County are thrifty and progressive and are usually willing to take up new methods of crop production or management practices which have proven profitable. The thrift and progressiveness of these farmers is reflected also in the large number of owner-operated farms. These farmers, if given proper technical advice, will be among the first to recognize and cope with the problems of soil conservation and soil management.

Marion County, located in the central part of Kansas, lies chiefly in one natural land resource area <sup>2/</sup> known as the Central Kansas Prairies Region. The extreme eastern portion of the county is occupied by part of the Kansas-Oklahoma Bluestem, Limestone, Flinthills Region; while the flat area around Goessel is in what is known as the Claypan Section of the Loess Outwash Tablelands. Approximately three-fourths of the county is gently undulating or slightly rolling. The extreme southwest portion of the county has smooth to almost level relief. Here in many cases drainage is more or less imperfect, as indicated by the lack of drainage shown on the soils map.

In the extreme northwestern part of the county, the surface relief is somewhat rough and broken due to dissections by a number of ravines which have worked southward into the comparatively high plains of Marion County from a lower plain north of the county boundary. This area is underlain by Dakota sandstone, giving rise to the somewhat sandy soil which erodes easily. The surface features are more varying in the limestone-flinthills pasture areas in the central and southeastern parts of the county. It is part of a belt of the country stretching across the State from north to south underlain by beds of limestone and shales. That part of the belt included in Marion County is dissected rather thoroughly by the Cottonwood River and its many tributaries. The soils in this part of the county have developed on massive limestone, interbedded gray to dark shales, and highly flinty or cherty limestone (Middle and lower Permian).

The soils in the southwest portion of the county are developed on old alluvium carried down through the McPherson filled valley and wind-blown material (loess) or a mixture of loess, outwash, and shales. Under these varying conditions of topography and with the mixture of soil-forming materials, the soils in this county have shown wide differences in their susceptibility to sheet, wind, and gully erosion and in their ability to produce crops. They range in texture

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<sup>2/</sup> Report of the Kansas State Board of Agriculture "Soil Conservation in Kansas" February, 1946; Natural Agricultural Resource Areas of Kansas map by Claude L. Fly.

from deep, sandy loams to silty clays or claypan soils and vary in depth from deep, medium textured soils to shallow, gravelly, or stony soils. It is therefore important that the farmers make a thorough study of their soils and determine their needs so that they can treat them in accordance with their needs for conservation improvement and development.

The average growing season for the county is 177 days. This has varied from 143 days in one year to 209 days in another as shown by records of the U. S. Weather Bureau. The latest date in the spring on which a killing frost has been recorded was May 20th; while the earliest date of a killing frost in the fall was September 20th. The mean annual temperature is 66 degrees; while the absolute minimum was -29 degrees, and the absolute maximum was 111 degrees. The mean annual precipitation is 29.74 inches. This has varied from a minimum of 19 inches in one year to a maximum of 43 inches in another. In the average of years for which records are available, 69 per cent of the rainfall has come during the usual growing season. Excessive rainfall during the months of April and May frequently occurs that causes serious damage to land that is not protected by vegetative cover. Fields which have been freshly plowed or have slopes greater than 3 per cent present a serious problem, as all cultivated upland soils in the county will erode under these conditions unless protected by good conservation management practices.

Damage to crops by floods along the Cottonwood River and in other low-lying areas such as along Doyle Creek in the southern portion of the county occurs almost annually. Methods of reducing these annual losses of soils and crops through the destructive forces of erosion and floods should be initiated immediately. This problem can be met both individually and collectively by all persons concerned with agriculture in Marion County. Each tract of land within the county must be devoted to a system of farming that, so far as practicable, will maintain the fertility of the soil, control erosion, conserve moisture, and lessen the damage from floods.

Marion County agriculture presents a diverse picture. The two oil and gas producing fields in the county and the Scully estate in the proximity of Tampa and Durham in the northwestern part of the county with the divergent character of the type of farming in this section together with weed and water problems present characteristics decidedly varying from one part of the county to another.

Good water in sufficient quantity for domestic and other uses is easily obtained, and supplies of water for livestock in the grazing section are obtained in many places by building small dams across the drainageways. Some of the well water is hard, but water obtained from the larger springs such as those supplying the town of Florence is of excellent quality. In the grazing areas, more attention should be given to the proper selection and construction of farm ponds for livestock use to prevent their silting or flooding and destroying the dam site.

Soil, slope, erosion, and land use conditions of major significance in determining use, conservation, and management of farm lands are shown by the survey map accompanying this report. Descriptions of these conditions are presented here together with joint recommendations by the Kansas Agricultural Experiment Station and the Soil Conservation Service. Tables of measurements made from

the map and descriptions of the land are given together with recommendations for crops and practices designed to obtain maximum sustained use of each land condition delineated on the map.

The survey map shows the character, location, and extent of the different kinds of land in Marion County in sufficient detail for overall community or county use, but a more detailed survey may be necessary on some individual farms for planning sound land use, soil conservation, and soil management.

#### SUMMARY OF FACTS FROM THE SURVEY

1. Of the land broken out of sod, approximately 13,900 acres are not suitable for cultivation and should be returned to some type of permanent vegetation. In addition to this, 19,100 acres of land now in cultivation should not be used for row crops but should be used for long-time legume-grass rotations with limited or occasional cultivation. The map shows approximately 117,300 acres of land that are suitable for cultivation which are still in native vegetation; however, much of this land lies in small, widely scattered tracts or is included in large pasture areas, and it is unlikely that much of it will be brought under cultivation except in the more level areas where more cropland is needed.

2. Of the lands which are in cultivation and are suitable for continuous cropping, 59,000 acres are nearly level and well drained and need no special practices for erosion control and fertility maintenance other than recognized good farming practices. 19,300 acres need only simple practices such as drainage on bottomlands or contour farming and conservation of crop residues together with a good rotation designed to maintain the fertility of the soil.

231,700 acres of cropland or over two-thirds of the cropland in the county needs intensive or complex practices such as grassed waterways, terraces, contour farming, conservation of residues, and other soil conservation practices to prevent their further deterioration. The remainder of the lands in the county is suited only to the production of grasses or trees with the exception of 19,100 acres described above as suitable for occasional or limited cultivation.

3. By measurements of aerial photographs of 1938 flights <sup>3/</sup> as checked with the AAA office in 1946, it was determined that the 613,760 acres of Marion County were being used as follows: broken out for cultivation - 343,145 acres; in pasture or native grassland - 232,495; woodland occupied approximately 3,559 acres—making a total of 579,199 acres of agricultural lands in the county. Non agricultural areas such as wasteland in riverbed, towns, farmsteads, roads, railroads, churches, schools, etc. occupied 34,561 acres.

4. The survey showed that 96,721 acres have slopes less than 2 per cent with no abrupt changes in relief. 9,493 acres consisted of irregular or low,

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<sup>3/</sup> Land Use map developed from aerial photographs 1938 flights by Soil Conservation Service and checked with AAA records prior to measurement.

hummocky topography chiefly in the southwest portion of the county around Goessel. 371,326 acres have moderately sloping topography ranging from 2 to 7 per cent. Low hummocky or irregular relief along creek banks was found on 26,114 acres. Steep, upland slopes of 7 to 12 per cent occupy 65,399 acres. Steep or bluff-like slopes greater than 12 per cent occupy 10,146 acres. These classifications of land surface relief do not include the 34,561 acres classified as of miscellaneous use.

5. By measurements from the survey, it was found that of the 343,145 acres of cropland in the county, 85,508 acres showed little or no damage by erosion. There were 224,590 acres that were moderately affected by sheet and gully erosion. 32,809 acres showed moderately severe to severe erosion.

6. The geologic materials on which the soils of Marion County are developing include 257,220 acres that have been developed from wind-borne, fine silts and clays (Loess) and a mixture of loess, outwash, and shale. Soils developing over limestone occur on approximately 97,300 acres. Soils developed from limy shales include approximately 61,000 acres. Soils developed from Dakota sandstone chiefly in the northwest portion of the county included 24,800 acres; while soils developed from chert or flinty limestone occurred on approximately 7,300 acres. The remaining 75,200 acres with no parent material symbol included the alluvial soils along the bottomland and stream terraces.

7. Five major groups of soils occur in Marion County. The most important groups from the standpoint of their value for the production of cultivated crops are: dark, tight clay and claypan soils - 371,533 acres; light-colored, tight clay and claypan soils - 6,572 acres; friable, silty to clayey soils - 94,500 acres; and moderately sandy soils with friable to clayey subsoils - 30,900 acres. Shallow, gravelly, or stony soils occupied 55,600 acres which are unsuitable for cultivation. Small areas of barren rock and alkali spots were included in the above groups since they could not be shown on the scale of mapping used.

#### USING THE LAND

All lands in Marion County have definite limitations of intensity with which they may be used. Six different classes of land have been recognized in this survey, and all agricultural lands within the county have been placed in one of these classes. The land classes indicate the degree or intensity of conservation practices needed to protect the land from undue soil and moisture losses whether it be in cultivation, hayland, or grassland.

The goal of every farmer in Marion County should be to follow a conservation farm plan that devotes each tract of land, so far as practicable, to its best use in order to "get the most from the land for the longest period of time with the least loss of natural land resources."

