

MECHANIZATION IN THE LUMBER INDUSTRY

**WORK PROJECTS ADMINISTRATION
NATIONAL RESEARCH PROJECT**

WPA NATIONAL RESEARCH PROJECT

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FEDERAL WORKS AGENCY
WORK PROJECTS ADMINISTRATION

F. C. HARRINGTON
Commissioner

CORRINGTON GILL
Assistant Commissioner

NATIONAL RESEARCH PROJECT

ON

Reemployment Opportunities and Recent Changes
in Industrial Techniques

DAVID WEINTRAUB

Director

Studies in Equipment Changes and Industrial Techniques

George Perazich, Engineer in Charge



Farm Security Administration (Rothstein)

LOG MECHANICALLY CONVEYED FROM POND TO SAW

MECHANIZATION IN THE LUMBER INDUSTRY

*A Study of Technology in Relation to Resources
and Employment Opportunity*

by

Alfred J. Van Tassel
with the assistance of
David W. Bluestone

WORK PROJECTS ADMINISTRATION, NATIONAL RESEARCH PROJECT

Report No. M-5

Philadelphia, Pennsylvania

March 1940

**THE WPA NATIONAL RESEARCH PROJECT
ON REEMPLOYMENT OPPORTUNITIES AND RECENT CHANGES
IN INDUSTRIAL TECHNIQUES**

Under the authority granted by the President in the Executive Order which created the Works Progress Administration, Administrator *Harry L. Hopkins* authorized the establishment of a research program for the purpose of collecting and analyzing data bearing on problems of employment, unemployment, and relief. Accordingly, the National Research Program was established in October 1935 under the supervision of *Corrington Gill*, Assistant Administrator of the WPA, who appointed the directors of the individual studies or projects.

The Project on Reemployment Opportunities and Recent Changes in Industrial Techniques was organized in December 1935 to inquire, with the cooperation of industry, labor, and governmental and private agencies, into the extent of recent changes in industrial techniques and to evaluate the effects of these changes on the volume of employment and unemployment. *David Weintraub* and *Irving Kaplan*, members of the research staff of the Division of Research, Statistics, and Finance were appointed, respectively, Director and Associate Director of the Project. The task set for them was to assemble and organize the existing data which bear on the problem and to augment these data by field surveys and analyses.

To this end, many governmental agencies which are the collectors and repositories of pertinent information were invited to cooperate. The cooperating agencies of the United States Government include the Department of Agriculture, the Bureau of Mines of the Department of the Interior, the Bureau of Labor Statistics of the Department of Labor, the Railroad Retirement Board, the Social Security Board, the Bureau of Internal Revenue of the Department of the Treasury, the Department of Commerce, the Federal Trade Commission, and the Tariff Commission.

The following private agencies joined with the National Research Project in conducting special studies: the Industrial Research Department of the University of Pennsylvania, the National Bureau of Economic Research, Inc., the Employment Stabilization Research Institute of the University of Minnesota, and the Agricultural Economics Departments in the Agricultural Experiment Stations of California, Illinois, Iowa, and New York.

Since September 1, 1939, the Project has been sponsored by the National Resources Planning Board, Executive Office of the President, Washington, D. C.

FEDERAL WORKS AGENCY
WORK PROJECTS ADMINISTRATION

1734 NEW YORK AVENUE NW.

WASHINGTON, D. C.

F. C. HARRINGTON
COMMISSIONER OF WORK PROJECTS

March 14, 1940

Colonel F. C. Harrington
Commissioner of Work Projects

Sir:

In 1937 the lumber industry still ranked third among manufacturing industries as an employer of labor despite the fact that for three decades production and employment in this industry had been declining. The report transmitted herewith discusses technology, resource conditions, and labor productivity within this setting of generally declining employment opportunity.

Substitute products have taken over a great many of the functions of lumber in the construction and manufacturing industries. In the country as a whole, per-capita as well as total consumption has declined; rapidly declining production - 17 percent between 1909 and 1929 - was the principal cause of declining employment in the industry.

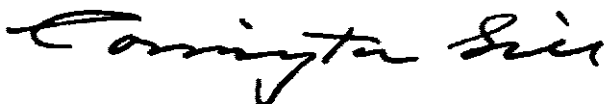
The economic dislocation which attended the decline of production has been intensified in particular regions by the depletion of the timber resources. The traditional clear-cutting policy resulted in the migration of the industry to fresh sources of supply, leaving abandoned cut-over areas in its wake. In the period of agricultural expansion the population of these areas frequently made a successful transition to agriculture; studies of our Division of Research have shown that in recent years such areas have become, for want of alternative employment opportunity, centers of particularly aggravated relief problems.

Timber depletion has taken its toll of lumber and related forest industries, particularly in the Northeastern, Lake, and Central States. Although the southern lumber regions as a whole are not now similarly threatened, particular localities have been

struck by the passing of the lumber industry. The United States Forest Service found that in 1934 there were over 18 thousand workers employed in southern logging and sawmilling operations of large mills whose owners expected to exhaust their local timber supplies by 1944. The expected increase in the number of small and medium-size mills is not likely to enhance the employment security of workers attached to such mills because of the prospective depletion of the timber supply within the working area of the mills. Although in the Pacific Coast States fewer localities are subject to the same imminent dangers, the potential economic dislocation due to timber depletion is much greater because of the strategic position occupied by the forest industries in the economy of the Northwest.

Certain of the types of logging equipment now available hold a promise that in the future the industry will be able to operate economically on a "cropping" instead of the traditional "mining" basis. Such agencies as the Forest Service of the United States Department of Agriculture and similar State-supported agencies are carrying on the major share of the work that is being done on reforestation, fire protection, and research in methods of forest management, use of forest products, and even logging and milling techniques. Sustained-yield logging, strongly advocated by these governmental forest agencies, combined with other features of progressive forest management, not only would assure for the future a continuous supply of high-grade lumber at reasonable prices but also would be an important factor in preserving the level of and stabilizing the location of employment opportunity.

Respectfully yours,

A handwritten signature in cursive script that reads "Corrington Gill". The signature is written in dark ink and is positioned centrally below the typed name.

Corrington Gill
Assistant Commissioner

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PREFACE

Prior to 1850 mechanization in the lumber industry was directed primarily toward securing building materials with the least possible effort from the abundant timber stands that were found almost everywhere more or less at hand. During the last half of the nineteenth century the Nation entered a period of rapid expansion; the nature of new developments and production techniques was dictated by the growth in demand for lumber and the consequent pressure to cut-out as rapidly as possible and to liquidate large forest holdings in order to be able to acquire other promising holdings. In recent years, with the demand for lumber declining and with the last great forest region the scene of the most active production, the objective of technological change has been shifted from high output and complete liquidation to the lowering of production costs in order to maintain competitive position.

In extractive industries technology is faced with continually increasing physical difficulties if operations are continued at one location. These difficulties must be overcome if the productivity of labor is to be maintained or increased. To the extent that the lumber industry has employed extractive techniques, it has faced obstacles to increased productivity analogous to those encountered by the mining industries. By and large the lumber industry has "mined" the timber in its path and has migrated to fresh sources of supply when the timber supply has been depleted. Production techniques have had to be altered in the course of the migration of the industry as well as in the course of operations within each region. The methods used were in each case conditioned by the characteristics of the resource. There are, therefore, profound regional differences in technology corresponding to regional differences in the characteristics of the timber stand and in the stage of development of the individual regions.

There have been two principal modes of adjustment to timber depletion. One method involved improvements in technique and machinery in order to accomplish the logging and milling of timber from less desirable stands with the same or a reduced expenditure of labor per unit of output. The other involved the shift of an increasing proportion of production to smaller mills operating closer to the timber stand, employing simpler and less extended production processes, and producing, in general, a somewhat cruder product. That is, the steady improvement in the machines and techniques available for use has not been accompanied by a consistent increase in the extent of their use.

The most striking technological development since 1920 has been the adaptation of tractors, trucks, and light cable yarders for logging operations. The use of this equipment has enabled the industry to undertake the logging of scattered stands which could not be profitably cut with the heavy steam cable yarders and forest railroads that had hitherto constituted the principal tools of mechanized logging. Within the sawmills cost reductions have been achieved through the more extensive use of mechanical handling equipment, through refinements in sawmill and planing-mill machinery which contributed to increased speed of operation, and through the shift to electric power which contributed to automatization of processes, increased speed of operation, and reduced power-generation and maintenance personnel. This mode of adjustment to less favorable stands of sparse or less accessible timber was characteristic primarily of the Pacific Coast region, and there the unit labor requirements of large operations appear to have declined throughout the period 1920-36.

The shift toward smaller mills, on the other hand, appears to have been typical of the southern lumber regions, and there such changes in technology as have been made barely served to offset the increasing natural difficulties. The small mill is able to operate closer to the timber and can draw on stands of smaller volume than are required for the successful operation of large, stationary mills. To do so, however, the small mill must move frequently; it attains the requisite mobility by sacrificing much of the labor-saving machinery of the large, stationary mills. The rise in the number of small sawmills represents, however, only a temporary adjustment to increased difficulties and, in any long view, must be regarded as a symptom rather than as a solution of the problems created by timber depletion.

Through technical advances and shifts of production to smaller mills the lumber industry has succeeded in maintaining production in the face of timber depletion. The lumber industry, however, bears the social responsibilities associated with operation on an exhaustible national resource; these responsibilities are not fully met so long as the industry's operation continues to be accompanied by a decline in the quality and availability of timber resources. The state of the forest resource has far-reaching implications for many phases of national life - in its relationship to other forest industries, soil erosion, flood control, and scenic and recreational values. Furthermore, although the industry as a whole has been able to adjust itself to declining timber resources, the workers and the communities that grew up around the camps and mills have not always been so successful. The migration of the industry has been

accompanied by the disruption of employment opportunities and the economic life of communities partly or wholly dependent upon the industry.

The most important factor affecting the level of employment opportunities during the past three decades has been the decline in the demand for lumber. This has been principally determined by factors beyond the industry's control. However, it should be noted that if there is to be an improvement in the position of lumber in its competition with other materials, the maintenance of high-quality timber resources is of paramount importance.

The problems of conservation of the forest resources differ fundamentally from those associated with the mineral resources. While some measure of depletion is an inevitable counterpart of the use of mineral resources, the forest can actually be made to yield an increasing raw-material return by the employment of appropriate forest-management techniques. The nature of recent technological developments in logging methods has been such as to encourage sustained-yield logging which, if widely adopted, would assure a basis for continued and stable operation in the industry. The effect of technical developments on future employment opportunities in the industry may well depend more on how the equipment is employed than on what particular equipment is developed and at what rate it is introduced.

The report was prepared by Alfred J. Van Tassel with the assistance of David W. Bluestone. It is one of the series of "Studies in Equipment Changes and Industrial Techniques" supervised by George Perazich. The manuscript was edited and prepared for publication under the direction of Edmund J. Stone.

Many of the data used in the report were derived from field surveys conducted by the National Research Project in cooperation with the National Bureau of Economic Research. A sample of lumber mills was covered in a cooperative study undertaken in 1936 as one in a series of "Studies of Productivity and Employment in Selected Industries" under the supervision of Harry Jerome and William A. Neiswanger. Tabulations developed for that study, which was conducted by Milton Gilbert, have been used extensively in this report, and many of the basic data are published in appendix A. Data on sales of various types of machinery and equipment to the lumber industry were also obtained in a field survey conducted in cooperation with the National Bureau of Economic Research. Harry Jerome participated in the planning of this survey of machinery manufacturers, and J. Van Horn Whipple organized the field work and supervised the editing of the materials collected.

The National Research Project is particularly indebted to the Forest Service of the United States Department of Agriculture, which cooperated in this study by furnishing statistical data and preparing special analyses. The Project is also indebted to the following individuals who reviewed the manuscript or furnished valuable suggestions or data: Axel J. F. Brandstrom, I. F. Eldredge, Herman M. Johnson, Burt P. Kirkland, R. E. Marsh, Raymond Miller, Richard W. Nelson, C. V. Sweet, C. J. Telford, George W. Trayer, and R. K. Winters, all of the Forest Service; Nelson C. Brown, professor, New York State College of Forestry at Syracuse University; and A. E. Hall, manager of the Milling Machinery Department of the Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin. The National Research Project is, of course, alone responsible for the content of the report and the conclusions reached.

DAVID WEINTRAUB

PHILADELPHIA

March 13, 1940

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APPENDIX A

DESCRIPTION OF DATA FROM NRP-NBER LOGGING-CAMP AND SAWMILL SURVEY¹

In order to obtain data for a study of changes in the labor productivity of the lumber industry, the National Research Project, in cooperation with the National Bureau of Economic Research, made a field study in 1936 of 64 Pacific Coast and southern sawmills and 22 of the logging camps supplying these sawmills. In the case of each operation an attempt was made to secure year-by-year data on capacity, production, and the number of man-hours of employment. Where a break-down was possible, the man-hour data were obtained for separate departments. In addition, detailed information on changes in production techniques was obtained for a smaller number of plants, including data on the nature and the amount of equipment purchased, replaced, and retired and the effect of these changes on the absorption or displacement of labor.