A means of achieving this goal is by: (1) adoption of such soil and water conservation and fertility maintenance practices and crop rotations as will maintain or improve production on each piece of land; and (2) the control of runoff water to reduce erosion on fields and pastures and decrease flood and silt damage along the streams by (a) providing vegetative and mechanical measures

for reducing the rate and volume of runoff water below damaging levels, (b) using practices to increase penetration of water into the soil, and (c) protecting waterways to prevent gully erosion.

### CHOOSING PRACTICES TO FIT THE LAND

#### LANDS SUITABLE FOR CONTINUOUS CULTIVATION

The climate and soils are favorable to varying degrees for the production of most major crops grown in the state. They are better adapted to small grains, legumes, and sorghums than to corn because of low rainfall and hot dry winds during the summer months. Corn is usually not a successful crop excepting on the bottomlands along the major streams of the county. County yields of all crops grown in the years 1911 to 1932 were 111 per cent of state average yields. <sup>4/</sup> Wheat, the major crop of the county, has shown no noticeable increase or decrease in the average yield for the past 30 years for which records are available, the average yield being about 14 bushels—which is very low considering the natural adaptation of the major part of the soils of the county to this crop. This average yield could be raised.

Crop yields can be maintained at either a high or a low level, depending on treatment and management of the soils. Success depends largely on the farmer's knowledge and skill in applying the proper cultural methods or system of management for his particular soil or soils. One of the important problems is to conserve and utilize to the best advantage the comparatively low amount of rainfall. The farmer who begins turning under wheat stubble immediately after the crop is harvested invariably conserves a higher percentage of moisture in the soil than do those who wait until late summer or fall to do their plowing. In this locality, considerable time is necessary to bring about the proper decay of either wheat stubble or green-manure crops before the succeeding crop is planted. A smaller percentage of noxious weeds goes to seed if plowing is done immediately after harvesting. If rains start a new crop of weeds, a light harrowing or disking will eliminate them and put the land in better condition for the succeeding crop.

As a rule, the soils are fairly absorptive and retentive of moisture. Continual cropping without legumes or grasses in the rotation gradually depletes the soil of its valuable supply of organic matter; and on the more sloping areas, erosion is accelerated, thereby still further increasing the runoff and diminishing the amount of water absorbed by the soil. Many of the soils which have been under cultivation for 40 or 50 years have been depleted of one-third or more of their original supply of organic matter. This situation is disregarded by most farmers who produce small grains, and many of them have not noticed any serious decline in yields. On the other hand, corn—which requires much more organic matter and nitrogen than wheat—has shown a marked decrease in yields.

The continuous growing of wheat year after year on the same land has depleted the soil not only of organic matter and nitrogen but also of other valuable

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<sup>4/</sup> Agricultural Resources of Kansas, Kansas State College Bulletin, Vol. XXI, No. 10, 1937.




plant nutrients. The available supply of phosphorus in the soils has been lowered considerably; and in as much as phosphorus is one of the more important plant nutrients for wheat, this constituent must be supplied in some form or other. Commercial fertilizers have not been generally used owing to the light precipitation in this locality. Should the season be dry, the results due to their use are negligible; and most farmers are inclined not to risk the extra expense involved when results are so uncertain.

Diversified farming, therefore, seems to be the most practical way of restoring a more adequate supply of plant nutrients in the soil. This type of agriculture not only requires the growing of grain sorghums, sweet clover, and other hay and forage crops but stimulates the production of more livestock and poultry and their products. This practice makes possible the turning under of some leguminous pasture crops each year in addition to the application of barnyard manure on other fields with a benefit to both fertility and tilth. Such a type of agriculture is not only more dependable in producing good yields of crops, but the productivity of the soil is maintained at a much higher level than when the land is consistently cropped to the chief cash crop, wheat. Up to the present time, no cropping system has been followed in which legumes are grown each year and some crops turned under primarily for soil-improvement purposes. Sweet clover, however, is increasing in acreage and probably will be grown more extensively in the future.

The conditions of soil, slope, and erosion vary so widely within the county that a knowledge of each land type within a farm unit and its capability for use as discussed in the following pages is prerequisite to determining the best practices for soil and water conservation, improved production, and sound land use. The order of discussion is explained on the inside cover sheet.

LANDS shown IN GREEN color (Class I) on the map ARE those best SUITED TO CULTIVATION and REQUIRE NO SPECIAL PRACTICES for erosion control and fertility maintenance. This class of land includes two major groups of soils.

The first of these, DEEP, FRIABLE, SILTY TO CLAYEY SOILS, is shown on the map by the pattern  in green and by the land type symbols 22A1 and 75A1 in red. 5/

Areas designated by the symbol 75A1 include smooth, usually well drained bottomlands adjacent to the major drainageways of the county. This land type includes approximately 42,900 acres of grayish-brown 6/ to dark, grayish-brown, friable, silt loam surface 12 to 16 inches deep which is neutral to calcareous in reaction. This is underlain by a friable, granular, grayish-brown to yellowish-brown silt loam to silty clay loam to a depth of 24 to 36 inches. The lower subsoil is a light yellowish-brown to light yellowish-gray, friable, silt loam which usually contains some organic matter and mottling.

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5/ Individual parts of the symbol shown here and of others throughout the report are explained in the legend on the back of the enclosed map.

6/ Colors used in describing land types are based on standard colors adopted for soils in the United States Department of Agriculture, Misc. Pub. 425, 1941.


This land type presents no serious problems in its continued use, conservation, and management other than recognized good farming practices and a suitable crop rotation that includes a legume each five or six years. On a few lower lying areas, crops may be occasionally damaged by flooding and simple drainage practices may be needed where the soils are heavier and drainage is slow. This may be accomplished by the use of open furrows or a system of plowing each year that puts the dead furrows in the same place. A strip one to two rods wide adjacent to streams should be left in trees or grass to control gullies and side cutting.

Rotations recommended for these areas include: (a) corn 2 years, sorghum, oats and sweet clover, sweet clover, wheat; (b) wheat and sweet clover, sorghum, corn oats, alfalfa 5 or 6 years; and (c) sorghum 2 years, oats and sweet clover, sweet clover, wheat. Small grains may lodge during years of excessive spring rainfall and some of the lower lying areas may be occasionally damaged by flooding. On these areas, row crops, grasses, and legumes should be grown where practical in the farm enterprise.

Land type 22A1 includes approximately 2,368 acres of smooth, well drained, stream terrace and second bottoms along the major stream valleys of the county. The surface soil is brown or moderate brown, silty clay loam ranging from 9 to 14 inches in thickness. The subsoil is a weak brown to moderate brown, friable, silty clay becoming lighter in color with increase of depth and lighter in texture below a depth range of 24 to 30 inches.

This land type includes some of the best cropland in the county, and practically all of it is cultivated. Although corn and wheat are the principal crops, the land is adapted to many crops. Yields of corn and alfalfa compare favorably with those obtained on land type 75A1. Since the soils are deep and permeable and the slopes are almost level, most of the rainfall can be absorbed by the soil. Crops are not damaged by flooding due to the elevated position of these lands above the flood plains. An occasional diversion terrace may be required to intercept runoff water from adjacent steep slopes. These should be built in accordance with the Engineering Handbook adapted to this area. Crop residue management by tillage methods that leave residues at or near the surface and the addition of barnyard manure are desirable on these lands from the standpoint of increasing moisture penetration, improving tilth, and maintaining organic matter.

Recommended rotations for this land type include: (a) wheat 3 years, oats and sweet clover, row crop; (b) corn, sorghum, sorghum, oats, alfalfa 5 or 6 years; and (c) corn, sorghum, oats and sweet clover, sweet clover, wheat, wheat. These crop rotations will be adjusted to the feed and grain requirements of the farm.

The second group in this class, DEEP, DARK, MODERATELY FRIABLE SOILS OVER DARK-COLORED, TIGHT CLAY OR SEMI-CLAYPAN SUBSOILS, is shown on the map by the pattern  in green and by the land type symbols 24A1(O), 24A1(Sh-L), and 24A1(Sh-Lo) in red.

These land types occupy approximately 36,205 acres chiefly in the south and southwestern portion of the county and along the smooth divides near Lost Springs in the north portion of the county. The soils are quite similar in most characteristics, their chief difference being in the parent material from which they were

derived, the granular layer in the lower part of the surface soil, and the texture of the surface soil.

Land types 24A1(Sh-L) and 24A1(Sh-Lo) have a dark, grayish-brown to nearly black silt loam to silty clay loam surface 12 to 14 inches thick. The lower part of the surface at from 8 to 14 inches is highly granular; and in virgin areas, it contains a large amount of organic matter. The subsoil is a dark grayish-brown, slightly prismatic clay or heavy, silty clay loam to a depth of 24 to 28 inches. This is underlain by a dark brown to light, olive brown, massive, silty clay loam containing numerous lime concretions at a depth of 34 to 36 inches.

Areas of 24A1(O) around Goessel in the southwest portion of the county differ from the above in having a heavier subsoil and less granulation in the lower surface soil. In some places, this land type has a sprinkling of very fine sand throughout the profile suggesting that it has been deposited by winds from a mixture of outwash materials. When dry, the subsoil of this land type becomes quite hard.

The problems of continued use, conservation, and management of these lands are relatively simple as compared with the more sloping uplands of the county. They are better adapted to small grains, legumes, and sorghums than to corn. They produce a large quantity of the wheat for which Marion County is noted. During the dryer years, some of these areas were subject to slight wind erosion where not properly managed; however, this can be easily prevented by proper land use practices. These practices include a planned system of farming with a crop rotation that includes a legume once in each five or six years, use of barnyard manure, and management of crop residues by tillage methods that leave residues at or near the surface to conserve moisture, improve fertility and tilth of these heavy soils.

Many farmers have the habit of burning small grain stubble which not only destroys plant food but leaves the soil with nothing on it to prevent the ground from drying out. Where these residues are returned to the soil, it has helped in keeping them open for moisture penetration; and the organic matter has had a binding effect to prevent wind erosion during the years of extremely low rainfall. Phosphate fertilizer will usually increase the yields of wheat and legumes and should be used when field tests show the need for it.

Crop rotations recommended for these areas include: (a) wheat 3 years, grain sorghum, oats and sweet clover, sweet clover; (b) wheat 3 years and alfalfa 5 or 6 years; and (c) oats and sweet clover, sweet clover, wheat, wheat, sorghum 2 years. Barley has been gaining favor in recent years in this county as a cash and feed crop, and where grown should be substituted in the rotation for wheat. Brome grass for seed, hay, and pasture makes excellent yields on these land types where properly supplied with nitrogen which can be added in the form of legumes, barnyard manure, or commercial fertilizers.

LANDS shown IN YELLOW color (Class II) on the map ARE SUITABLE FOR continuous CULTIVATION and REQUIRE only SIMPLE PRACTICES for erosion control and fertility maintenance. One soil group occurs in this class.

This group, DEEP, VERY DARK SOILS WITH TIGHT CLAY OR SEMI-CLAYPAN SUBSOILS, is shown on the map by the pattern  in yellow and by the land type symbols 74A1 and 24Ax1(0) in red.

Land type 74A1 includes approximately 15,200 acres chiefly along the Cottonwood River and Doyle Creek. This land type lies on generally smooth, broad areas. The soils are dark, heavy clay and silty clay loams developing along the bottomlands. The surface soil is a dark, grayish-brown to black clay to silty clay loam 12 to 14 inches thick. The subsoil is a dark brown to black, heavy clay to claypan which is slightly granular in the upper part and neutral to calcareous in reaction. It becomes lighter in color and more friable at a depth of 30 to 34 inches where in some cases lime concretions are found.

Surface and internal drainage on these areas is slow due to their flat relief and heavy claypan subsoils. Crops may be occasionally damaged by flooding due to excessively heavy rainfall on the adjoining uplands. Where a good crop rotation has not been followed and the organic matter maintained at a relatively high level, these soils tend to be very hard to work in some years.

To insure the best yields of crops from these areas, a system of small, open furrows should be established to allow excess surface water to enter the main streams along with a good crop rotation and crop residue management practices that return large amounts of vegetative material to the soil to maintain or increase the organic matter, improve tilth, and allow moisture penetration.

This land type is well adapted to the growing of small grains, sorghums, sweet clover, alfalfa, and bromegrass. Phosphate fertilizer usually will increase the yield of wheat, legumes, and grasses. Recommended rotations for this land type include: (a) wheat 3 years, sorghums, oats and sweet clover, sweet clover; (b) wheat 3 years and alfalfa 5 or 6 years; and (c) sorghum, oats and sweet clover, sweet clover, brome and alfalfa from 5 to 7 years. Barley may be grown in place of wheat where this crop is part of the farm enterprise. Alfalfa and bromegrass should be seeded to meet the feed and grass requirements of the farm; however, they have also proved to be excellent cash crops since this county is relatively close to the large pasture sections of the State and a high protein hay is usually in demand.


The second land type in this group, 24Ax1(0), is located chiefly in the extreme southwest portion of the county and occupies approximately 9,500 acres. The soils are quite similar as those described as 24A1(0) on page 9. They are characterized chiefly by their slightly rolling or hummocky topography and lighter textured surface.

These lands are sometimes affected by wind erosion. The lower areas are poorly drained in wet years. The lighter textured soils on the knolls are usually low in organic matter. In local areas where the dunes are quite sandy and contour farming is impossible, it is recommended that they be farmed in alternate, parallel strips of small grains and row crops. This will help control erosion by blowing. A rotation that includes deep rooted legumes will help open up claypan subsoils of the

low places. These crops will also add organic matter to the sandy areas and reduce blowing. Phosphate fertilizer will often increase wheat yields.

Rotations best suited to these lands are: (a) wheat 2 years, sorghum, oats and sweet clover; and (b) sorghum, oats, wheat 3 years and alfalfa 5 or 6 years.

LANDS shown IN PINK color (Class III) on the map ARE SUITABLE FOR continuous CULTIVATION, but in contrast to those shown in green and yellow, REQUIRE more INTENSIVE OR COMPLEX PRACTICES to control sheet and gully erosion and maintain the fertility and productiveness of the soil. Four major groups of soils are included in this class.

The first group in this class, DEEP TO MODERATELY DEEP, DARK TO VERY DARK, FRIABLE, SILTY TO CLAYEY SOILS, is shown on the map by the pattern  in pink and by the land type symbols 6B2(L) and 7B2(L) in red.

Land type 6B2(L) includes approximately 22,791 acres and is found chiefly in the eastern portion of the county in the limestone and limy shales section. The soils are characterized by having weak brown to dusky brown, silt loam to silty clay loam surface soils 8 to 12 inches thick. The subsoils have moderate brown to dusky brown, silty clay to clay loam to a depth of 30 to 38 inches. The underlying calcareous shale and limestone are usually encountered at depths of 40 to 60 inches. The soils are neutral to slightly acid. Where this land type occurs underneath outcropping limestone and limy shales at the base of the slopes, it is darker in color—having a brownish-black to black, granular, silty clay loam topsoil; and at a depth of 10 to 14 inches, a black, permeable, coarsely granular, silty clay loam subsoil that grades into a heavy dark yellowish-brown to moderate olive brown lower subsoil.

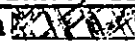
Land type 7B2(L) includes approximately 5,700 acres. The surface soil is a moderate brown, slightly acid, silt loam to silty clay loam 6 to 10 inches thick. The subsoil is a strong brown to moderate brown, neutral to slightly acid, clay loam to a depth of 24 to 32 inches. The underlying parent shales and limestone are calcareous. Unweathered limestone is usually encountered at depths of 3 to 4 feet.

These lands have suffered moderate sheet erosion with some gullies where they have been cultivated. They are usually low in phosphorus and nitrogen; and in places, they require lime for the successful establishment of the growth of legumes. The slopes range from 3 to 7 per cent. During periods of excess rainfall, a large amount of water accumulates on these slopes and runs off, carrying with it some of the friable, silty surface and in places causes gullies. Gullies have formed in the drainageways and swales on the steeper slopes. They are working back at an increasing rate into the more productive upland types. These land types have a moderately high water infiltration rate and good moisture storage capacity, if they are well supplied with organic matter and practices are used to keep the water from rushing down the slopes. Generally speaking, they are among the most severely eroded cultivated soils in the county. They have been farmed without regard to the contour of the land and direction of the flow of the water.

Practices needed by all lands in this group include contour farming with terraces, grassed waterways, an increase in the acreage devoted to legumes

and a decrease in row crops. Crop residue management by tillage methods that leave residues at or near the surface, application of barnyard manure as available, and growth of legume crops will not only help control erosion but will add organic matter, improve tilth, and maintain or improve the fertility of these lands. Waterways should be seeded to a mixture of brome and alfalfa or native grasses such as western wheat grass, slough grass, bluestems or buffalo grass prior to diverting terraces or other runoff water in them.

Recommended crop rotations designed to obtain the maximum production from these lands with the least soil and moisture losses when carried on in conjunction with the above recommended practices include: (a) wheat 2 years, sorghums, oats and sweet clover, sweet clover; (b) wheat 2 years and alfalfa 5 or 6 years; and (c) oats and sweet clover and brome grass in a long-time rotation to be used for hay, pasture, or seed. Phosphate fertilizer will usually increase the yield of wheat and legumes and should be used when field tests show the need. Old stands of brome grass probably will need nitrogen fertilization.

The second group in this class, DEEP AND MODERATELY DEEP, DARK, TIGHT CLAY AND SEMI-CLAYPAN SOILS, is shown on the map by the pattern  in pink and by the land type symbols 24B2(O), 24B2(Sh-L), 24B2(Sh-Lo), and 25B2(Sh) in red.

These land types resemble quite closely those shown by the same pattern of Class I lands on page 9 with the exception that they are found on slopes of 3 to 5 per cent, which has caused them generally to have thinner surface soils (8 to 10 inches)—the remainder having been removed by sheet erosion. These land types occupy approximately 278,200 acres of which approximately 200,000 acres are in cultivation.

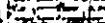
They include the most extensive areas of farm land in the county. These land types are affected by some gully erosion where proper preventive measures have not been taken. Wind erosion has been a problem during the series of dry years in the early 30's; however, this type of erosion is easily controlled in this section of the State by proper tillage methods and maintenance of crop residues. Gullies forming in this land type is not a serious problem; but the soil lost from sheet erosion is the chief problem to production. These land types are separated on the map chiefly from their origin in different parent materials.