The numbers of operations used in the various statistical analyses were smaller than the total number of plants surveyed because most records did not provide complete information over the period 1920-36, either because the operations were not working in all years or because their records were incomplete.

PACIFIC COAST LOGGING CAMPS

The 1936 survey covered 20 Pacific Coast logging camps. Seventeen of the camps were engaged principally in logging Douglas fir, usually together with hemlock and frequently with cedar and spruce. Three were engaged in logging ponderosa pine, and two of the three cut some other species. Thirteen of the 20 estimated their daily capacity at between 100 and 249 thousand board feet; 4, between 250 and 499 thousand board feet; and 3, at over 500 thousand board feet. Eleven of the camps were located in Washington, seven were in Oregon, one was in California, and

Note.- The appendixes were prepared by the author in collaboration with Julius H. Balick and William R. Gray.

¹Except as specified, the data included in this appendix were collected in a field survey conducted by the National Research Project in cooperation with the National Bureau of Economic Research as one in a series of "Studies of Productivity and Employment in Selected Industries" directed by Harry Jerome and William A. Neiswanger. For this study data were also available from a field survey conducted in 1928-29 by the National Bureau of Economic Research (see Harry Jerome, *Mechanization in Industry* [New York: National Bureau of Economic Research, 1934], p. 15). The basic statistical techniques employed in handling these field data were developed in the "Studies of Productivity and Employment in Selected Industries" section of the Project. Milton Gilbert conducted the study of the lumber industry.

one was in Montana.² All 20 supplied sawmills included in the Pacific Coast sawmill sample.

Table A-1 shows the percentage of the total lumber cut in the Pacific Coast States which was obtained from logs supplied by the 20 camps covered in the survey. The incompleteness of records, particularly in earlier years, made it impossible to include all camps in each year. Accordingly there is a steady growth in the percentage of total Pacific Coast production accounted for by these operations. As may be observed from an examination of table A-2, the sample was considerably more representative of the camps supplying the larger mills. In 1929 all of the camps surveyed were attached to mills which cut at least 25 million board feet in that year; 82.6 percent of the production of the camps surveyed was accounted for by camps attached to the largest mills, those which cut at least 50 million board feet. After 1929, therefore, the sample is reasonably adequate for the camps supplying large mills and particularly for the camps supplying the largest mills, which accounted for over half of the 1929 Pacific Coast lumber production.

In order that accurate figures for the logging operation might be obtained, the NRP-NBER data were collected in the form of logging man-hours and logging production in log-scale measure. Thus the fact that a company may sell some of its logs to other sawmills or purchase some of the logs used in its sawmill does not introduce any error into the logging-camp figures. Logging-camp production in log scale was converted to board measure (lumber scale) by the year-by-year overrun experience of the mills which the NRP-NBER camps supplied with logs. The overrun for a mill constitutes the difference, within a given time period, between the number of feet, log scale, supplied to the mill in log form and the output in feet, board measure, actually achieved. The higher the overrun of a given mill, the more lumber that mill is obtaining from the logs which it receives. The overrun varies with the precision of manufacture and the size of logs sawed. For camps for which the overrun experience was not available, the average of the overrun ratios for other camps was used.

All the labor time spent in the camp or in transporting logs to the mill has been included in the man-hour totals. These man-hours include such operations as felling and bucking, skidding, yarding, and loading, as well as transportation of logs to mill or tidewater and construction

²The Montana operation surveyed cut ponderosa pine and operated under conditions and with methods characteristic of the operations of the ponderosa-pine regions of Oregon and California. The Montana operation was therefore included in the sample and was treated as if it were located in one of the three Pacific Coast States.

and maintenance of logging roads or railroads. In short, all the labor time which appears on the logging pay-roll records is included. However, it was not possible to obtain a figure for all the transportation man-hours in cases where some of the work was done by independent booming companies or common carriers.

Table A-3 presents production, man-hours, and unit labor requirements for all camps for which data were available in each year of the 1920-35 period; data for two camps for which data are available in each year of the period are also given.

PACIFIC COAST SAWMILLS

The NRP-NBER survey covered 36 Pacific Coast sawmills in 1936. Nineteen of these mills and 17 others had been surveyed in 1928 and 1929 by the NBER.³ It proved impossible to obtain an adequate sample of small mills, and the surveys were accordingly limited to a sample of 53 large mills, each of which cut more than 15 million board feet in one of the years for which data for the respective mills were obtained. Data for 2 of the 53 mills were not adequate, and these mills were not included in the analyses.

Of the 51 mills in the sample, 47 were engaged principally in cutting Douglas fir and associated species; the other 4 produced lumber from ponderosa pine and associated species. Thirty-three of the mills were located in Washington, 15 in Oregon, 2 in California, and 1 in Montana.⁴

The sample shows a steady growth in coverage, from 9.5 percent of the total Pacific Coast production in 1919 to 27.4 percent in 1927. From 1927 to 1929 the coverage of the sample declined sharply because a large number of the mills included in the sample for 1927 were surveyed by the NBER in 1928 and at the time of the resurvey (in 1936) 17 of the mills were out of existence or could not cooperate. The coverage since 1929 is relatively stable at a 20-percent level (table A-4).

The analysis of the change in unit labor requirements is confined to the experience of the large mills, and for this group of mills the sample is considerably more adequate than figures on the percentage of total production would indicate. This is shown in table A-5 by an analysis of census data for 1929, the only year in the period covered for which

³An effort was made to resurvey all 36 sawmills surveyed in 1928-29, but 17 of the mills were no longer operating or could not cooperate. The combination of mills covered in the two surveys into one sample did not have a distorting effect, however, for the 19 mills covered in both surveys and the 17 covered in the second survey showed similar movements of unit labor requirements (see table A-6, fn. d).

⁴See fn. 2 of this appendix.

production figures are available classified according to the size of the reporting mill.

In 1929 the sample included only 2.5 percent of the total number of mills in the Pacific Coast States. However, the production of mills included in the survey represented 17.2 percent of the total production of the Pacific Coast States. About 27 percent of the total production of mills which cut over 50 million board feet in 1929 was accounted for by the mills included in the sample; about 20 percent of the production of Pacific Coast mills which cut over 15 million board feet in 1929 was cut by sample mills. None of the 1,061 Pacific Coast mills which cut less than 15 million board feet in 1929 were surveyed. The sample, then, is reasonably adequate for mills which cut more than 15 million board feet, but it is most representative of the largest mills. Sample mills in the latter group produced 84 percent of the lumber sawed by sample mills.

Table A-6 presents chain indexes of man-hours, equivalent production,⁵ and man-hour requirements per unit of equivalent production for sample mills. The man-hour and equivalent-production indexes were computed on the basis of percentage changes from year to year of aggregates for all mills which reported in each of two consecutive years. The unit-labor-requirement index was computed from the man-hour and equivalent-production indexes. The figures are for 1918-35.

Table A-7 presents two additional indexes of labor requirements per unit of equivalent production. One represents a weighted average for all mills for which data were available for the respective years. The other represents an index of the medians of the ratios for individual sample mills. The table shows, in addition, the lowest and highest individual mill ratios for each of the years. The period covered is 1918-35.

Unit labor requirements, percentages of capacity utilized, and aggregate capacities⁶ are presented in table A-8 for two groups of identical mills. The figures for a group of 11 mills cover the period 1920-35; the figures for a group of 18 mills (including the 11 mills in the first group) cover the period 1926-35.

SOUTHERN SAWMILLS

The NRP-NBER survey covered 28 mills in Alabama, Louisiana, Mississippi, South Carolina, and Texas. Because of the inadequacy of available records, it proved impossible to sample small mills adequately. The sample

⁵For method of computing equivalent production see pp. 146-9.

⁶See table A-8, ftms. a and b.

was accordingly limited to large mills believed to have a daily capacity of more than 40 thousand board feet; the four smaller mills were eliminated from the analysis, as was another mill for which data were inadequate.⁷

The percentage of the total southern production accounted for by sample mills is shown in table A-9. Coverage ranges from 3.8 to 7.0 percent in the census years from 1927 to 1935. Small mills are quite important in the South, and the sample covers a much greater proportion of the production of large southern mills, for which the sample is reasonably adequate.

Table A-10 shows the relation between the production of sample mills and total southern production, by size groups. With one exception the sample mills cut more than 10 million board feet in 1929; over half of the sample mills cut more than 25 million board feet in that year. These size classes contained less than 3 percent and less than 1 percent, respectively, of the total number of southern mills in 1929. The sample was reasonably adequate, however, for the group of mills which cut more than 25 million board feet in 1929. NRP-NBER mills accounted for 19.8 percent of the production of mills which cut at least 50 million board feet and 12.6 percent of the production of mills which cut 25 to 50 million board feet in 1929. The entire NRP-NBER sample accounted for 8.6 percent of the production of all southern mills which cut more than 10 million board feet in that year.

Table A-11 presents chain indexes, derived as in the case of the Pacific Coast sample, of man-hours, equivalent production, and man-hour requirements per unit of equivalent production for the period 1926-35. Table A-12 presents an index of weighted average labor requirements per unit of equivalent production for all sample mills for which data were available in the respective years, an index of the medians of the ratios for individual mills, and the range of the ratios for each year. The period covered by this table is 1926-35. Unit labor requirements, percentages of capacity utilized, aggregate capacities, and aggregate equivalent production are presented in table A-13 for a group of 12 mills for 1926-35.

Data on production, man-hours, and unit labor requirements were obtained for 1927-35 for two logging camps supplying two of the southern sawmills included in the sample. These data are presented in table A-14.

⁷Of the 23 mills retained in the sample, 20 had a practicably obtainable capacity of at least 12 million board feet; the other 3 had capacities which were in excess of 11.6 million board feet. On the basis of 300 working days per year, these yearly figures can be reduced to daily figures of at least 59 thousand board feet. It is believed that daily capacity figures obtained in this fashion are considerably lower than figures for daily rated capacity; mills included in the NRP-NBER survey are therefore considered to fall within the category of mills having a daily rated capacity of more than 40 thousand board feet. Twelve of the 23 mills [Con.]

BASIS OF SELECTION OF MILLS FOR STUDY

Sawmills and attached planing mills commonly manufacture a variety of products, such as timbers,⁸ rough lumber, surfaced lumber, doors, sashes, molding, lath, boxes, and shingles. These products require a varying quantity of labor time for their manufacture, and it was believed that differences in the relative output of such products might impair comparisons between mills and between years. Accordingly, mills included in the field survey were those which manufactured a relatively small variety of products.

In a further effort to obtain a fairly uniform sample, only sawmills which had planing mills attached were surveyed.⁹

Sizes of lumber may also vary considerably, and each size requires a different amount of labor per board foot. Thus the mills studied were those which produced the general run of sizes common to the industry of the particular section of the country. Because it is possible to cut a greater proportion of timbers from the large trees on the Pacific Coast than from the smaller logs available to southern mills, there is an important difference in lumber sizes produced by sample mills of the two areas.

COMPOSITION OF PRODUCTION AND MAN-HOUR DATA

A number of the mills studied produced byproducts (such as hogged fuel, briquets, and sawdust) and special products (such as lath, shingles, and boxes). Such products and the labor time expended in their production were, on the whole, excluded from the production and man-hour data presented in this report. Man-hours expended in auxiliary services not common to all mills, such as new construction, company stores, retailing, and local delivery by truck, were also excluded. It was not possible in every case, however, to separate and exclude completely the various by-product, special-product, and auxiliary-service items; this is especially true of indirect labor, such as handling, which could not be allocated to production and surfacing of lumber on the one hand and to waste utilization, byproduct manufacture, and the production of minor forest products on the other. Kiln-drying labor, used in some mills but not in others, was included in the data presented.

⁷[Com.] had practicably obtainable annual capacities of more than 24 million board feet. The largest mill included in the sample had a daily practicably obtainable capacity of 305 thousand board feet. (For method of determining practicably obtainable capacity of sample mills see pp. 149-50.)

⁸Timbers are lengths of wood whose smallest diameter is at least 5 inches.

⁹One of the Pacific Coast mills studied did some surfacing but did not have a complete planing mill attached.

Unadjusted production figures represent aggregates of surfaced and un-surfaced lumber produced. The man-hour figures are aggregates of the labor time expended in the pond, the sawmill, the dry kiln, the yard, the planing mill, shipping, power production, maintenance, and other work directly or indirectly connected with lumber production, rough and surfaced.

DERIVATION OF EQUIVALENT PRODUCTION

The operation of a planing mill increases labor requirements without increasing footage produced. Although only sawmills with attached planing mills were surveyed, changes in unit labor requirements of an individual mill or a group of mills may reflect changes in the proportion of the output which is surfaced as well as changing efficiency in the utilization of labor. Differences in unit labor requirements may similarly reflect differences in the proportion of the output which is surfaced.