Land type 25B2(Sh) is derived chiefly from calcareous shales with a mixture of loess in some places. These soils resemble quite closely those of 24B2(Sh) with the exception of having thinner surface soils (5 to 7 inches) and are usually found on a little more sloping topography averaging around 4 or 5 per cent. The subsoil in many cases is a reddish-brown to brown, prismatic, heavy clay to silty clay loam to a depth of 18 to 20 inches. The lower subsoil becomes more friable and lighter in color, being a weak reddish-brown to moderate brown, silty clay loam. The subsoil is sticky or plastic when wet and very hard when dry. This usually rests on partially weathered, red calcareous shales of the Permian formation at depths varying from 3 to 5 feet. The entire profile is neutral to slightly calcareous, no lime being used for the growth of legumes. They are commonly lower in phosphorus and nitrogen than the other land types in this group.

Wheat has been the principal crop grown on these land types with little emphasis being placed on the growth of legumes or the use of barnyard manure. Many farmers in the past have burned the stubble from the fields prior to preparing the ground for reseeding. As a result, their fertility has been depleted along with the organic matter supply which tends to hold these lands in place during abnormal seasons of either especially high or low rainfall.

On these land types all crops should be planted on the contour and protected by field terraces with grassed waterways to carry excess water from the fields. On fields to be terraced, natural waterways should be selected, if possible, and a good stand of grasses and legumes such as brome and alfalfa established prior to the construction of field terraces which will discharge water on them. The use of barnyard manure and crop residue management by tillage methods that leave residues at or near the surface will increase the organic matter content, fertility, and infiltration rate on these soils. The addition of phosphate fertilizer on legumes and wheat will usually increase yields and should be used where field tests show the need.

Crop rotations for these land types should include an increase in the acreage of legumes to a point where about one-fourth of the area is included each year. Corn is not well adapted and should be grown only when weather or other conditions do not permit the growing of more suitable crops. An adapted variety of grain sorghum will produce more grain for livestock feeding. Recommended rotations include: (a) wheat, wheat and sweet clover, sweet clover, sorghum 2 years, oats; (b) wheat 2 years, sorghum, oats and sweet clover, sweet clover; and (c) small grain 3 years and alfalfa 5 or 6 years. These lands are well adapted to bromegrass for hay, seed, or pasture, and where it is to be used for seed production, a legume should be grown prior to seeding to furnish needed nitrogen. If used for hay or pasture, a legume such as alfalfa should be included as part of the seeding mixture. Land type 25B2(Sh) should not be planted to row crops two years in succession and, where practical, should be used for hay or pastures as much as possible.

The third group in this class, DEEP TO MODERATELY DEEP, LIGHT-COLORED, TIGHT CLAY AND CLAYPAN SOILS, is shown on the map by the pattern  in pink and by the land type symbol 4B2(Sh) in red.


This land type includes approximately 6,700 acres chiefly in the extreme southeast portion of the county around Burns. The soils have a light gray to brownish-gray, crumb structured, usually acid, silt loam surface 6 to 10 inches thick. This is underlain by a medium gray to light grayish-brown, silt loam to silty clay loam to a depth of 12 inches. It rests abruptly on a light brownish-gray to dark yellowish-brown, dense, mottle, massive, claypan layer that extends to a depth of 24 to 30 inches. The underlying substrata consists of less dense, mottle, sandy clay that is lighter in color than the above layer. It occupies slopes of the uplands of 2 to 5 per cent.

These lands are subject to erosion on long slopes because large volumes of runoff water accumulate during periods of high rainfall. Because of difficult tillage and drainage problems, much of the area is devoted to grass for hay. Their long slopes, heavy claypan subsoils, and low content

of organic matter are conducive to even more serious sheet and gully erosion. The soils are usually wet in the early spring and dry and droughty in the summer, making them unsuitable for corn. Fair to good yields of sorghums, small grains, and grasses may be secured, however, provided proper management and practices are used to improve fertility and control erosion.

All crop residues should be returned to the soil. Barnyard manure and green manure crops will help improve organic matter, fertility, and tilth. The building up of the organic matter supply also increases penetration of moisture and helps control erosion. All cropping plans should include contour farming supported by field terraces with grassed waterways to dispose of excess runoff water and prevent gullying. Where alfalfa and sweet clover are to be used in the rotation, heavy applications of lime should be added to correct acidity. Phosphate fertilizer will increase yields of legumes and small grains and help in securing and maintaining stands of clover and alfalfa.

Corn should not be planted on this land type. Cropping plans should include an increase in small grains, legumes, and green manure crops and a decrease in the acreage devoted to row crops. A rotation of wheat, oats, sweet clover, and sorghum as best fits the needs of the farm should be adapted to areas of this land type.

The last group of lands in this class, DEEP OR MODERATELY DEEP, DARK OR VERY DARK SOILS WITH MODERATELY SANDY SURFACE SOILS AND LOAMY TO FRIABLE, CLAYEY SUBSOILS, is shown on the map by the pattern  in pink and by the land type symbols 7aB2(Ss) and 19Bx2(0) in red.

Land type 7aB2(Ss) includes approximately 19,500 acres chiefly in the west and northwest portions of the county. They are found on moderately sloping topography of 3 to 7 per cent and have been formed from the weathering of non-calcareous sandstone and outwash silts, sands, and clays. They have a brownish-gray to moderate brown, friable, fine sandy loam to loam surface 6 to 10 inches thick. This is underlain by a weak brown to strong brown, friable, sandy clay loam to silt loam subsoil which may contain fragments of partially weathered sandstone or gravel at a depth of 24 to 36 inches. No lime is encountered in the soil, and it is usually found to be slight to medium acid.

Land type 19Bx2(0) includes approximately 7,400 acres and is found chiefly in the western portion of the county along the slopes adjacent to the drainages. The surface soil consists of a brownish-gray to light brownish-gray, friable, loam and very fine sandy loam 8 to 12 inches thick and is slight to medium acid in reaction. The subsoil is a pale reddish-brown to weak reddish-brown, friable loam, fine sandy loam, or sandy clay loam to a depth of 28 to 36 inches and is slight to medium acid in reaction. When dry, the subsoil is quite hard, massive, or brittle; but it is coarse and allows moisture to penetrate quite easily. The topography on these areas varies from gently undulating or rolling to low hummocky. In places, low dunes are formed which are more sandy and friable in the subsoil than in the surrounding areas. They are, however, too small and insignificant to show in a survey of this type.

All lands in this group of moderately sandy soils have suffered from sheet and gully erosion; gullies being more pronounced in those of the 7a than in the 19 group. Areas of 19Bx2 have suffered some from wind



erosion due to the shifting of the small dunes of almost incoherent sand during some of the dryer years. These soils are usually low in nitrogen, phosphorus, and organic matter; this is because of continued cropping without regard to direction of land slope which has encouraged erosion and the failure to produce legume crops or return organic matter to the soil.

Practices recommended to control erosion and maintain the fertility of the soil on these land types are the same as those set forth for the friable, silty to clayey soils on page 13.

Recommended rotations include: (a) sorghum 1 year, oats and sweet clover, sweet clover, wheat, wheat; (b) wheat 2 years and brome and alfalfa 5 to 7 years for hay or pasture; and (c) wheat 2 years, sorghum, oats and sweet clover, sweet clover. These lands usually need lime for best results on sweet clover and alfalfa, and it should be applied when field tests show the need for it. Phosphate fertilizer will give increased yields of wheat and legumes and should be applied at seeding time. An application of barnyard manure or nitrogen fertilizer will increase the seed production on old stands of bromegrass and promote erosion control by more vigorous growth and denser ground cover.

Land type 7aB2(Ss) is not highly productive over a period of years for cash crops of small grains and sorghums and should remain in legumes and grasses for hay, pasture, or seed as much as can be adapted to the farm organization.

#### LANDS NOT SUITABLE FOR CONTINUOUS CULTIVATION

Of the lands already described as suitable for continuous cultivation, approximately 117,300 acres are in tame or native grasses. The lands discussed in the remainder of this report are generally too eroded, shallow, sandy, steep, hilly, or rough and broken for cultivation even though over 13,900 acres of such lands are being plowed. A limited amount of cultivation may be carried out on the lands shown in blue on the map (Class IV) provided rigid erosion control and soil fertility maintenance practices are used. In general, however, the lands described in the remainder of this report are suited for hay, grazing, woodland, or wildlife. Overgrazing, burning, excessive early grazing, drouth, and failure to control brush and weeds have in many cases destroyed much of the original bluestem vegetation. Shallow soils on steep slopes and eroded areas are somewhat more infested with weeds, brush, and annual grasses than the pastures which have been properly stocked and not overgrazed or burned with those that have been so abused. Where good grazing management has been practiced, the original cover of bluestem grasses is still present and erosion is kept to a minimum.

#### General Practices for Grazing Lands and Haylands

The following practices are recommended as necessary to control erosion, increase production, maintain adequate vegetative cover, and properly utilize grazing lands of Marion County: (1) when necessary to burn, do so over wet ground and just before growth starts in the spring; (2) graze to maintain a cover of desirable forage plants; (3) defer grazing three to four weeks after growth starts in the spring or until grasses have developed sufficiently to

withstand trampling and removal of top growth; (4) provide supplementary pasture of legumes or sudan grass for summer grazing where needed; (5) fence out large active gullies; (6) mow weedy pastures while in bud to bloom stage; (7) maintain a reserve feed supply; (8) use small diversion terraces or contour ridges when reseeding eroded land to grass; and (9) reseed bare spots around watering, salting, and feeding grounds.

On both grazing and haylands: (1) control gullies; (2) interseed with more desirable grasses and legumes where needed and practical to do so; (3) spot sod native grasses in barren waterways and gullies; (4) avoid excessive trampling when wet; (5) construct diversions around heads of gullies; (6) do not graze new seedings until well established (usually require one season's growth); (7) use fertilizer and barnyard manure where needed on new seedings on eroded land; (8) increase or maintain grass yields by use of legumes in seeding mixture. Mow haylands when weeds are budding to bloom for weed control and best yields; and (9) improve seeding conditions by use of sweet clover to precede grass legume mixtures.

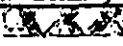
#### Woodland and Wildlife

All irregular broken bottomland soils, the steep, eroded, friable upland soils, and the sandy soils of the county are good sites for woodland plantings or the development of existing woodlands for producing fuel, posts, and—in some cases—lumber. Recommended varieties of trees for these plantings include: cottonwood, Red elm, locust, Post Oak, Osage orange, catalpa, walnut, and hackberry.

All planting sites should be selected one year in advance where possible and conservation practices such as contour cultivation, terracing, mulching, and fertilizing instituted so as to insure moisture and fertility for the young trees. Both grazing and burning are detrimental to tree growth and should be carefully avoided. Desirable practices to obtain maximum utilization and production of tree plantings include: (a) selective thinning and cutting; (b) interplanting of desirable species; (c) removal of competing underbrush and weeds; (d) control of disease and insects; (e) harvesting of mature trees; (f) thinning of stands where too crowded; and (g) control of erosion by methods outlined for each land class. Many farmsteads in the county are without the protection afforded by a good windbreak and adequate trees to furnish posts and fuel. An organized program should be initiated with any farm plans to meet this situation and steps taken to remedy it through a sound program of shelterbelt and woodlot development.


Due to physical characteristics or hazards such as erosion, steep slopes, shallow, stony, or gravelly conditions or position, the land types described in the remainder of this report are unsuitable for continuous cultivation.

LANDS shown IN BLUE color (Class IV) on the map ARE NOT SUITABLE FOR CONTINUOUS CULTIVATION BUT MAY BE SUITABLE FOR THE LIMITED PRODUCTION OF CULTIVATED CROPS. Two groups of soils occur in this class.

The first group, MODERATELY DEEP, DARK, TIGHT CLAY AND CLAYPAN SOILS, is shown on the map by this pattern  in blue and by the land type symbol 24B3(Sh) in red.

This land type occupies approximately 32,400 acres. The soils are quite similar to those described as 24B2(Sh-L) on page 12 with the exception of having thinner surface soil (4 to 8 inches deep), and they are usually found on a little more sloping topography adjacent to drainageways. These areas as a whole are severely eroded and contain large gullies which have penetrated the lower subsoil or parent materials. Crop yields are noticeably lower and erosion is severe. Their fertility is becoming fast depleted, and tillage operations are becoming more difficult.

Where this land type has been severely eroded, it is suggested that it be retired from continuous cultivation. These areas should never be used for clean-tilled row crops but may be used for a limited production of drilled crops, hay and tame grasses. It is recommended that they be terraced where practical and seeded to permanent grasses and legumes. The use of grassed waterways, diversions around heads of large, active gullies, and the planting of gullies to trees, shrubs, or grasses are additional practices needed to control erosion. For best production, the use of phosphate fertilizer and barnyard manure is recommended on new seedings of sweet clover, grasses and legumes. All tillage operations in connection with seedings should be performed on the contour. Permanent seedings of grasses and legumes should be attempted on a firm, well prepared seedbed with adequate moisture.

The second group of soils in this class, MODERATELY DEEP TO SHALLOW, FRIABLE, SILTY TO CLAYEY SOILS, is shown on the map by the pattern  in blue and by the land type symbol 7B3(L) in red.

This land type consists of moderately deep soils chiefly derived from limestone and limy shales along the breaks and steeper slopes in the eastern part of the county. It includes approximately 5,900 acres. The surface soils usually are from 3 to 7 inches thick and are of a weak brown to moderate brown, silt loam to silty clay loam. The subsoil is a moderate brown to strong brown, silty clay to clay loam resting at a depth of 28 to 34 inches on partially weathered limestone or limy shales.

These lands have suffered—in the past—moderate to severe erosion on the long slopes because large volumes of water accumulate during periods of high rainfall. Due to difficult tillage, these lands should be retired from cultivation where more suitable cropland is available. They may be used, however, for the production of occasional crops of small grains, legumes, and hay. No row crops should be grown on these areas.

Suggested grasses and legumes for these areas include sweet clover, alfalfa, and brome grass. Sweet clover should be planted on these lands and disced down the second year to form a mulch to protect new brome and alfalfa seedings. It will also help prevent erosion and add nitrogen to these eroded areas.

LANDS shown IN ORANGE color (Class VI) on the map ARE NOT SUITABLE FOR CULTIVATION BUT ARE SUITABLE FOR GRAZING OR WOODLAND WITH MODERATE RESTRICTIONS IN USE and practices to control erosion.


These lands consist of excessively steep slopes, shallow, stony, or gravelly soils, severely eroded areas, dunesand, and frequently flooded or saline

bottomlands. They are, for the greater part, unfit for cultivation and are at present in hay or pastureland. In some cases, they are being farmed in spite of poor yields, excessive erosion, and difficult management. Such conditions must be overcome and these lands be retired to permanent vegetation. Within these land types as shown on the map, there will be found small areas of soil suitable for cultivation and on which the same practices and management should be applied as in larger areas of comparable land types. Two major groups of soils are included in this class.

The first group, FRIABLE, SILTY TO CLAYEY SOILS, is shown on the map by the pattern  in orange and by the land type symbol 82Bx3 in red.

This land type consists of mixed alluvial soils along drainageways. The slopes are rough and broken and side gullies are numerous. The lands are unsuitable for cultivation due to position, danger of flooding, and erosion hazards. The soils are fertile and well supplied with water. Some areas suitable for cultivation were included in this land type that were too small to be shown on the scale of mapping used.

To control erosion, decrease flood damage, and side cutting of stream banks, these lands should be in permanent vegetation of grass or trees, and practices as outlined for woodland or grassland followed to control erosion. A stubble mulch such as second year sweet clover or a cover of hay or straw is needed on raw banks and eroded spots.

The second group of soils in this class, SHALLOW, COMMONLY GRAVELLY OR STONY SOILS, is shown on the map by the pattern  in orange and by the land type symbols 71C3(Ch), 71C3(1), and 71D3(Ch) in red.

These land types occupy approximately 55,400 acres. They are found on steep, rough slopes chiefly in the eastern portion of the county. This is the western extension of what is known as the "Kansas Flinthills area." Some of the best pastures in the state of Kansas are found on these lands. The soils are developing over limestone and limy shales for the greater part on steep slopes of 5 to 12 or 14 per cent. The surface soil is usually a dark, gray to brownish-black, granular, silt loam to silty clay loam 3 to 5 inches thick. The subsoil is a light yellowish-brown to moderate brown, silty clay loam resting on limestone or limy shales at depths of 10 to 16 inches. Most of this land is left in native grasses, but small areas have been broken for cultivation which have in most cases resulted in poor yields and complete failures.

Land type 71C3(Ch) differs from those formed from limestone in that it is derived chiefly from cherty limestone and flint. The soils have a dusky brown to weak brown, cherty, silty clay loam surface 3 to 5 inches thick underlain by moderate to strong brown subsoil containing large amounts of chert and partially weathered limestone or gravel to depths from one to three feet. The underlying materials consist of beds of strong brown clay, chert, and cherty limestone. Where the concentration of gravel is high, this material is used quite extensively for road surfacing within the county.


The chief erosion problem on these areas seems to be in the formation of large gullies which gradually become deeper during each succeeding year. This is caused primarily by improper grazing management and early burning.

of pasture land each year without allowing a chance for recovery and establishment of the native grasses. Some sheet erosion also damages these lands in years when high rainfall occurs after burning has been completed and before the native grasses have become established in the spring. Since these lands are among some of the best pasture lands in the state of Kansas, it is imperative that we do all we can to conserve them to be used in this capacity. Grass probably represents their only productive capacity.

As the slopes are steep and the soils are thin, these land types deteriorate very rapidly by erosion if a good cover of grasses is not maintained. Many overgrazed pastures have large deep gullies in them, and sheet erosion has removed much of the original shallow surface soil. Most of the areas occupied by these land types are in pasture or hayland and should remain so as they are unsuitable for any type of cultivated crops. Where they have been broken out for cultivation, they should be returned immediately to permanent vegetation.

Deep, active gullies should be fenced out and planted to grasses and legumes or trees. Hay with seed that has matured may be spread on bare spots and gully banks as one means of establishing a grass cover. Diversions should be constructed around heads of gullies where feasible. Construction of stock ponds and soil-saving dams in small drains is one means of securing livestock water as well as assisting in the control of runoff water. Grazing within carrying capacity and the prevention of burning are two of the most important and effective means of controlling erosion, maintaining production, and increasing the yield of grasses on these lands.

LANDS shown IN BROWN color (Class VII) on the map ARE SUITABLE FOR GRAZING OR HAYLAND WITH SEVERE RESTRICTIONS IN USE and practices to control erosion. One group of soils occurs in this class.

This group, SHALLOW, COMMONLY GRAVELLY OR STONY SOILS, is shown on the map by the pattern  in brown and by the land type symbols 71D4(L) and 71D4(Ss) in red.