Unfortunately the data were not sufficiently adequate to permit presentation of separate unit-labor-requirement series for the manufacture of rough and surfaced lumber. An effort was therefore made to adjust the production series in such a fashion that, when divided into the man-hour series, it would yield a series of man-hour ratios which would not be appreciably influenced by shifts or differences in percentage of total output surfaced. The adjusted production is referred to as "equivalent" production.

Planing-mill outputs in each year were multiplied by average ratios of unit labor requirements in planing mills to unit labor requirements in sawmills. The resulting figures (representing theoretically the amount of additional lumber which would have been cut had man-hours expended in the planing mill been expended instead in the sawmill) were added to the sawmill production of the respective mills in order to obtain each mill's equivalent production. Thus the equivalent-production figures exceed the figures for actual production; they represent both rough and surfaced output in terms of rough output.

Ratios used to convert surfaced production to rough production are presented in table A-15. They were computed from reports for mills for which separate planing-mill and sawmill data were available. Separate ratios were computed for Pacific Coast mills, southern pine mills, and southern hardwood mills. Except for the latter group of mills, each of which had a practicably obtainable capacity of less than 50 million board feet, separate ratios were also computed for mills whose practicably obtainable annual capacity was under or over 50 million board feet. Thus

ratios were computed for five distinct groups of mills. For each group ratios were computed for the period preceding 1930 and for the period 1930-35. Each of the ratios shown in table A-15 represents an average of selected ratios for individual mills and years.¹⁰

Examination of table A-15 reveals that the ratios for each area are, in general, similar. For three of the five groups of mills the ratios for 1929 and earlier years were identical with those for 1930-35. In the remaining two cases the proportion of surfaced production added to total rough production rose from 20 to 25 and from 23 to 30 percent. In view of the facts (1) that the production of not all mills in either area was adjusted by ratios which changed over time and (2) that only part of the rough production of the mills was surfaced, the distorting influences on equivalent production exerted by changes in the ratios are believed to be negligible.

DERIVATION OF PRACTICABLY OBTAINABLE CAPACITY

Practicably obtainable capacity was computed for individual logging camps and sawmills on the basis of attained production peaks and normal interruptions of production. The production peak attained for any 3-month period was quadrupled to yield hypothetical annual obtainable capacity under conditions of continuous peak production. This estimate was then adjusted downward in order to take into account necessary shut-downs occasioned by weather or repairs. The adjustment was based on the season during which the 3-month peak occurred and on information obtained from officials and engineers of the operations surveyed.

Where only annual production figures were available, the highest annual figure was inflated to yield practicably obtainable capacity. Annual peaks were multiplied by the median ratio, as observed for operations in the same area for which monthly production data were available, of practicably obtainable capacity to peak annual production.

In some cases further adjustment was made necessary because of known changes in the length of the working day, in the number of shifts per day, and in major equipment items. In other cases further adjustment was made to take into account several discernible production peaks or definite trends in production, either of which might indicate changes in obtainable capacity.

¹⁰Ratios were computed annually for individual mills in each of the five groups of mills. These ratios were then separated according to the period to which they referred. The ratios in each of the 10 groups of ratios were arrayed in order of magnitude, and those occupying a central position in each array were combined into an unweighted average (these averages are shown in table A-15). The number of ratios selected for use in computing the average varied from 3 to 8, depending upon the total number of ratios in the group.

It should be noted that factors other than size of operation may lead to differences in practicably obtainable capacity. For instance, different mills may have working days of different duration, and this would be reflected in the annual practicably obtainable capacities. Particularly, the working day in the South was normally somewhat longer than that on the Pacific Coast.

Table A-1.- TOTAL AND SAMPLE PRODUCTION OF PACIFIC COAST LOGGING CAMPS, 1925-35

Year	Thousands of board feet		Sample as percent of total Pacific Coast
	Total Pacific Coast ^a	Sample ^b	
1925	13,286,699 ^c	417,175	3.1
1927	13,389,525 ^c	684,759	5.1
1929	14,149,301 ^c	1,181,015	8.3
1931	7,493,772	882,731	11.8
1933	6,146,749	958,447	15.6
1935	7,953,477 ^c	887,290	11.2

^aData for 1925-29 from *Fifteenth Census of the United States: 1930, "Manufactures: 1929"* (U. S. Dept. Com., Bur. Census, 1933), II, 447; data for 1931 from *Census of Manufactures: 1931* (U. S. Dept. Com., Bur. Census, 1935), p. 429; data for 1933-35 from same, 1935 (1936), p. 474. Data are for California, Oregon, and Washington, and include only mills producing 50 M ft. b. m. or more.

^bConverted from log scale to board measure. See p. 143.

^cIncludes data for Nevada because output for California and Nevada was reported together. The effect of the inclusion of Nevada is negligible, however, for in 1919, the only year for which separate production data were reported for Nevada, the output of Nevada was only 0.2 percent of the total output of California, Oregon, and Washington.

Table A-2.- TOTAL AND SAMPLE PRODUCTION OF PACIFIC COAST LOGGING CAMPS, BY VOLUME OF PRODUCTION, 1929

Volume of production ^a (M ft. b. m.)	Total Pacific Coast ^b		Sample	
	Production (M ft. b. m.)	Percent	Production (M ft. b. m.)	Percent of total Pacific Coast
Total	14,149,301	100.0	1,181,015	8.3
50-24,999	3,230,747	22.8	0	0
25,000-49,999	3,378,738	23.9	205,688	6.1
50,000 or over	7,539,816	53.3	975,347	12.9

^aOutput of the sawmill to which the logging camp is attached.

^bData from *Fifteenth Census of the United States: 1930, "Manufactures: 1929"* (U. S. Dept. Com., Bur. Census, 1933), II, 448. Data are for California, Nevada, Oregon, and Washington. See table A-1, fn. c.

Table A-9.- PRODUCTION, MAN-HOURS, AND UNIT LABOR REQUIREMENT RATIOS IN SAMPLE PACIFIC COAST LOGGING CAMPS, 1920-35^a

Period	All reporting camps				Two identical camps		
	Number of camps	Production (M ft. b. m., lumber scale)	Man-hours		Production (M ft. b. m., lumber scale)	Man-hours	
			Number	Per M ft. b. m.		Number	Per M ft. b. m.
1920	2	131,113	1,165,448	8.89	131,113	1,165,448	8.89
1921	2	30,353	176,554	5.88	30,353	176,554	5.88
1922	2	122,973	1,097,710	8.93	122,973	1,097,710	8.93
1923	3	117,037	940,538 ^a	8.04 ^a	87,872	699,434 ^a	7.96 ^a
1924	3	179,823	1,412,734	7.86	153,146	1,246,849	8.14
1925	8	417,176	3,046,533	7.30	158,146	1,118,413	7.07
1926	9	504,670	3,063,142	6.07	147,226	996,576	6.77
1927	10	684,759	3,664,650	5.35	153,292	919,756	6.00
1928	13	893,818	5,386,358	6.03	163,034	1,115,384	6.84
1929	16	1,181,016	7,221,313	6.11	161,649	1,052,662	6.51
1930	18	1,267,466	7,019,603	5.54	112,227	686,196	6.11
1931	18	882,731	4,166,374	4.72	53,235	208,299	3.91
1932	15	560,255	2,627,298	4.69	36,084	198,340	5.50
1933	17	956,447	4,376,115	4.58	90,622	527,399	5.82
1934	16	902,592	4,430,051	4.91	76,427	349,023	4.57
1935	15	887,290	4,385,924	4.94	116,012	594,623	5.13
1920-23	-	401,476	3,382,260	8.42	372,311	3,141,146	8.44
1924-26	-	1,101,668	7,522,409	6.83	458,518	3,361,838	7.33
1927-29	-	2,759,592	16,274,321	5.90	477,975	3,087,802	6.46
1930-32	-	2,710,462	13,812,275	5.10	201,546	1,092,835	5.42
1933-35	-	2,746,329	13,194,090	4.80	283,061	1,471,044	5.20
Percentage decrease							
1920-23 to 1924-26	-	-	-	18.9	-	-	13.2
1924-26 to 1927-29	-	-	-	13.6	-	-	11.9
1927-29 to 1930-32	-	-	-	13.6	-	-	16.1
1930-32 to 1933-35	-	-	-	5.9	-	-	4.1

^aAt one of the camps a large proportion of the working time was spent in new construction. Since this would seriously distort the trend of man-hours and unit labor

requirements, the number of man-hours spent in construction at this camp was estimated and subtracted from the total number of man-hours. See ch. III, fn. 23.

Table A-4.- TOTAL AND SAMPLE PRODUCTION OF PACIFIC COAST
SAWMILLS, 1919-35

Year	Thousands of board feet		Sample as percent of total Pacific Coast
	Total Pacific Coast ^a	Sample	
1919	8,798,504	832,295	9.5
1921	7,204,457	988,074	13.7
1923	12,761,833 ^b	2,083,015	16.3
1925	13,288,899 ^b	2,726,757	20.5
1927	13,389,525 ^b	3,668,710	27.4
1929	14,149,301 ^b	2,435,426	17.2
1931	7,493,772	1,583,979	21.1
1933	6,148,749	1,337,719	21.8
1935	7,953,477 ^b	1,543,791	19.4

^aData for 1919 from *Fourteenth Census of the United States: 1920*, Vol. X, "Manufactures: 1919" (U. S. Dept. Com., Bur. Census, 1923), p. 437; data for 1921-23 from *Census of Manufactures: 1923* (U. S. Dept. Com., Bur. Census, 1926), p. 449; for source of data for 1925-35 see table A-1, ft. a. Data are for California, Oregon, and Washington, and except for 1921 include only mills producing 50 M ft. b. m. or more.

^bSee table A-1, ft. c.

**Table A-5.- TOTAL AND SAMPLE NUMBER OF PACIFIC COAST SAWMILLS AND THEIR PRODUCTION,
BY VOLUME OF PRODUCTION, 1929**

Volume of production (M ft. b. m.)	Total Pacific Coast ^a				Sample					
	Mills		Production		Mills			Production		
	Number	Percent	M ft. b. m.	Percent	Number	Percent	Percent of total Pacific Coast	M ft. b. m.	Percent	Percent of total Pacific Coast
Total	1,307	100.0	14,149,301	100.0	33	100.0	2.5	2,435,428	100.0	17.2
50-14,999	1,061	81.2	2,031,951	14.3	0	0	0	0	0	0
15,000-24,999	61	4.7	1,198,798	8.5	4	12.1	6.6	82,826	3.4	6.9
25,000-49,999	93	7.1	3,378,738	23.9	8	24.3	8.6	299,471	12.3	8.9
50,000 or over	92	7.0	7,539,816	53.3	21	63.6	22.9	2,053,129	84.3	27.2
50-14,999	1,061	81.2	2,031,951	14.3	0	0	0	0	0	0
15,000 or over	246	18.8	12,117,350	85.7	33	100.0	13.4	2,435,428	100.0	20.1

^aSee table A-2, fn. b.

Table A-6.- CHAIN AGGREGATIVE INDEXES OF MAN-HOURS, EQUIVALENT PRODUCTION, AND UNIT LABOR REQUIREMENTS
IN SAMPLE PACIFIC COAST SAWMILLS, 1917-35

Year	Number of mills	Given year		Preceding year		Link relative ^a		Chain index (1929=100)		
		Man-hours	Equivalent production (millions of board feet)	Man-hours	Equivalent production (millions of board feet)	Man-hours	Equivalent production	Man-hours ^b	Equivalent production ^c	Unit labor requirements ^d
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1917	-	-	-	-	-	-	-	80.8	55.3	108.9
1918	7	4,221,110	356.0	4,580,294	434.4	0.922	0.820	56.0	45.3	123.6
1919	12	7,945,333	725.9	6,675,623	592.5	1.190	1.225	66.7	55.6	120.0
1920	15	9,880,900	904.2	9,754,204	923.1	1.019	0.990	87.5	54.5	123.9
1921	21	10,292,860	1,012.0	14,279,861	1,292.2	0.721	0.783	48.7	42.6	114.3
1922	24	16,005,799	1,656.6	11,092,835	1,110.2	1.443	1.492	70.3	63.6	110.5
1923	29	21,201,061	2,203.3	16,804,851	1,950.3	1.127	1.130	79.2	71.9	110.2
1924	33	22,620,932	2,511.7	22,371,266	2,326.6	1.011	1.079	80.1	77.6	103.2
1925	37	29,054,235	3,053.6	24,885,614	2,665.5	1.167	1.146	93.4	88.9	105.1
1926	39	31,707,480	3,486.6	29,409,345	3,097.9	1.078	1.125	100.7	100.0	100.7
1927	40	33,399,645	3,695.3	32,806,957	3,619.4	1.018	1.021	102.6	102.1	100.5
1928	42	32,312,898	3,660.6	33,853,231	3,876.9	0.969	0.998	99.4	101.7	97.7
1929	29	19,140,215	2,421.9	19,026,931	2,463.8	1.006	0.933	100.0	100.0	100.0
1930	33	19,609,893	2,516.7	21,369,201	2,773.6	0.918	0.907	91.8	90.7	101.2
1931	33	14,497,108	1,911.9	19,687,126	2,506.7	0.736	0.763	87.5	69.2	97.5
1932	27	9,310,760	1,124.4	13,675,976	1,809.7	0.691	0.621	46.0	43.0	107.0
1933	27	11,478,468	1,538.1	9,310,760	1,124.4	1.233	1.368	56.7	58.6	96.4
1934	31	12,294,650	1,598.6	11,978,678	1,607.6	1.026	0.988	58.2	58.1	100.2
1935	29	13,709,938	1,844.4	11,642,502	1,535.1	1.177	1.201	68.4	69.7	98.1

^aCols. (2) and (3) respectively divided by cols. (4) and (5).