These land types are similar to those described in this group under Class VI land. They differ chiefly in that they have more severe gullying and sheet erosion. The slopes are all over 12 per cent, and the topography is very hilly and rough. In the sandstone area in the northwest portion of the county, many escarpments occur where there is little or no surface soil and large sandstone boulders or ledges are at or near the surface.

Many large grassland areas within this land type are overgrazed and overstocked to the point that the native grasses are killed out. Brush, weeds, and unpalatable annual grasses furnish very little protective cover during periods of intensive rainfall. Under these conditions, the large gullies, thin surface soils, and steep slopes lend themselves favorably to more severe erosion if care in the use and management of these lands is neglected.

To effectively control erosion, utilize to a maximum, and maintain these lands, it is recommended that in addition to the practices outlined on page 15 for haylands and grazing lands, that: (a) large active gullies be controlled by fencing and seeding or sodding to native grasses, trees, or shrubs; (b) grazing be limited or controlled to allow reseeding of

grasses and vegetative spread; (c) construction of farm ponds and silting reservoirs in small drainageways; (d) reseeding of bare spots; and (e) movement of salting and feeding grounds often enough to prevent excessive trampling of these areas. During years of low rainfall and excessively hot weather, supplementary pasture should be supplied and a reserve feed supply maintained at all times so that livestock may be removed from these areas at critical times. Weeds should be mowed when in bud or bloom stage and brush should be killed out by mowing.

A P P E N D I X

Table I . . . . . Present Use of Land in Each Soil Group and Land-Capability Class . . . . . Page 21, 22

Table II . . . . . Distribution of Land-Capability Classes by Numbered Soil Groups and by Land Use . . . . . Pages 22,23,24

Table III . . . . . Distribution of Numbered Soil Groups by Slope and Erosion Classes . . . . . Page 25










Maps in Folder




Reconnaissance Soil Conservation Survey Showing Generalized Classes of Land According to Use Capability

Reconnaissance Soil Conservation Survey Showing Present Land Use in Detail

Base map alone - showing all cultural features and complete drainage system - available only on request

TABLE I. PRESENT USE OF LAND IN EACH SOIL GROUP AND LAND-CAPABILITY CLASS IN MARION COUNTY, KANSAS  
 (Based on measurements of 1940 Reconnaissance Soil Conservation Surveys)

LAND CLASSES AND SOIL GROUPS		Cultivated (Acres)	Native Pasture (Acres)	Woodland (Acres)	TOTAL (Acres)
Soils suitable for cultivation, grazing, or woodland use					
Class I - Requires no special practices (green color)					
	Friable, silty to clayey soils	27,840	14,653	2,807	45,300
	Dark, tight clay and claypan soils	31,203	4,982	20	36,205
TOTAL		59,043	19,635	2,827	81,505
Class II - Requires simple practices (yellow color)					
	Dark, tight clay and claypan soils	19,291	4,782	636	24,709
TOTAL		19,291	4,782	636	24,709
Class III - Requires intensive or complex practices (pink color)					
	Dark, tight clay and claypan soils	198,815	79,375	16	278,206
	Light-colored, tight clay and claypan soils	1,847	4,905	—	6,752
	Friable, silty to clayey soils	14,673	13,803	24	28,500
	Moderately sandy soils with friable subsoils	16,429	14,435	28	30,892
TOTAL		231,764	112,518	68	344,350
Class IV - Requires limited crop use and very intensive practices (blue color)					
	Dark, tight clay and claypan soils	16,828	15,585	—	32,413
	Friable, silty to clayey soils	2,327	3,608	—	5,935
TOTAL		19,155	19,193	—	38,348

Soils <u>not</u> suitable for cultivation but suitable for woodland or for grazing use					
Class VI - Requires moderate restrictions in use (orange color)					
	Friable, silty to clayey soils	5,295	9,444	—	14,742
	Shallow, gravelly, or stony soils	8,356	57,015	28	65,399
	TOTAL	13,654	66,459	28	80,141
Class VII - Requires severe restrictions in use (brown color)					
	Shallow, gravelly, or stony soils	238	9,908	—	10,146
	TOTAL	238	9,908	—	10,146
TOTAL AGRICULTURAL LANDS		343,145*	232,495	3,559	579,199
MISCELLANEOUS LANDS (Wasteland in riverbed = 5,008 acres; towns and non-ag areas = 3,136 acres; other lands such as roads, farmsteads, highways, schools, churches, railroads, etc. = 26,417 acres)					34,561

Total County Acreage (1940 Census)

613,760

\*Land use obtained from aerial photographs of July 1938 (Symbol AYG)

TABLE II. DISTRIBUTION OF LAND-CAPABILITY CLASSES BY NUMBERED SOIL GROUPS AND BY LAND USE

SOIL GROUP NO.	PRESENT LAND USE	CLASS I (Acres)	CLASS II (Acres)	CLASS III (Acres)	CLASS IV (Acres)	CLASS VI (Acres)	CLASS VII (Acres)	TOTAL (Acres)
4	Cultivated			1,847				1,847
	Pasture			4,905				4,905
	Woodland			—				—
	TOTAL			6,752				6,752
6	Cultivated			12,157				12,157
	Pasture			10,610				10,610
	Woodland			24				24
	TOTAL			22,791				22,791



7 and 7a	Cultivated Pasture Woodland			11,771 13,458 —	2,327 3,608 —			14,098 17,066 —
	TOTAL			25,229	5,935			31,164
19	Cultivated Pasture Woodland			7,174 4,170 28				7,174 4,170 28
	TOTAL			11,372				11,372
22	Cultivated Pasture Woodland	2,138 230 —						2,138 230 —
	TOTAL	2,368						2,368
24	Cultivated Pasture Woodland	31,203 4,982 20	7,942 1,531 20	187,442 68,864 16	16,828 15,585 —			243,415 90,962 56
	TOTAL	36,205	9,493	256,322	32,413			334,433
25	Cultivated Pasture Woodland			11,373 10,511 —				11,373 10,511 —
	TOTAL			21,884				21,884
71	Cultivated Pasture Woodland					8,356 57,015 28	238 9,908 —	8,594 66,923 28
	TOTAL					65,399	10,146	75,545
74	Cultivated Pasture Woodland		11,349 3,251 616					11,349 3,251 616
	TOTAL		15,216					15,216

75	Cultivated Pasture Woodland	25,702 14,423 2,807						25,702 14,423 2,807
	TOTAL	42,932						42,932
82	Cultivated Pasture Woodland					5,298 9,444 —		5,298 9,444 —
	TOTAL					14,742		14,742
Total of County	Cultivated Pasture Woodland	59,043 19,635 2,827	19,291 4,782 636	231,764 112,518 68	19,155 19,193 —	13,654 66,459 28	238 9,908 —	343,145 232,495 3,559
TOTAL AGRICULTURAL LANDS		81,505	24,709	344,350	38,348	80,141	10,146	579,199
Wasteland (lakes, rivers, and streams)								5,008
Areas of municipalities (towns, industrial areas)								3,136
Other lands (Roads, farmsteads, highways, schools, churches, etc.)								26,417
TOTAL								34,561

Total County Acreage (1940 Census)

613,760

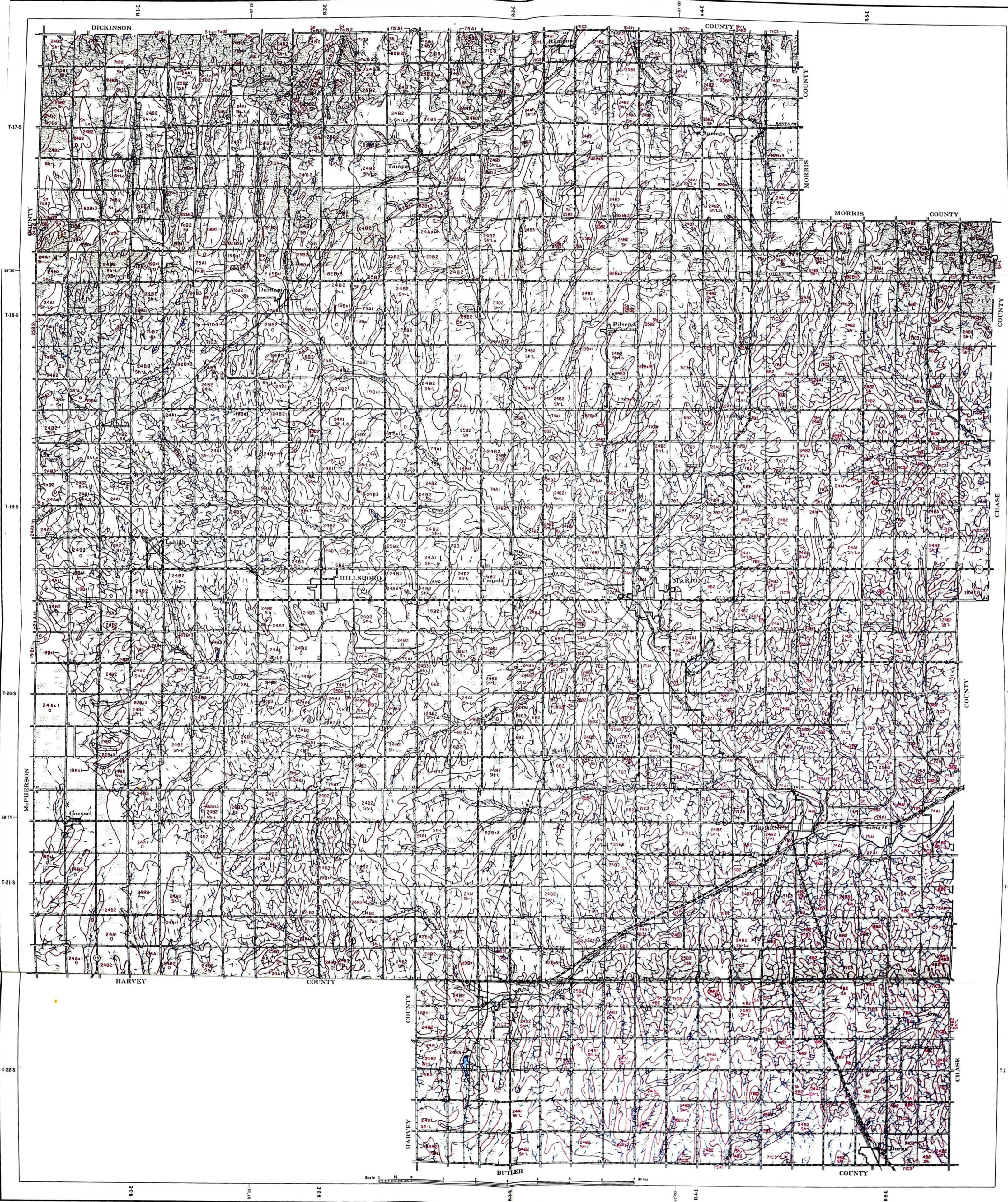
\*See legend on back of enclosed map for explanation of numbered soil groups.

TABLE III. DISTRIBUTION OF NUMBERED SOIL GROUPS BY SLOPE AND EROSION CLASSES, MARION COUNTY, KANSAS

SOIL GROUP NO.	EROSION CLASSES	A	Ax	B	Bx	C	D	TOTALS
4	Slight Moderate			4,905 1,847				4,905 1,847
6	Slight Moderate			10,634 12,157				10,634 12,157
7a	Slight Moderate			10,265 9,255				10,265 9,255
7	Slight Moderate Mod. Severe			6,801 2,516 2,327				6,801 2,516 2,327
19	Slight				11,372			11,372
22	Slight	2,368						2,368
24	Slight Moderate Mod. Severe	36,205	9,493	84,465 187,442 16,828				130,163 187,442 16,828
25	Slight Moderate			10,511 11,373				10,511 11,373
71	Slight Mod. Severe Severe					57,043 8,356	9,908 238	57,043 18,264 238
74	Slight	15,216						15,216
75	Slight	42,932						42,932
82	Slight Mod. Severe				9,444 5,298			9,444 5,298
	TOTALS	96,721	9,493	371,326	26,114	65,399	10,146	579,199

# MARION COUNTY KANSAS

## RECONNAISSANCE SOIL CONSERVATION SURVEY



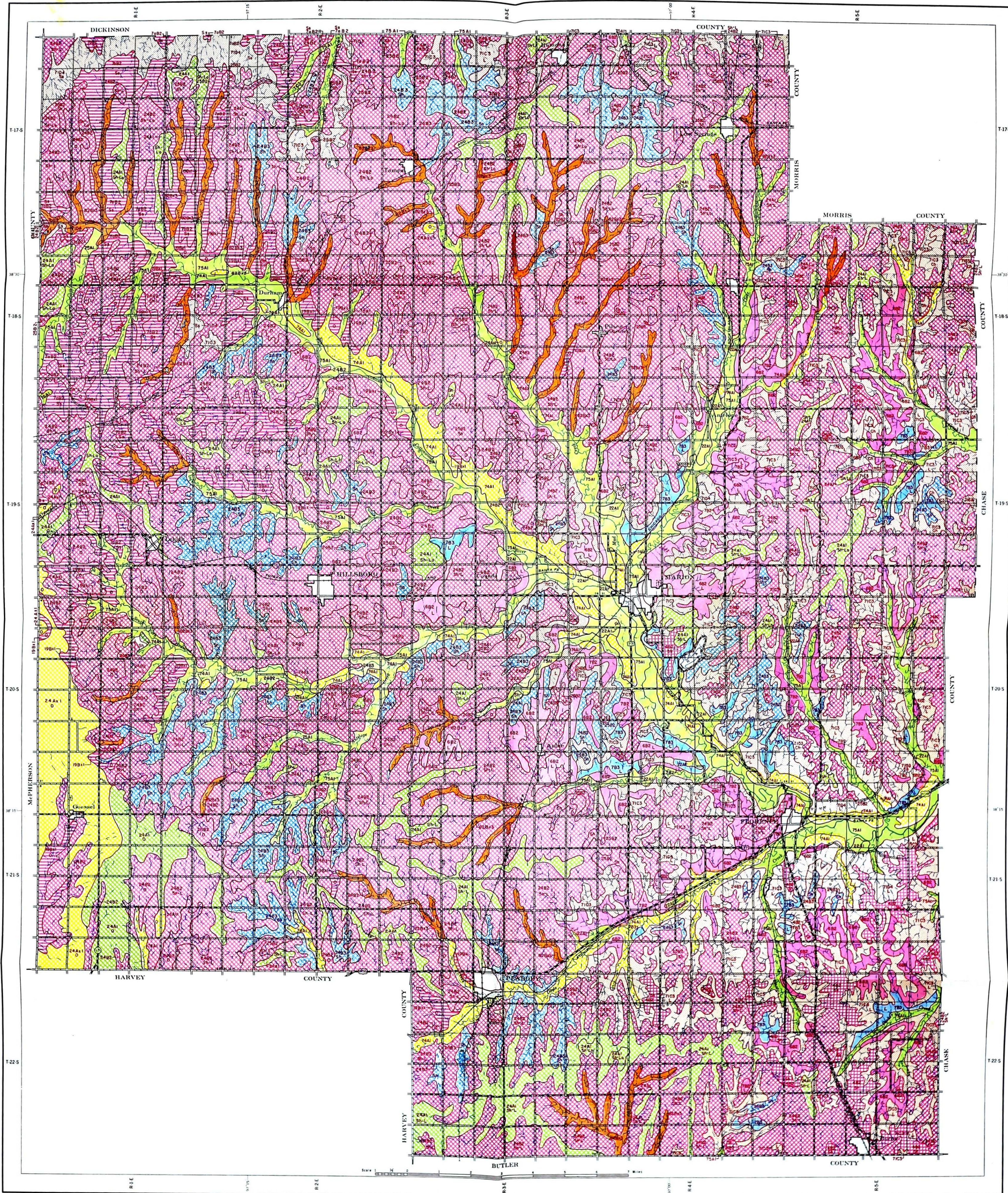
Base map compiled by the Soil Conservation Service from Kansas county and transportation maps, with drainage determined from aerial photographs. Physical Survey by the Soil Conservation Service in cooperation with the Kansas State Agricultural Experiment Station. Polyconic projection. North American, 1927. Datum indicated by marginal ticks. Sixth Principal Meridian. Horizontal control by G. L. O. Reproduced by the Soil Conservation Service. Field Survey completed March 1940.

See back of map for: (1) Explanation of survey legend; (2) Table showing relations of physical factors and land capability classes; and (3) Legend of geographic symbols.

# MARION COUNTY KANSAS

## RECONNAISSANCE SOIL CONSERVATION SURVEY

### SHOWING GENERALIZED CLASSES OF LAND ACCORDING TO USE CAPABILITY



Base map compiled by the Soil Conservation Service from Kansas county and transportation maps, with drainage delineated from aerial photographs. Physical Survey by the Soil Conservation Service in cooperation with the Kansas State Agricultural Experiment Station. Polyconic projection. North American, 1927. Datum indicated by marginal ticks. Sixth Principal Meridian. Horizontal control by G. L. O. Reproduced by the Soil Conservation Service. Field Survey completed March 1940.

Colors indicate classes of land according to capability for safe and continued use, based upon the physical factors mapped and the existing environment. See back of map for: (1) Explanation of survey legend; (2) Table showing relations of physical factors and land capability classes; and (3) Legend of geographic symbols.

SOIL CONSERVATION SERVICE WASHINGTON, D. C.  
1979 JUNE 1940

SUITABLE FOR CULTIVATION WITH				NOT SUITABLE FOR CULTIVATION; SUITABLE FOR GRAZING OR WOODLAND WITH	
I No special practices		II Simple practices		III Intensive practices	
	Friable, silty to clayey soils		Dark, tight clay and claypan soils		Dark, tight clay and claypan soils
	Dark, tight clay and claypan soils				Light-colored, tight clay and claypan soils
					Friable, silty to clayey soils
					Moderately sandy soils with friable subsoils
				IV Limited use and intensive practices	
					Dark, tight clay and claypan soils
					Friable, silty to clayey soils
				VI Moderate restrictions in use	
					Friable, silty to clayey soils
					Shallow, gravelly or stony soils
				VII Severe restrictions in use	
					Shallow, gravelly, or stony soils

Approximate North

1024  
9.12.52

RECONNAISSANCE SOIL CONSERVATION SURVEY

LEGEND

Explanation of order of symbols: (Example: 24B2 with symbol Sh-L occurring separately in the same area)

24 = SOIL GROUP: Deep, very dark soils with moderately tight clay or semiclaypan subsoils. Uplands (Chernozem and Prairie Soils Zone). B = SLOPE: Range of 2 = 5%. 2 = EROSION: No or slight erosion on grassland and moderate erosion on cultivated land. Sh-L = DOMINANT PARENT SOIL MATERIAL: Shales and limestone.