^bComputed from col. (6).

^cComputed from col. (7).

^dCol. (8) divided by col. (9), and multiplied by 100. Similar indexes for 1928-35 for the group of 19 mills included in both surveys and the group of

17 mills included only in the 1936 survey are as follows (1929=100):

Year	All mills	19 mills	17 mills	Year	All mills	19 mills	17 mills
1928	87.7	97.9	97.6	1932	107.0	107.1	106.7
1929	100.0	100.0	100.0	1933	98.4	99.8	93.8
1930	101.2	103.8	98.1	1934	100.2	102.3	98.1
1931	97.5	97.8	97.9	1935	98.1	94.3	102.6

Table A-7.- INDEXES OF AVERAGE AND MEDIAN UNIT LABOR REQUIREMENTS IN SAMPLE PACIFIC COAST SAWMILLS, 1918-35

Year	Number of mills	Number of man-hours	Equivalent production (millions of board feet)	Man-hours required per thousand board feet of equivalent production			Indexes of unit labor requirements (1929=100)	
				All mills, weighted mean ^a	Individual mills		Weighted mean ^b	Median ^c
					Range	Median		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1918	13	7,424,679	670.2	11.08	7.21-19.74	9.62	143.9	125.6
1919	15	9,754,204	923.1	10.57	6.29-21.07	9.66	137.3	126.1
1920	21	14,279,661	1,292.2	11.05	6.28-16.69	10.38	143.5	135.5
1921	24	11,092,835	1,110.2	9.99	5.35-24.66	9.59	129.7	125.2
1922	29	16,804,651	1,950.3	9.64	5.67-13.35	9.40	125.2	122.7
1923	33	22,371,266	2,326.8	9.61	5.54-16.53	10.33	124.8	134.9
1924	37	24,866,614	2,665.5	9.34	4.21-23.97	8.86	121.3	115.7
1925	39	29,409,345	3,097.9	9.49	4.02-19.99	8.47	123.2	110.6
1926	41	33,175,262	3,655.4	9.08	4.59-15.12	7.99	117.9	104.3
1927	44	36,795,105	4,159.2	8.85	4.62-14.75	7.40	114.9	96.6
1928	44	33,003,962	3,957.5	8.34	3.58-14.94	6.81	108.3	88.9
1929	33	21,369,201	2,773.6	7.70	4.48-13.15	7.66	100.0	100.0
1930	35	20,023,445	2,560.3	7.82	4.48-12.06	6.00	101.6	104.4
1931	33	14,497,108	1,911.9	7.58	4.50-11.93	7.98	98.4	104.2
1932	27	9,310,760	1,124.4	8.28	3.90-16.39	7.87	107.5	102.7
1933	31	11,978,678	1,607.6	7.45	3.90-13.54	7.39	96.8	95.5
1934	32	12,561,715	1,626.6	7.72	3.89-12.11	7.55	100.3	98.6
1935	29	13,708,938	1,844.4	7.43	3.85-16.84	6.97	95.5	89.7

^aNumber of man-hours divided by equivalent production.

^bComputed from col. (4).

^cComputed from col. (6).

Table A-8.- UNIT LABOR REQUIREMENTS, PERCENTAGES OF CAPACITY UTILIZED, AND AGGREGATE CAPACITY OF IDENTICAL SAMPLE PACIFIC COAST SAWMILLS, 1920-35

Year	Weighted average of man-hours required per M ft. b. m.		Percentage of capacity utilized ^a		Aggregate annual capacity ^b (millions of feet, b. m.)	
	11 plants	18 plants	11 plants	18 plants	11 plants	18 plants
1920	10.34	n. a.	64.5	n. a.	808	n. a.
1921	9.87	n. a.	46.0	n. a.	828	n. a.
1922	9.95	n. a.	69.3	n. a.	916	n. a.
1923	9.85	n. a.	76.3	n. a.	937	n. a.
1924	9.27	n. a.	70.1	n. a.	977	n. a.
1925	9.09	n. a.	68.8	n. a.	991	n. a.
1926	8.57	8.52	74.1	79.9	1,005	1,711
1927	8.18	8.21	78.0	82.2	1,017	1,725
1928	8.14	7.77	78.7	81.7	1,030	1,739
1929	8.16	7.93	76.1	79.4	1,043	1,753
1930	8.35	8.14	65.3	70.3	1,043	1,693
1931	8.04	7.78	48.6	56.7	1,043	1,693
1932	9.41	8.45	27.3	31.2	1,043	1,697
1933	8.24	7.99	41.1	42.6	1,043	1,697
1934	8.64	8.04	38.2	42.9	1,043	1,697
1935	8.24	7.60	46.9	53.2	1,043	1,697

^aBased on equivalent production and aggregate capacity. See pp. 148-9 and pp. 149-50.

^bPractically obtainable capacity. See pp. 148-9.

n. a. Data not available.

Table A-9.- TOTAL AND SAMPLE PRODUCTION OF SOUTHERN SAWMILLS, 1927-35

Year	Thousands of board feet		Sample as percent of total South
	Total South ^a	Sample	
1927	14,475,897	547,559	3.8
1929	15,462,485	628,637	4.1
1931	5,983,762	421,547	7.0
1933	5,765,491	363,606	6.3
1935	7,828,572	417,910	5.3

^aData for 1927-29 from *Fifteenth Census of the United States: 1930, "Manufactures: 1929"* (U. S. Dept. Com., Bur. Census, 1933), II, 447; data for 1931 from *Census of Manufactures: 1931* (U. S. Dept. Com., Bur. Census, 1935), p. 429; data for 1933-35 from same, 1935 (1938), p. 474. Data are for Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, and Virginia, and include only mills producing 50 M ft. b. m. or more.

Table A-10.- TOTAL AND SAMPLE NUMBER OF SOUTHERN SAWMILLS AND THEIR PRODUCTION,
BY VOLUME OF PRODUCTION, 1929

Volume of production (M ft. b. m.)	Total South ^a				Sample					
	Mills		Production		Mills			Production		
	Number	Percent	M ft. b. m.	Percent	Number	Percent	Percent of total South	M ft. b. m.	Percent	Percent of total South
Total	11,046	100.0	15,482,485	100.0	22	100.0	0.2	828,637	100.0	4.1
50- 9,999	10,728	97.1	8,178,974 ^b	52.9	0	0	0	0	0	0
10,000-14,999 ^c	118 ^b	1.1	1,442,083 ^d	9.3	7	31.8	6.0	77,897	12.4	5.4
15,000-24,999	102 ^d	0.9	2,110,165 ^e	13.6	3	13.7	2.9	52,246	8.3	2.5
25,000-49,999	90 ^e	0.8	3,331,845 ^f	21.6	11	50.0	12.2	419,802	66.7	12.6
50,000 or over	10 ^f	0.1	399,418	2.6	1	4.5	10.0	79,092	12.6	19.8
50- 9,999	10,728	97.1	8,178,974	52.9	0	0	0	0	0	0
10,000 or over	318	2.9	7,283,511	47.1	22	100.0	6.9	828,637	100.0	6.6

^aData from *Fifteenth Census of the United States: 1930, "Manufactures: 1929"* (U. S. Dept. Com., Bur. Census, 1933), II, 448. For States included see Table A-9, fn. a.

^bProduction data for 1 of the 118 mills producing 10,000-14,999 M ft. b. m. are included with production data for mills producing 50-9,999 M ft. b. m.

^cSample data include one mill with an output of 9,500-10,000 M ft. b. m.

^dProduction data for 2 of the 102 mills producing 15,000-24,999

M ft. b. m. are included with production data for mills producing 10,000-14,999 M ft. b. m.

^eProduction data for 5 of the 90 mills producing 25,000-49,999 M ft. b. m. are included with production data for mills producing 15,000-24,999 M ft. b. m.

^fProduction data for 4 of the 10 mills producing 50,000 M ft. b. m. or over are included with production data for mills producing 25,000-49,999 M ft. b. m.

Table A-11.-- CHAIN AGGREGATIVE INDEXES OF MAN-HOURS, EQUIVALENT PRODUCTION, AND UNIT LABOR REQUIREMENTS
IN SAMPLE SOUTHERN SAWMILLS, 1925-35^a

Year	Number of mills	Given year		Preceding year		Link relative ^b		Chain index (1929=100)		
		Man-hours	Equivalent production (millions of board feet)	Man-hours	Equivalent production (millions of board feet)	Man-hours	Equivalent production	Man-hours ^c	Equivalent production ^d	Unit labor requirements ^e
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1925	-	-	-	-	-	-	-	97.4	100.6	96.8
1926	10	7,039,129	452.7	6,979,318	454.6	1.009	0.998	98.2	100.2	98.0
1927	14	9,335,825	572.1	8,934,570	536.9	1.045	1.066	102.6	106.8	96.1
1928	17	10,202,213	592.2	10,583,951	654.5	0.964	0.905	98.9	96.7	102.3
1929	21	12,012,694	740.1	11,894,654	715.8	1.011	1.034	100.0	100.0	100.0
1930	22	10,399,636	677.0	12,461,294	765.1	0.835	0.985	83.5	88.5	94.4
1931	22	8,238,180	499.2	10,399,636	677.0	0.792	0.737	66.2	65.3	101.4
1932	23	6,743,470	415.3	8,430,446	520.8	0.800	0.798	53.0	52.1	101.7
1933	22	6,681,144	449.8	6,166,694	393.2	1.083	1.144	57.4	59.7	96.1
1934	22	5,800,104	364.9	6,691,144	449.8	0.869	0.811	49.8	48.4	102.9
1935	21	6,450,106	530.4	6,291,264	371.6	1.343	1.427	65.8	69.0	96.8

^aOne of the mills covered in this table cut 9,500-10,000 M ft. b. m. in 1929; the others cut at least 10,000 M ft. b. m. in that year.

^bCols. (2) and (3) respectively divided by cols. (4) and (5).

^cComputed from col. (6).

^dComputed from col. (7).

^eCol. (8) divided by col. (9), and multiplied by 100.

Table A-12.- INDEXES OF AVERAGE AND MEDIAN UNIT LABOR REQUIREMENTS IN SAMPLE SOUTHERN SAWMILLS,
1926-35

Year	Number of mills	Number of man-hours	Equivalent production (millions of board feet)	Man-hours required per thousand board feet of equivalent production			Indexes of unit labor requirements (1929=100)	
				All mills, weighted mean ^a	Individual mills		Weighted mean ^b	Median ^c
					Range	Median		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1926	14	8,934,570	536.9	16.84	12.85-54.40	16.27	102.1	104.5
1927	17	10,583,951	654.5	16.17	12.78-22.59	16.87	99.3	108.3
1928	21	11,884,654	715.8	16.80	10.40-29.77	14.73	101.9	94.8
1929	22	12,461,294	765.1	16.29	11.46-28.19	15.57	100.0	100.0
1930	22	10,399,636	677.0	15.36	12.54-22.68	15.63	94.3	100.4
1931	23	8,430,446	520.3	16.20	9.11-24.95	16.52	99.4	106.1
1932	23	6,743,470	415.3	16.24	9.82-37.95	17.95	99.7	115.3
1933	22	6,681,144	449.8	14.85	7.73-23.45	16.48	91.2	105.8
1934	23	6,647,283	387.8	17.14	7.89-36.99	17.64	105.2	113.3
1935	21	8,450,106	530.4	15.93	7.65-29.04	16.01	97.6	102.8

^aNumber of man-hours divided by equivalent production.

^bComputed from col. (4).

^cComputed from col. (6).

Table A-13.- UNIT LABOR REQUIREMENTS, PERCENTAGE OF CAPACITY UTILIZED, AGGREGATE CAPACITY, AND AGGREGATE PRODUCTION OF 12 SAMPLE SOUTHERN SAWMILLS, 1926-35

Year	Weighted average of man-hours required per M ft. b. m.	Percentage of capacity utilized ^a	Aggregate annual capacity ^b (millions of feet, b. m.)	Aggregate annual equivalent production ^c (millions of feet, b. m.)
1926	15.34	87.4	459	401
1927	16.00	86.1	459	395
1928	16.84	72.8	449	327
1929	15.99	81.5	449	366
1930	15.02	71.0	449	319
1931	16.97	52.1	449	234
1932	16.35	47.0	449	211
1933	15.59	50.8	449	228
1934	16.71	39.9	449	179
1935	15.73	55.5	449	249

^aBased on equivalent production and aggregate capacity. See pp. 148-9 and 149-50.

^bPractically obtainable capacity. See pp. 149-50.

^cSee pp. 148-9.

Table A-14.- PRODUCTION, MAN-HOURS, AND UNIT LABOR REQUIREMENTS OF TWO SAMPLE SOUTHERN LOGGING CAMPS, 1927-35^a

Period	Production (M ft. b. m., lumber scale)	Man-hours	
		Number	Per M ft. b. m.
1927	27,445	394,178	14.36
1928	24,428	364,816	14.93
1929	22,217	370,026	16.66
1930	23,658	315,152	13.32
1931	20,977	267,456	12.75
1932	16,418	265,393	14.41
1933	17,523	248,861	14.20
1934	11,824	149,891	12.69
1935	20,068	261,614	13.04
1927-29	74,090	1,129,020	15.24
1930-32	69,053	848,001	13.45
1933-35	49,415	660,366	13.86
Percentage decrease			
1927-29 to 1930-32	-	-	11.7
1930-32 to 1933-35	-	-	0.7
1927-29 to 1933-35	-	-	12.3

^aOne of these camps supplied a mill whose practically obtainable capacity was 12 million board feet per year; the other, a mill whose practically obtainable capacity was 21 million board feet per year. Both camps cut yellow pine principally.

Table A-15.- RATIO OF PLANING-MILL TO SAWMILL UNIT LABOR REQUIREMENTS OF SAMPLE SAWMILLS, BY REGION, MILL CAPACITY, AND PERIOD^a

Period	Pacific Coast mills		Southern pine mills		Southern hardwood mills, less than 50 million board feet
	Less than 50 million board feet	50 million or more board feet	Less than 50 million board feet	50 million or more board feet	
Number of mills	2	5	5	3	3
Ratio					
Before 1930	0.19	0.20	0.32	0.23	0.37
1930-35	0.19	0.25	0.32	0.30	0.37

^aFor method of computing ratios see pp. 148-9. Mill-capacity figures refer to practicably obtainable annual capacity (for method of determining practicably obtainable capacity see pp. 149-50).

APPENDIX B.

DESCRIPTION OF DATA FROM NRP MACHINERY-MANUFACTURERS SURVEY¹

Data were obtained in a field survey covering 14 equipment-manufacturing companies conducted by the National Research Project in cooperation with the National Bureau of Economic Research. From these companies was obtained the value of sales (and in some instances the number of units sold), chiefly for the period 1920-36, of equipment used in the manufacture of lumber. Of these companies, seven produced sawmill or other woodworking equipment, three produced lumber carriers, two produced tractor logging equipment, and three produced excavating equipment.²

SAWMILL AND OTHER WOODWORKING EQUIPMENT

The woodworking-machinery sales data include equipment employed in sawmills and in planing mills attached to sawmills and, in addition, a wide variety of equipment used in other woodworking industries. The sales of companies covered in the survey have accordingly been divided into the following three categories:

1. Sawmill machinery. This category includes large band mills, portable circular sawmills, steam feeds, carriages, edgers, trimmers, gang saws, large vertical resaws, large horizontal resaws, cut-off saws, and circular rip-saws.

2. Heavy planing-mill machinery used in planing mills attached to sawmills, and including only machines that would be used for the surfacing and finishing of lumber as discussed in this report. This category includes planers, planer-matchers, planer-matcher-molders, planer-matcher-floorers, band resaws, vertical resaws, rip-saws, surfacers, and molders.

3. Light woodworking machinery. This category contains items of machinery used to some extent in planing mills attached to sawmills, but the sales represent mainly equipment used in furniture factories and other woodworking establishments which are not attached to the lumber industry as defined in this report. It includes small planers, gang planers, cabinet planers, small planer-matchers, hand planers-and-jointers,

¹Except as specified, the data included in this appendix were collected in a field survey conducted by the National Research Project in cooperation with the National Bureau of Economic Research. Harry Jerome participated in the planning of the survey and J. Van Horn Whipple organized the field work and supervised the editing of the materials collected.

²One of the companies produced equipment in two of the indicated categories.

small surfacers, small cut-off saws, scroll saws, shapers, small molders, woodworkers, sanders, wood lathes, tenon machines, mortisers-and-tenoners, hand jointers, sash and door stickers, and band, siding, and circular resaws.

Data obtained from three of the companies were for sales of sawmill and heavy planing-mill machinery only. The remaining four produced equipment falling in two or more of the three categories, and the allocation of sales to these categories was made on the basis of the sales of individual new machines.

The data obtained for two of the seven companies represented inseparable totals for sales of new machines, repairs, and parts. Sales of repairs and parts were separated and eliminated in the case of the other five companies.

The value of sales of woodworking machinery by these seven manufacturers is presented in table B-1 according to the three categories noted above. Sales of some of the companies were not available for a few years of the period 1920-36. For such years sales of the companies for which data were lacking were estimated on the basis of the average proportions that the sales of these companies comprised of the sales of other companies manufacturing similar products. The proportions were computed for years for which the sales of all companies were available. One of the companies required such estimates for the period 1920-27. It was necessary in the case of two companies to divide estimated total sales of woodworking equipment into sales of sawmill and planing-mill equipment. This was done on the basis of the percentage of all sales of the individual companies accounted for by sales of sawmill and planing-mill equipment. In one instance estimates for the last 2 months of 1936 were made on the basis of the average for the first 10 months.

Table B-2 presents a comparison of the value of sales of sawmill and heavy planing-mill machinery by the seven companies and the value of sawmill machinery as estimated by the code application division of the National Recovery Administration.

Of the 39 subdivisions of the machinery and allied products industry specified by the NRA, 1 manufactured woodworking machinery with the exception of sawmill machinery and 1 manufactured sawmill machinery, defined as equipment "for use in sawmills for converting saw logs or timbers into lumber and other timber products."³ Since it is not certain whether planing-mill machinery, even of the limited types contained in

³National Recovery Administration, *Codes of Fair Competition*, Nos. 330-373 (Approved Code No. 347, Mar. 17, 1934), VIII, 242, 245.

the sample, is included in sawmill machinery as defined by the NRA, the comparisons in table B-2 are made on the basis of two sample totals, one including and one excluding sales of heavy planing-mill machinery.

Examination of table B-2 reveals that the volume of sales obtained in the survey fluctuates closely with the values reported to NRA. The percentage which the sample series including sawmill and heavy planing-mill machinery comprises of the NRA series varies between 51 and 63; the percentage which the sample series including only sawmill machinery comprises of the NRA series varies between 38 and 48.

The NRA registered 17 manufacturers of sawmill machinery, and it was estimated that 7 of these concerns accounted for 75 percent of the sales.⁴ The NRP machinery-manufacturers survey included five producers of sawmill machinery and two producers of planing-mill machinery. Three of the five producers of sawmill machinery also manufactured planing-mill machinery.

The biennial *Census of Manufactures* has reported the value of production of woodworking machinery; since 1927 it has also reported on woodworking power-saw blades. Table B-3 presents a comparison between the value of total sales of the seven manufacturers included in the survey and the value of production of all woodworking machinery as reported by the *Census of Manufactures*.

The percentage which the value of sample sales comprises of the value of total production declines steadily from 1925 to 1935. It seems reasonable to assume that sales of sawmill and heavy planing-mill machinery may have declined proportionately more than the sales of other woodworking machinery. If this were so, it would account in part, at least, for the decline in the percentage of the value of total production represented by the sales sample.

LUMBER CARRIERS

Data obtained for three of the companies surveyed refer principally to the value of sales of the straddle-truck type of lumber carrier. These data included the sales values of a small front-lift truck used for piling lumber (this machine embodies the operating principles of the front-lift device which constitutes a special feature of one of the straddle-truck carriers). In the case of two of the three companies, only total sales of all equipment were available for a few years of the period 1920-36, and it was necessary to estimate the value of their sales of lumber carriers for these years. The estimates were made on the basis

⁴W. H. Dillingham, Report on NRA Pre-Code Labor and Production Statistics (National Research Project memorandum, 1936, based on NRA file materials).

of the average of the ratios in surrounding years of the value of sales of lumber carriers to total value of sales of the company in question. One company began manufacturing carriers in 1927, and sales for 1927 and 1928 were estimated by straight-line interpolation between 1929 and the known zero in 1926. For two of the companies 1936 data were available only for the first 9 months; sales for the last 3 months were estimated from the 9-month average.

The three carrier-manufacturing companies surveyed are the only producers of lumber carriers at the present time; other producers have never been important. The sample of sales shown in table B-4 is therefore believed to represent practically all of the sales of lumber carriers during the period 1920-36.

The sales data for these machines do not represent sales made only to the lumber industry. Sales of carriers of the type discussed here to industries engaged in activities other than the fabrication and distribution of lumber products have been small in volume; on the other hand, many carriers are employed in the wholesale and retail distribution of lumber.

TRACTOR LOGGING EQUIPMENT

Data for two of the companies surveyed cover the value of sales of tractor hoists and logging arches. Only total sales of all equipment were available for 1932 and 1933 for one of these companies, and it was necessary to estimate the value of sales of tractor logging equipment for these years. The estimates were made on the basis of the average of the 1931 and 1934 ratios of the company's sales of tractor logging equipment to its total sales. Data for one of the two companies were available only through the first 9 months of 1936; sales for the last 3 months were estimated from the 9-month average.

There are no comparable data with which to compare sample sales of tractor logging equipment. An examination of trade journals indicates that the two companies surveyed are among the leading advertisers of this equipment. It seems likely that the sample of sales shown in table B-5 reflects the course of the sales of this equipment with reasonable accuracy.

EXCAVATING EQUIPMENT

Each of the three excavating-equipment companies surveyed manufactured power shovels, and one also produced locomotive cranes.

The sales of power shovels and locomotive cranes to the lumber industry account for only a small proportion of the total sales of excavating equipment of the three companies. Their total sales, however, comprise a large portion of the total production of this type of equipment. They represent between 33 and 61 percent of the total volume of production of power shovels and locomotive cranes (see table B-6).

Repairs and resales make up a considerable portion of the sales of two of these companies; for the third, available data cover only new units. The *Census of Manufactures* normally includes in its detailed production tables only new units and parts, listing receipts for repair work separately. It is therefore likely that the percentages shown in table B-6 are inflated.

The total-sales series was partly estimated. For one company the 1936 data were obtained for only 9 months; figures for the last 3 months were estimated on the basis of the monthly average for the first 9 months. For another company the figures for 1920 and 1936 were estimated on the basis of the ratios in 1921 and 1935, respectively, of the sales of this company to the sales of the other two.

**Table B-1.- VALUE OF SALES OF WOODWORKING MACHINERY
BY SEVEN COMPANIES, BY TYPE OF EQUIPMENT, 1920-36^a**

(Thousands of dollars)

Year	Total	Sawmill	Planing-mill (heavy finishing)	Planing and woodworking
1920	3,893	2,843	681	569
1921	2,089	1,370	344	375
1922	2,454	1,509	439	506
1923	3,316	2,108	619	591
1924	3,301	2,091	592	618
1925	2,387	1,280	489	618
1926	2,653	1,648	471	534
1927	1,865	1,039	372	454
1928	1,587	933	325	329
1929	1,956	1,222	344	390
1930	1,161	731	230	200
1931	555	324	115	116
1932	230	126	39	65
1933	338	198	114	38
1934	401	253	107	41
1935	516	303	165	48
1936	907	628	203	76

^a For definition of specified types of machinery see pp. 162-3.

**Table B-2.-- VALUE OF TOTAL SALES AND SAMPLE SALES
OF WOODWORKING MACHINERY, 1928-32**

Year	Total sales ^a (thousands of dollars)	Sales of seven companies ^b (thousands of dollars)		Percent of total sales accounted for by sample sales of -	
		Sawmill machinery	Planing-mill (heavy finishing) machinery	Sawmill machinery ^c	Sawmill and planing-mill (heavy finishing) machinery ^c
1928	2,440	939	325	38.2	51.6
1929	2,540	1,222	344	48.1	61.7
1930	1,608	731	230	45.5	59.8
1931	780	324	115	42.8	57.8
1932	261	128	39	48.3	63.2

^aW. H. Dillingham, Report on NRA Pre-Code Labor and Production Statistics (National Research Project memorandum, 1936, based on NRA file materials).

^bTable B-1.

^cThe series presented may not be strictly comparable. It is not known whether the NRA figures include sales of parts and repairs; except for two of the seven companies, such sales are not included in the sample series. The percentages may therefore understate or overstate the coverage of the sample.