SOIL GROUPS

In the Reconnaissance Soil Conservation Survey of Kansas, soils were mapped in such a manner as to group under one title and field number those soils which are closely related in depth, color, general mode of development, position and subsoil character. In the chart below the dominant parent soil materials, soil series, and soil textures are arranged, insofar as possible, in related sequence. Numbers on the map indicate the soil groups that occur in this county. They have been further grouped according to texture, depth and drainage characteristics into general groups, which are indicated by hatching in colors on the map, the color depending upon the land-capability class. The correct general group symbol for each mapping unit is indicated in the chart below.

PARENT SOIL MATERIALS

The dominant geologic material, other than recent stream deposits, is shown by a letter symbol apart from the soil group number. The symbols and the kind of materials they indicate are as follows: Ch—chert and cherty limestone; C—caliche; G—waterworn gravel; Gs—gypsum and highly gypsiferous sandstone and shale; L—limestone and interbedded limy shale; Lo—loess; O—old alluvial deposits of consolidated and unconsolidated sand, silt and clay; S—wind-deposited sand; Sh—heavy shale and shaly clay; St—chalk and chalky shale; Sl—siltstone sand; Ss—sandy shale and shaly sandstone; T—glacial till; No Symbol—recent stream deposits of flood plains and terraces.

SLOPES

Letters are used to indicate significant ranges of slopes for each soil group with respect to soil development, erodibility, and runoff characteristics. The slope classes are: A—nearly level to smooth, gentle slopes; B—moderate slopes,

usually undulating to gently rolling topography; C—moderately steep slopes, usually rolling to hilly topography; D—steep slopes, usually hilly to rough, broken topography. Ax, Bx and Cx denote slightly, moderately and strongly, irregular or hummocky slope conditions, respectively; and X indicates dunes or dune-like topography. Slope limits for each class are shown by soil groups in the chart below.

EROSION

Since grass protects the soil, erosion is usually more severe on cultivated land than on grassland. Erosion classes were not mapped in detail on this reconnaissance survey, but symbols were used to indicate the following combinations: 1—no erosion or slight erosion on grassland and cultivated land; 2—no erosion or slight erosion on grassland and moderate erosion on cultivated land; 3—no erosion or slight erosion on grassland and severe erosion on cultivated land; 4—moderate erosion on grassland and severe or very severe erosion on cultivated land; 5—severe or very severe erosion on both grassland and cultivated land. Slight erosion means the loss of less than 25 percent of the surface soil, deposits less than 6 inches deep, or infrequent shallow gullies. Moderate erosion is the loss of 25 to 75 percent of the surface soil, deposits 6 to 24 inches deep, or occasional gullies. Severe or very severe erosion is the loss of more than 75 percent of the surface soil, deposits more than 24 inches deep, frequent gullies, or very large gullies.

CAPABILITY OF LAND

Land-capability classes, shown by colors on the map, are based upon the physical factors; soil, slope, and erosion considered together with climate. Class I is

suitable for cultivation without any special practices for erosion control. Class II is suitable for cultivation with simple practices. Class III is suitable for cultivation with intensive practices. Class IV is suitable for only limited cultivation, and must be farmed with intensive practices. Classes V, VI and VII are not suitable for cultivation but can be used safely for grazing or woodland. Class V requires no special restrictions for safe use; Class VI requires moderate restrictions; and Class VII requires severe restrictions. Class VIII consists of mine dumps, barren rocks, and other land not suitable for cultivation, grazing, or woodland use. Specific practices and measures are determined locally for each soil, slope, and erosion condition after careful consideration of climate, adapted crops, productivity and erodibility of the soil and accepted sound cropping and range management practices. Although this map is suitable for over-all, i.e., community or county planning, more detailed surveys may be necessary for developing sound plans of conservation and land use on individual farms and ranches. The relationships of land-capability classes and the physical factors mapped in this county are given in the chart below.

LAND USE  
(Reproduced in gray)



Land Use obtained from aerial photographs of July, 1938 (Symbol AYG)

SYMBOLS USED TO DESIGNATE PHYSICAL FACTORS, AND THE RELATION OF PHYSICAL FACTORS TO USE CAPABILITY OF THE LAND IN MARION COUNTY, KANSAS

SOIL GROUPS					SLOPES		LAND-CAPABILITY CLASSES BASED ON SOIL, SLOPE, EROSION AND CLIMATE								
General Group Symbol	Soil Group No.	Description	Dominant Parent Materials	Probable Dominant Soil Series 1/	Dominant Surface Soil Textures	Symbol	Percent Range	Erosion Symbol - 1	Land Class	Erosion Symbol - 2	Land Class	Erosion Symbol - 3	Land Class	Erosion Symbol - 4	Land Class
								Erosion Type		Erosion Type		Erosion Type		Erosion Type	
	4	Deep, light or very light-colored soils with tight clay or dense claypan subsoils. Uplands (Prairie Soils Zone).	shale, shaly clay	Parsons	silt loam	B	2 - 5	—	—	sheet	III	—	—	—	—
	6	Deep, very dark soils with friable or moderately friable, silty to clayey subsoils. Uplands (Prairie Soils Zone).	limy shales, limestone	Summit, Labette	silty clay loam, silt loam	B	2 - 7	—	—	sheet	III	—	—	—	—
	7	Moderately deep, dark or very dark soils with friable or moderately friable, silty to clayey subsoils. Uplands (Prairie Soils Zone).	limy shales, limestone	Newtonia	silty clay loam	B	2 - 7	—	—	sheet	III	sheet, gully	IV	—	—
	7a	Moderately deep, dark soils with sandy or moderately sandy surface soils over loamy to friable, clayey subsoils. Uplands (Prairie Soils Zone).	sandy shales, sandstone	Lancaster	fine sandy loam	B	2 - 7	—	—	sheet, gully	III	—	—	—	—
	19	Deep, dark reddish soils with moderately sandy surface soils and loamy to friable, clayey subsoils. Uplands (Reddish Prairie Soils Zone).	old alluvium, wind-reworke sands	undetermined series	very fine sand, fine sandy loam	Bx	low hummocky	wind, sheet	III	—	—	—	—	—	—
	22	Deep, dark to reddish-colored soils with friable, silty to clayey subsoils. Terraces (Reddish Prairie Soils Zone).	stream terrace deposits	Arvonja 2/	silt loam	A	0 - 2	deposition	1 3/	—	—	—	—	—	—
	24	Deep, very dark soils with moderately tight clay or semiclaypan subsoils. Uplands (Chernozem and Prairie Soils Zone).	limy shales, old alluvium, loess	Idana, Longford, Gnessel, Crete, Butler	silt loam, silty clay loam	A B	0 - 2 2 - 5	sheet sheet	1 4/ II	—	—	sheet, gully	III	sheet, gully	IV
	25	Moderately deep, dark or very dark soils with tight or moderately tight clay subsoils. Uplands (Chernozem and Prairie Soils Zone).	limy shales, limestone	Kipp 2/, Idana, (thin solum phase)	silty clay, clay loam	B	2 - 5	—	—	sheet, gully	III	—	—	—	—
	71	Shallow and very shallow, commonly gravelly or stony soils and parent soil materials. Uplands.	limestone, limy shales, chert sandstone, sandy shales	Sogn, Florence, Collinsville	silty clay, cherty clay loam, fine sandy loam	C D	7 - 14 over 14	—	—	—	—	gully gully	VI VI	gully, sheet	VII
	74	Very dark or dark soils with tight clay subsoils. Bottomlands.	recent stream deposits	Osage, Sutphen 2/	silty clay loam, silty clay	A	0 - 2	flooding	II	—	—	—	—	—	—
	75	Very dark or dark soils with friable or moderately friable, silty to clayey subsoils. Bottomlands.	recent stream deposits	Webash, Verdigris	silt loam, very fine sandy loam	A	0 - 2	deposition	1 5/	—	—	—	—	—	—
	82	Mixed, generally nonarabic, alluvial soils along narrow drainageways. (Soil groups undifferentiated).	recent stream deposits	undifferentiated	silt loam, fine sandy loam	Bx	broken	—	—	—	—	gully, deposition	VI	—	—

1/ Soil series names based on recent inspections in nearby counties and Bureau of Chemistry and Soils Surveys of 1930.  
 2/ Preliminary name pending final correlation.  
 3/ Small poorly drained heavy clay areas that are Class II are included in these areas.  
 4/ Within the large areas of Class I are small areas of 2 and 3 per cent slope that would be shown as Class II on more detailed surveys.  
 5/ Areas adjacent to streams are Class VI.

GEOGRAPHIC SYMBOLS

WORKS AND STRUCTURES

BOUNDARIES, MARKS, AND MONUMENTS

DRAINAGE

City or Town	Church
Pipe line (Pipe lines shown in open country only and are not carried along roads.)	School
Railroad	Dam
Roads, Hard-surfaced	Tanks
Gravel	Oil or Gas Wells
Improved dirt	Cemetery
Unimproved dirt	Mine, Quarry or Gravel pit
U. S.	Bridge
State	Non Agricultural Area (Uncolored)
Building (With descriptive note)	

State
County
Township, U. S.
Land grant
Reservation-Indian or military and
National forest
Section line
Triangulation station
Permanent reference point or
Primary traverse station

Intermittent stream
Perennial stream
Perennial lake
Intermittent lake
Marsh
Rock outcrops

LOCATION MAP