**Table B-3.-- VALUE OF TOTAL PRODUCTION AND SAMPLE SALES
OF WOODWORKING MACHINERY, 1925-35**

Year	Value (thousands of dollars) of -		Percent 7-company sales are of total production ^c
	Total production ^a	Total sales of seven companies ^b	
1920	n. a.	6,508	-
1921	(d)	3,518	-
1922	n. a.	4,064	-
1923	(d)	5,394	-
1924	n. a.	5,103	-
1925	49,861 ^e	4,112	8.2
1926	n. a.	4,320	-
1927	37,213	3,054	8.2
1928	n. a.	2,769	-
1929	41,827	3,322	7.9
1930	n. a.	2,185	-
1931	13,968	1,090	7.8
1932	n. a.	471	-
1933	6,717	599	6.6
1934	n. a.	784	-
1935	15,683	843	5.4
1936	n. a.	1,708	-

^aIncludes woodworking machinery and woodworking power-saw blades. Data for 1925-29 from *Fifteenth Census of the United States: 1930, "Manufactures: 1929"* (U. S. Dept. Com., Bur. Census, 1933), II, 979, 1102; data for 1931 from *Census of Manufactures: 1931* (U. S. Dept. Com., Bur. Census, 1935), pp. 820, 938; data for 1933 and 1935 from same, 1935 (1938), pp. 911, 1056.

^bRepresents gross sales.

^cThe *Census of Manufactures* production figures normally refer to new units and parts; receipts for repair work are listed separately. The 7-company series represents gross sales and includes inseparable items for parts and repairs. Although receipts from repairs comprised a small but indeterminate proportion of the total for repairs and parts, it is likely that the percentages are somewhat inflated.

^dFigures for woodworking machinery only are \$25,482,000 for 1921 and \$44,447,000 for 1923. No effort was made to extrapolate figures for woodworking power-saw blades as was done in the case of 1925.

^eData for woodworking power-saw blades were not reported for 1925. The value was estimated by multiplying the value of woodworking machinery in 1925 by the 1927 ratio of the value of woodworking power-saw blades to the value of woodworking machinery.

n. a. Data not available.

Table B-4.- VALUE OF SALES OF LUMBER CARRIERS, 1920-36^a

Year	Thousands of dollars	Year	Thousands of dollars
1920	236	1929	506
1921	109	1930	251
1922	299	1931	178
1923	589	1932	63
1924	447	1933	123
1925	437	1934	178
1926	555	1935	388
1927	393	1936	690
1928	410		

^aData refer to sales by the only three manufacturers of this equipment at the time of the survey. Sales to retail and wholesale distributors of lumber are included, as is the small volume of sales to other industries.

Table B-5.- VALUE OF SALES OF LOGGING ARCHES AND TRACTOR HOISTS BY TWO COMPANIES, 1929-36

(Thousands of dollars)

Year	Logging arches	Tractor hoists	Year	Logging arches	Tractor hoists
1929	85	456	1933	21	85
1930	63	280	1934	61	186
1931	19	129	1935	108	362
1932	20	9	1936	169	601

Table B-6.- VALUE OF TOTAL PRODUCTION AND SALES
BY THREE COMPANIES OF POWER SHOVELS
AND LOCOMOTIVE CRANES, 1919-36

Year	Value of total production ^a (thousands of dollars)	Value of sales by three companies			
		Total ^b		To lumber industry ^c	
		Thousands of dollars	Percent of value of total production	Thousands of dollars	Index (1925=100)
1919	15,368 ^d	n. a.	-	n. a.	-
1920	n. a.	14,478 ^e	-	245	121.9
1921	15,867 ^d	5,422	34.2	97	48.3
1922	n. a.	9,074	-	218	108.5
1923	29,226 ^d	14,112	48.3	450	223.9
1924	n. a.	11,648	-	187	93.0
1925	32,835 ^f	12,547	38.2	201	100.0
1926	n. a.	13,005	-	158	78.6
1927	36,494 ^f	12,742	33.1	142	70.6
1928	n. a.	14,878	-	196	97.5
1929	49,301	16,952	34.4	111	55.2
1930	n. a.	9,941	-	89	34.3
1931	20,442	8,183	40.0	25	12.4
1932	n. a.	3,507	-	15	7.5
1933	5,095	3,108	61.0	0	0
1934	n. a.	4,568	-	24	11.9
1935	13,295	6,282	47.3	0	0
1936	n. a.	8,218 ^e	-	66	32.8

^aBased on *Census of Manufactures: 1925* (U. S. Dept. Com., Bur. Census, 1928), p. 1031; *1929* (1933), II, 1099; and *1935* (1936), p. 1076.

^bData are from NRP machinery-manufacturers survey and cover two companies manufacturing power shovels and one company manufacturing both power shovels and locomotive cranes. Data for the latter company are for new units only (no repairs or rebuilt equipment). Data for the former companies include repairs and resales. In the case of one, about 70 percent of the sales represented sales of new units, about 20 percent represented resales, and about 10 percent represented parts. In the case of the other, about one-third represented repairs.

^cIncludes complete units only. Some rebuilt units may be included. The company manufacturing both power shovels and locomotive cranes sold only the latter to the lumber industry.

^dData for locomotive cranes were not reported for 1919, 1921, and 1923. Values were estimated by multiplying the value of power shovels in these years by the 1925 ratio of the value of locomotive cranes (see fn. f) to the value of power shovels.

^ePartly estimated.

^fCrawler and locomotive cranes were reported in combination in 1925 and 1927. The value of locomotive cranes only was estimated on the basis of the 1929 proportions.

n. a. Data not available.

APPENDIX C

DESCRIPTION OF DATA FROM WEST COAST DIRECTORY

The *West Coast Lumberman*, a trade publication of the Pacific Coast lumber industries, has published periodically its *Handbook and Directory of the Western Timber Industries*. The sections on the lumber industry contained information for concerns operating logging camps and sawmills in each of the various localities.¹

NATURE OF THE DATA

Many of the concerns listed reported their approximate daily capacity and the nature of their principal items of equipment. In a considerable number of instances the number of items of equipment was also reported.

A particular virtue of the directories as a source for equipment data is that they cover a large number of operations. The 1935-36 directory, for instance, listed 1,477 Pacific Coast operations.² The number of Pacific Coast mills reported by the *Census of Manufactures* for 1935 was only 1,090.³ This difference may be explained only in part by the fact that the census figure does not include establishments whose products for 1935 were valued at less than \$5,000.

The 1933, 1935-36, and 1937 editions of the directories were used as the basis for tabulations designed to indicate techniques utilized by Pacific Coast logging camps and sawmills. According to the publishers of the directory, the material in the 1933 and 1937 directories was collected during the early months of the date year and the late months of the preceding year. The publishers did not specifically state the period during which materials for the 1935-36 directory were collected, and it was assumed that this material was collected late in 1935 and early in 1936. The data from these directories were therefore considered to refer to the years 1933, 1936, and 1937.

Unfortunately, reports for many of the operations did not contain information on equipment. Since there is evidence to indicate that reports for smaller operations were considerably more deficient in this respect

¹Some concerns had establishments in several localities and were accordingly listed in each. In such cases the various establishments were considered to be separate operations and were so treated in tabulations based on the directories.

²Logging camps and sawmills were counted as separate operations unless they were operated by the same concern in the same locality, in which case the sawmill and its logging camp were counted as a single operation.

³*Census of Manufactures: 1935* (U. S. Dept. Com., Bur. Census, 1936), p. 476.

than reports for larger operations,⁴ equipment data for operations of all sizes would therefore be of doubtful significance. In individual size groups, however, this source of distortion is minimized. Because many reports also failed to indicate the capacity of the operation, a large proportion of the operations had to be excluded from the tabulations.⁵ Another reason for the exclusion of a number of operations from the tabulations was that reports in earlier directories were less detailed than those for 1937; this could be offset only by including in time comparisons those operations for which adequate reports were available for 1933 and 1937 and for 1936 and 1937.

DESCRIPTION OF THE TABULATIONS

Logging Camps

In order to determine changes over time and differences between camps of different size with respect to log-yarding equipment of Pacific Coast camps, a tabulation was made of operations reporting such equipment. Because operating conditions differ according to size, camps included in the tabulations were separated into five size groups, which are based on reported daily capacity.⁶ Comparisons were made for each size group between 1933 and 1937 and between 1936 and 1937. In order that distortion due to incomplete reporting might be avoided, the only camps included in the 1933-37 comparisons were those which reported for both years the type of log-yarding equipment in use. Camps which failed to report on the number of units in use were included, for the tabulation was intended to indicate, for each of the two years, how many camps used donkey engines only, tractors only, or both. The size group to which a camp was assigned was determined by the daily capacity reported for 1937. Where the 1937 estimate was not available, the 1933 estimate was used. Where neither was available, the camp was not included in the tabulation. The procedure followed for the 1933-37 comparisons was also followed for the 1936-37 comparisons. Because a number of the camps for which adequate 1937 reports were available could not be included in the 1933-37 or 1936-37 comparisons, a separate distribution by size of camp

⁴See p. 175.

⁵The various tabulations are described in the following section.

⁶The reported size of an operation is based on the owner's estimate of the daily capacity of his operation. Since differing criteria may have been used by the various owners, the meaning and comparability of these estimates are open to some question. A number of the operations were covered in the NRP-NBER logging-camp and sawmill survey, and estimated daily capacities as reported to NRP-NBER field agents are quite similar to those published in the directories. The similarity suggests that the estimates in the directories are carefully considered ones. In any event, the figures as published are probably sufficiently accurate to show generally the differences in equipment associated with differences in size of operations.

and type of log-yarding equipment was made for all camps whose 1937 reports were sufficiently detailed to permit this. The results of the log-yarding tabulation are presented in table C-1. State break-downs of the 1937 distribution are shown in table C-2.

A tabulation similar to that for log-yarding equipment was made for log-hauling equipment (locomotives and trucks). The results are presented in tables C-3 and C-4.

A construction-equipment (bulldozers and power shovels) tabulation, shown in table C-5, was also made. In this tabulation, however, no effort was made to make comparisons over time, and the data refer to 1937 only. Furthermore, the basis for selection of camps to be included in the tabulation differed. It was believed that all camps required log-yarding and log-hauling equipment, and therefore differences in techniques could be indicated by differences in the types of equipment in use. Not all camps, however, have need for construction equipment of their own, and a different criterion was sought for inclusion of camps in the construction-equipment tabulation. The criterion selected was completeness of reporting; the test for this was: did the camp report adequately on the type of log-yarding or log-hauling equipment used? Thus the "Number of camps reporting" in table C-5 includes all camps included in the distributions of "All camps reporting in 1937" as shown in tables C-1 and C-3.

It should be noted that the changes over time shown by this series of tabulations, based as they are on groups of identical companies, may be somewhat biased. It was not possible to trace changes in ownership of the camps, nor was it feasible to trace changes in location. Thus the groups of camps are identical with respect to ownership and location as well as completeness of reporting. Such camps are likely to be more stable than the average in terms of the length of the period of cutting at a single location and are therefore likely to employ methods which are somewhat different from those employed by camps which move frequently. This applies particularly to the methods used for hauling logs.

It should be recognized, furthermore, that changes in techniques over a period of time for the Pacific Coast as a whole are likely to be minimized by a consideration of data for identical camps, for new camps are likely to employ new techniques.

Another series of tabulations was made. This series is concerned with the number of units of particular types of equipment in use rather than with the number of camps using them. There are three tabulations in the

series dealing, respectively, with log-yarding, log-hauling, and construction equipment. No distinction is made between units used in small and large camps. In this series, as in the preceding one, data for 1933 and for 1936 are separately compared with data for 1937.

In the tabulation dealing with log-yarding equipment the number of donkey engines and the number of tractors used by a group of camps in 1933 are compared with the number of each used by the same camps in 1937. Data used in the tabulation are for those camps which reported on the number of units of log-yarding equipment and on type of log-hauling equipment in both years.⁷ Failure to report on daily capacity did not constitute grounds for exclusion. The description of the 1933-37 comparisons also applies to the 1936-37 comparisons. In addition to these comparisons over time for groups of identical camps, the number of donkey engines and the number of tractors used by all camps which had sufficiently detailed reports were counted for 1936 and 1937. The results of this tabulation are presented in table 8.

Similar tabulations were made for log-hauling equipment (number of trucks and railroad mileage) and construction equipment (number of power shovels and number of bulldozers); these are shown in tables 9 and 10. Because of the fact that bulldozers were not introduced in Pacific Coast logging camps until 1932, adequate data for 1933 could not be obtained; the 1933-37 comparison for bulldozers is accordingly omitted from table 10. The criteria used for selecting camps to be included in the log-yarding tabulation were used in the case of the log-hauling tabulation. In the case of the construction-equipment tabulation, however, some modification was necessary because of the fact that not all camps needed construction equipment of their own. Camps included in the construction tabulation were those which reported the types of log-yarding or log-hauling equipment in use in both years; thus the camps included in the construction tabulation (table 10) include all camps included in either the log-yarding or log-hauling tabulations (tables 8 and 9).

The changes over time indicated by this second series of tabulations for logging camps, being based on the experience of identical camps, are subject to the kind of bias discussed in connection with the first series. Unlike the first series, which deals separately with camps of different size, these tabulations are subject to bias introduced by the relative overrepresentation of the larger camps.

⁷Such camps are believed to have reported fully on type of equipment. Accordingly, a camp which did not report at all on a given type of yarding equipment for one of the two years was assumed to have used no units of that type of yarding equipment in that year, and data for the camp were included in the tabulation. However, a camp that reported the use of a given type of yarding equipment without specifying the number of units in use was not included.

Sawmills

Information appearing in the 1935-36 edition of the directory was used in order to distribute sawmills by type of headsaw used (band saws only, circular saws only, or both) and by type of power used (steam only, electric only, or both).⁸ These distributions were made separately for each of the five size groups.⁹ All mills which indicated the type of headsaw used were included in the type-of-headsaw tabulation provided that they reported also their daily capacity. Similar criteria were used for the inclusion of mills in the type-of-power tabulation. The results of these tabulations are presented in table C-6.

Table C-7 presents the results of a third tabulation of sawmill equipment. This tabulation was made by counting the number of mills which reported using specified types of equipment. As in the case of the other two tabulations, the mills were assigned to their appropriate size class; where this could not be done, the mills were not counted. The first line of figures of table C-7 indicates the total number of mills reporting on any type of sawmill equipment in use and on daily capacity.

COVERAGE OF THE TABULATIONS

Indications of the extent of the coverage of the tabulations of logging camps according to types of equipment in use are given in table C-8. In table C-9 are given similar figures for the tabulations on number of units of such equipment. Table C-10 gives the coverage of the type-of-headsaw and type-of-power tabulations for sawmills. The measure of coverage used is the percentage that the number of logging camps or sawmills used in a given tabulation for a given year is of the total number of logging camps or sawmills listed in the directory for that year.

With respect to the tabulations of logging camps reporting type of equipment in use, 31 to 37 percent of the camps in the 1933 directory were included in the tabulation. Of the camps listed in the 1935-36 directory, 29 to 39 percent were included in the tabulation. Of the camps in the 1937 directory, 43 to 56 percent of the camps reported in sufficient detail to permit their inclusion in the distribution made for 1937.

Corresponding percentages for the tabulations dealing with the number of logging-camp equipment units in use are as follows: 24 to 27 for 1933, 22 to 25 for 1935-36, and 58 for 1937.

⁸An examination of data for other years indicated that changes in sawmill equipment over the period of time covered by the available directories (1933-37) were not of sufficient magnitude to warrant separate tabulations for each year.

⁹See fn. 8 of this appendix.

The type-of-headsaw tabulation for sawmills covered 46 percent of the sawmills listed in the 1935-36 directory; the type-of-power tabulation covered 38 percent.

The State distributions of the logging camps and sawmills included in the various tabulations were reasonably similar to the distributions of all listed logging camps and sawmills. This may be seen in tables C-8 to C-10, which present also the State coverages of the various tabulations. It will be noted that California logging camps are relatively overrepresented in most of the tabulations; Washington logging camps, on the other hand, are least adequately represented. This situation is reversed in the case of the sawmill tabulation.

In order that the characteristics of operations which reported might be compared with those of operations which did not report, special enumerations were made of operations listed in the 1935-36 directory. Operations were separated into two classes: those which reported on capacity and on some types of equipment and those which failed to report on one or both of these items. The first class includes operations eligible for inclusion in one or more of the tabulations; the second includes operations which could not have been included. The two classes were subdivided according to type of ownership - company, partnership, or individual. The numbers of operations in each class and subdivision are given in table C-11.

Table C-12 presents a distribution of those operations owned individually or in partnership which were eligible for inclusion in at least one of the tabulations. An examination of this table shows that an overwhelming majority of the operations having such ownership are in the smallest size class (daily capacity of 1 to 49 thousand board feet) and are concentrated in the lower half of that size class. With but few exceptions, none of the operations distributed in table C-12 had a daily capacity exceeding 100 thousand board feet.

An examination of data in table C-11 in the light of the data in table C-12 suggests that a majority of those operations which could not be included in any of the tabulations were in the smaller size groups. Whereas only 21 percent of the operations eligible for inclusion in the various tabulations were owned individually or in partnership, 58 percent of the ineligible operations had such ownership. It therefore appears likely that the tabulations are appreciably more representative of the larger operations.

Table C-1.- NUMBER OF PACIFIC COAST LOGGING CAMPS REPORTING ON LOG-YARDING EQUIPMENT, BY DAILY CAPACITY AND TYPE OF EQUIPMENT, 1933, 1936, AND 1937

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MECHANIZATION IN THE LUMBER INDUSTRY

Years and type of equipment	Daily capacity (M ft. b. m.) ^a									
	1-49		50-99		100-249		250-499		500 or over	
	Earlier year	1937	Earlier year	1937	Earlier year	1937	Earlier year	1937	Earlier year	1937
152 camps reporting in 1933 and 1937	22	22	25	25	53	53	36	36	18	18
Number employing -										
Donkey engines only	14	12	20	16	22	13	18	14	12	7
Donkey engines and tractors	6	7	4	7	15	25	9	13	3	8
Tractors only	2	3	1	2	16	15	9	9	1	1
266 camps reporting in 1936 and 1937	86	86	52	52	65	65	45	45	18	18
Number employing -										
Donkey engines only	46	43	29	23	22	19	19	16	8	7
Donkey engines and tractors	21	25	16	21	29	29	17	19	8	9
Tractors only	19	18	7	8	14	17	9	10	2	2
All camps (409) reporting in 1937	-	136	-	91	-	107	-	54	-	21
Number employing -										
Donkey engines only	-	70	-	39	-	32	-	20	-	8
Donkey engines and tractors	-	33	-	35	-	45	-	24	-	11
Tractors only	-	33	-	17	-	30	-	10	-	2

^aCapacity in 1937. Where this was not available, capacity in the "earlier year" was used.

**Table C-2.- NUMBER OF PACIFIC COAST LOGGING CAMPS REPORTING
ON LOG-YARDING EQUIPMENT, BY DAILY CAPACITY, STATE,
AND TYPE OF EQUIPMENT, 1937**

State and type of equipment	Daily capacity in 1937 (M ft. b. m.)				
	1-49	50-99	100-249	250-499	500 or over
California camps (64) reporting	22	9	22	9	2
Number employing -					
Donkey engines only	1	0	1	1	0
Donkey engines and tractors	6	4	10	6	0
Tractors only	15	5	11	2	2
Oregon camps (201) reporting	67	55	54	24	1
Number employing -					
Donkey engines only	46	24	12	6	1
Donkey engines and tractors	10	23	29	11	0
Tractors only	11	8	13	7	0
Washington camps (144) reporting	47	27	31	21	18
Number employing -					
Donkey engines only	23	15	19	13	7
Donkey engines and tractors	17	8	6	7	11
Tractors only	7	4	6	1	0

Table C-2.- NUMBER OF PACIFIC COAST LOGGING CAMPS REPORTING ON LOG-HAULING EQUIPMENT, BY DAILY CAPACITY AND TYPE OF EQUIPMENT, 1933, 1936, AND 1937

Years and type of equipment	Daily capacity (M ft. b. m.) ^a									
	1-49		50-99		100-249		250-499		500 or over	
	Earlier year	1937	Earlier year	1937	Earlier year	1937	Earlier year	1937	Earlier year	1937
128 camps reporting in 1933 and 1937	9	9	21	21	49	49	34	34	15	15
Number employing -										
Locomotives only	5	5	17	13	46	35	33	30	15	14
Locomotives and trucks	0	1	1	2	2	10	1	3	0	1
Trucks only	4	3	3	6	1	4	0	1	0	0
197 camps reporting in 1936 and 1937	40	40	33	33	62	62	44	44	18	18
Number employing -										
Locomotives only	8	8	19	14	51	38	44	36	18	17
Locomotives and trucks	3	1	1	3	2	10	0	5	0	1
Trucks only	29	31	13	16	9	14	0	1	0	0
All camps (349) reporting in 1937	-	102	-	75	-	102	-	50	-	20
Number employing -										
Locomotives only	-	7	-	20	-	49	-	43	-	16
Locomotives and trucks	-	2	-	4	-	19	-	6	-	2
Trucks only	-	93	-	51	-	34	-	1	-	0

^aSee table C-1, fn. a.

Table C-4.- NUMBER OF PACIFIC COAST LOGGING CAMPS REPORTING ON LOG-HAULING EQUIPMENT, BY DAILY CAPACITY, STATE, AND TYPE OF EQUIPMENT, 1937

State and type of equipment	Daily capacity in 1937 (M ft. b. m.)				
	1-49	50-99	100-249	250-499	500 or over
California camps (56) reporting	16	8	21	9	2
Number employing -					
Locomotives only	0	1	12	7	1
Locomotives and trucks	2	0	2	2	1
Trucks only	16	7	7	0	0
Oregon camps (169) reporting	51	44	52	21	1
Number employing -					
Locomotives only	2	12	23	16	1
Locomotives and trucks	0	2	11	4	0
Trucks only	49	30	18	1	0
Washington camps (122) reporting	33	23	29	20	17
Number employing -					
Locomotives only	5	7	14	20	16
Locomotives and trucks	0	2	6	0	1
Trucks only	28	14	9	0	0

Table C-5.- NUMBER OF PACIFIC COAST LOGGING CAMPS REPORTING CONSTRUCTION EQUIPMENT, BY DAILY CAPACITY, 1937

Type of equipment	Daily capacity in 1937 (M ft. b. m.)				
	1-49	50-99	100-249	250-499	500 or over
Number of camps reporting	187	95	109	55	21
Number of camps reporting bulldozers	7	31	55	22	11
Percent of total number of camps	4.2	32.6	50.5	40.0	52.4
Number of bulldozers reported ^a	7	31	64	29	24
Average number of units per camp reporting bulldozers	1.0	1.0	1.2	1.3	2.2
Number of camps reporting power shovels	0	6	51	42	18
Percent of total number of camps	0	6.4	46.8	76.4	85.7
Number of shovels reported ^a	-	9	69	76	64
Average number of units per camp reporting shovels	-	1.1	1.4	1.8	3.6

^aDiffers from data in table 10 (p. 51) in that equipment used by camps which did not report daily capacity is not included in this table.

Table C-6.- NUMBER OF PACIFIC COAST SAWMILLS REPORTING ON TYPE OF HEADSAW AND TYPE OF POWER, BY DAILY CAPACITY AND TYPE OF EQUIPMENT, 1936

Type of headsaw or type of power	Daily capacity in 1936 (M ft. b. m.)				
	1-49	50-99	100-249	250-499	500 or over
Mills reporting on type of headsaw	280	87	127	24	11
Number employing -					
Band saws only	30	50	105	22	10
Band and circular saws	4	1	3	0	1
Circular saws only	246	36	19	2	0
Mills reporting on type of power	209	69	116	23	9
Number employing -					
Steam power only	172	35	29	5	0
Steam and electric power	13	19	56	10	8
Electric power only	24	15	33	8	1

Table C-7.- NUMBER OF PACIFIC COAST SAWMILLS REPORTING SPECIFIED TYPE OF EQUIPMENT, BY DAILY CAPACITY, 1936

Type of equipment	Daily capacity in 1936 (M ft. b. m.)				
	1-49	50-99	100-249	250-499	500 or over
Number of mills reporting on equipment ^a	299	94	133	25	11
Number employing -					
Gang saws	3	10	28	13	8
Planing mills	157	73	118	24	11
Lath mills	13	23	81	18	9
Dry kilns	35	28	97	25	10
Shingle mills	19	5	13	4	6
Box factories	11	9	18	3	1
Machine shops	15	24	62	14	10

^aIncludes mills included elsewhere in this table or in table C-6.

Table C-8.-- COVERAGE OF PACIFIC COAST LOGGING-CAMP TABULATIONS
REFERRING TO TYPES OF EQUIPMENT IN USE, 1933, 1936, AND 1937^a

Year and State	Total number of camps ^b	Number of camps in tabulation ^c			Camps in tabulation as percent of total		
		Log yarding	Log hauling	Construc- tion	Log yarding	Log hauling	Construc- tion
1933, total	413	152	128	(d)	36.8	31.0	-
California	73	31	27	(d)	42.5	37.0	-
Oregon	182	65	48	(d)	35.7	26.4	-
Washington	158	56	53	(d)	35.4	33.5	-
1936, total	690	266	197	(d)	39.1	29.0	-
California	87	46	35	(d)	52.9	40.2	-
Oregon	272	121	88	(d)	44.5	32.4	-
Washington	321	99	74	(d)	30.8	23.1	-
1937, total	805	409	349	447	50.8	43.4	55.5
California	103	64	58	70	62.1	56.3	68.0
Oregon	374	201	169	216	53.7	45.2	57.9
Washington	328	144	122	161	43.9	37.2	49.1

^aFigures are for all camps, whether reported as operated separately or in conjunction with sawmills.

^bAll camps listed in the respective directories.

^cThe 1933 figures include only camps that reported adequately on the specified types of equipment for 1937 as well as 1936 and on daily capacity for 1933 or 1937; the 1936 figures include only camps which reported in a similarly adequate fashion for 1936 and 1937. The 1937 figures, however, include all camps which reported adequately for 1937.

^dTabulation not made for this year.

Table C-9.-- COVERAGE OF PACIFIC COAST LOGGING-CAMP TABULATIONS
REFERRING TO NUMBER OF EQUIPMENT UNITS IN USE,
1933, 1936, AND 1937^a

Year and State	Total number of camps ^b	Number of camps in tabulation ^c			Camps in tabulation as percent of total		
		Log yarding	Log hauling	Construc- tion	Log yarding	Log hauling	Construc- tion
1933, total	413	106	100	111	25.7	24.2	26.9
California	73	22	20	23	30.1	27.4	31.5
Oregon	182	40	37	41	22.0	20.3	22.5
Washington	158	44	43	47	27.8	27.2	29.7
1936, total	690	166	149	172	24.4	21.9	25.3
California	87	35	31	35	40.2	35.6	40.2
Oregon	272	66	58	71	25.0	21.3	26.1
Washington	321	63	60	66	19.6	18.7	20.6
1937, total	805	469	439	489	58.3	56.3	58.3
California	103	77	77	77	74.6	74.6	74.6
Oregon	374	227	227	227	60.7	60.7	60.7
Washington	328	165	165	165	50.3	50.3	50.3

^aFigures are for all camps, whether reported separately or in conjunction with sawmills.

^bAll camps listed in the respective directories.

^cThe 1933 figures include only camps that reported adequately on the number of units of the specified types of equipment for 1937 as well as 1936; the 1936 figures include only camps which reported in a similarly adequate fashion for 1936 and 1937. The 1937 figures, however, include all camps which reported adequately for 1937.

Table C-10.- COVERAGE OF PACIFIC COAST SAWMILL TABULATIONS
REFERRING TO TYPES OF EQUIPMENT IN USE, 1936^a

State	Total number of mills ^b	Number of mills in tabulation ^c		Mills in tabulation as percent of total	
		Type of headsaw	Type of power	Type of headsaw	Type of power
Total	1,139	529	428	46.4	37.6
California	233	92	78	39.5	33.5
Oregon	492	217	168	44.1	34.1
Washington	414	220	162	53.1	44.0

^aFigures are for all mills, whether reported as operated separately or in conjunction with logging camps.

^bAll mills listed in the 1935-36 directory.

^cAll mills reporting adequately on type of headsaw or power used in 1936 and on daily capacity in 1936.

Table C-11.- DISTRIBUTION OF REPORTING AND NONREPORTING
PACIFIC COAST OPERATIONS, BY TYPE OF OWNERSHIP, 1936^a

Type of ownership	Reporting		Nonreporting	
	Number	Percent	Number	Percent
All operations ^b				
Total	694	100	783	100
Company	546	79	391	42
Partnership	65	9	144	19
Individual	83	12	308	39
Logging camps				
Total	442	100	238	100
Company	339	77	110	46
Partnership	50	11	43	18
Individual	53	12	85	36
Sawmills				
Total	587	100	552	100
Company	464	79	226	41
Partnership	55	9	101	18
Individual	68	12	225	41

^aA "reporting" operation is one which reported on capacity and on some items of equipment; a "nonreporting" operation is one which failed to report on one or both of these items.

^bLogging camps and sawmills operated in conjunction with each other are considered a single operation for purposes of this table. Of the reporting logging camps, 835 were operated in conjunction with sawmills; of the logging camps for which there were no reports, 7 were operated in conjunction with sawmills.

Table C-12.- DISTRIBUTION OF REPORTING PACIFIC COAST OPERATIONS OWNED INDIVIDUALLY AND IN PARTNERSHIP, BY DAILY CAPACITY, 1936^a

Type of ownership and daily capacity (M ft. b. m.)	All operations ^b		Logging camps		Sawmills	
	Number	Percent	Number	Percent	Number	Percent
Individual	63	100	53	100	68	100
1- 24	50	60	26	49	44	65
25- 49	26	31	21	40	21	31
50- 74	3	4	3	5	1	1
75-100	3	4	2	4	2	3
Over 100	1	1	1	2	0	0
Partnership	65	100	50	100	55	100
1- 24	33	51	25	50	31	56
25- 49	20	31	13	26	19	35
50- 74	9	14	9	18	3	5
75-100	3	4	3	6	2	4

^aSee table C-11, ftm. a.

^bSee table C-11, ftm. b.

APPENDIX D

DESCRIPTION OF DATA FROM SOUTHERN FOREST SURVEY

The McSweeney-McNary Forest Research Act of 1928 authorized the United States Forest Service to conduct a Nation-wide survey of forest resources. The findings of the Southern Forest Survey, which was conducted pursuant to this act, represent the most complete and detailed body of data available regarding the southern lumber industry. Through a cooperative arrangement the Forest Service made some of these data, collected in 1934, available to the "Studies of Productivity and Employment in Selected Industries" section of the National Research Project. The data were supplied in the form of a special, unpublished report dated November 1, 1936. Later the Southern Forest Experiment Station supplied tabulation sheets of the Southern Forest Survey on types of equipment employed.

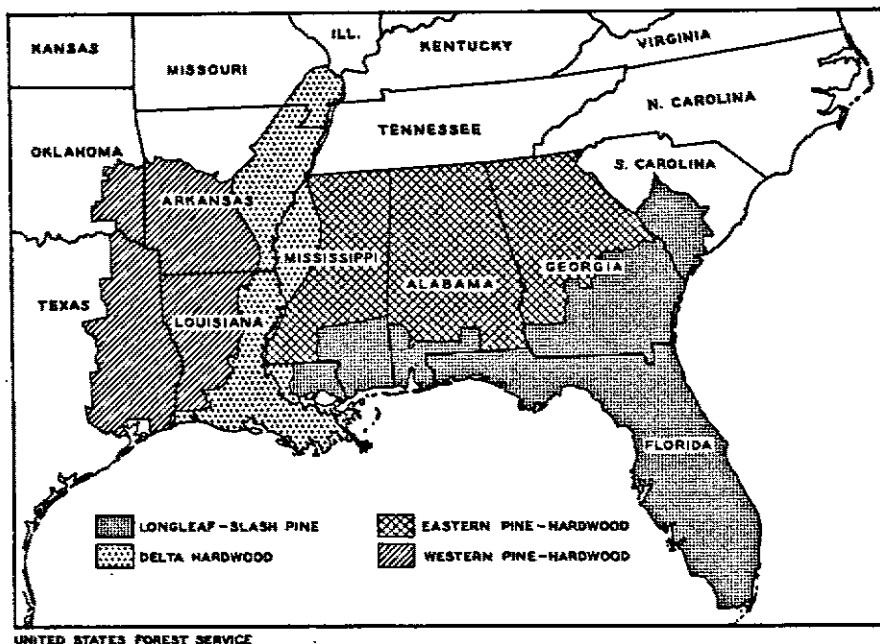
The territory covered by the survey is shown in figure D-1. It includes the Gulf States (Alabama, Florida, Louisiana, and Mississippi); Georgia; the most important pine-forest regions of Arkansas, Oklahoma, and Texas; and the Delta hardwood-forest regions of Arkansas, Kentucky, Missouri, and Tennessee. A small section of South Carolina is also included.

Operations of different sizes employ different techniques. For instance, about half of the mills having a daily capacity of 20 to 39 thousand board feet and practically all mills having a lower daily capacity may be considered to be portable mills. However, some of the very small sawmills are permanent neighborhood mills attached to plantations or doing local custom sawing. On the other hand, all of the largest sawmills, those with a daily capacity of 40 thousand or more board feet, may be considered stationary. The mills surveyed were broken down into five size groups, and separate data are presented for mills in each group.¹

In addition to break-downs by size, break-downs were also made according to the species of lumber constituting 50 percent or more of the production of the particular mills in 1934, the year of the survey. This latter break-down consists of three categories: pine, hardwood, and cypress.

¹Size classifications are based on rated capacity in thousands of board feet per 10-hour day. The capacities reported for each mill were frequently based on an arbitrary estimate made by the sawmill operator. These estimates may be subject to considerable error and may, furthermore, be based on differing criteria. Thus some operators underestimated capacity by quoting the cut under 1934 conditions, whereas others overestimated capacity by reporting the capacity which the operations might have had formerly when a favorable timber supply existed. Although the division of the mills into the specified size group may not be altogether accurate, it is nevertheless sufficient to differentiate in a general fashion between the practices and experiences of operations of different sizes.

Figure D-1.- SOUTHERN FOREST SURVEY TERRITORY



The Southern Forest Survey material has been used in this report in order to obtain information for southern operations on equipment in use, unit labor requirements, and life expectancy of mills.

DATA ON EQUIPMENT IN USE

A sample of 839 operations was used by the Southern Forest Survey in order to determine the short-haul equipment in use in southern operations. The operations were asked to supply information regarding the means of transportation used to move logs from the stump to the beginning of the long haul. The replies are summarized, by size of mill and predominant species cut, in table D-1.

Information on equipment used in the long haul was also obtained in the survey, in this instance from a sample of 862 operations. The sample operations were asked to check blanks provided for the following items: Team, truck, tractor, logging railroad, common-carrier railroad, barge, and raft. They were also asked to specify and describe briefly any other equipment in use. The reports obtained on long-haul equipment are summarized in table D-2.

The survey likewise sought information regarding equipment in use in sawmills. A total of 901 southern mills checked one or more of the following items: Band saw, circular saw, gang saw, resaw, planer, and dry kiln. The replies to this query are presented in table D-3.

Data presented in tables D-1 to D-3 were obtained from the tabulation sheets supplied by the Southern Forest Experiment Station.

DATA ON UNIT LABOR REQUIREMENTS

Logging and sawing unit labor requirements of 651 southern operations are presented in table D-4. Data are presented separately for mills cutting pine predominantly, for mills cutting hardwood predominantly, and for all mills regardless of species cut. As in the case of equipment data, separate figures are shown for mills falling into one or another of the different size groups.

Average unit labor requirements were calculated from information obtained from responses to several questions. Operators were asked to indicate the number of persons employed, either by the operator or his contractors or jobbers, in the wood, in the mill and yard, and in office or sales work. The operators were also requested to supply information on the number of hours worked in the woods and in the mill. In addition, information on daily cutting capacity was requested. These queries were to be answered on the basis of full-capacity rather than 1934 operation. Large mills were known to surface a much larger proportion of their product than the small mills. Although labor employed in surfacing was included in the reported totals, operators were asked to supply information on the proportion of the product surfaced. Responses to this last question indicated that about 80 percent of the output of the largest pine mills - those which cut 40 thousand or more board feet per day - was surfaced; a much smaller proportion of the output of small pine mills and of all hardwood mills was surfaced.

Concentration yards (mills that finish and market unsurfaced and frequently unseasoned lumber cut by a number of small operations) were not included in the survey.

Information on unit labor requirements was contained in the special co-operative report supplied to the National Research Project by the United States Forest Service. This report also contained information on unit labor requirements in 58 operations in the Lake States. This information is summarized in table D-5 in comparison with data for the Southern Forest Survey territory.

DATA ON LIFE EXPECTANCY OF MILLS

The information on life expectancy of mills presented in table 30² was obtained from 8,486 operations. These operations were asked how long a

²See p. 120.

lifetime they anticipated in the immediate vicinity of their 1934 location. Information on 1934 output, rated daily capacity, number of persons employed when operating at capacity, and number of hours worked when operating at capacity provided the basis for determining the 1934 "employment" of individual mills. These "employment" figures represent the number of man-years of employment required to produce the 1934 output. A man-year was arbitrarily assumed to be made up of 200 10-hour working days.

Replies to the question on life expectancy represented, of course, the operators' best opinions. In the case of a number of the largest mills which were cutting virgin timber from their own lands the answers were definite and probably rather accurate. Answers from mills cutting remnant old-growth stands, second-growth timber, and purchased timber were often indefinite and at best were good guesses. Answers from portable mills, which operate at each new location on small stands and which frequently compete with other mills in cutting these stands, are probably rough guesses. The United States Forest Service has found that operators are more likely to err in the direction of underestimating the future timber supply. On the other hand, the Forest Service has estimated that southern mills were in general operating at about a third of capacity in 1934; operators may have based their estimates of anticipated lifetime in the 1934 vicinity on an assumed future extent of capacity utilization varying from the proportion of capacity utilized in 1934 to full capacity utilization.

The data in table 30, therefore, can be used only to indicate the impact of timber depletion on the security of job tenure of workers attached to southern mills. They cannot be used as a basis for determining employment opportunities to be afforded by southern mills or unemployment resulting from the cutting-out of mills.

The source of the data on life expectancy was a United States Forest Service memorandum to I. F. Eldredge, who directed the Southern Forest Survey. A copy of this memorandum, dated December 2, 1936, was made available to the National Research Project by the Forest Service.

ANALYSIS OF THE SAMPLES

Number of Mills

Table D-6 presents, for the southern forest territory as a whole, the proportion of the mills in each size class covered by the various samples. The equipment samples included roughly 10 percent of all mills. In each of these samples, however, a much greater proportion of the large than of

the small mills was covered. The samples of mills having a daily capacity of at least 40 thousand board feet were quite large, constituting more than 60 percent of all mills of that size. An adequate sample of about 35 percent of the medium-size mills (those having a daily capacity of 20 to 39 thousand board feet) was obtained. The number of smaller mills covered is large although the percentages which the samples comprise of the totals are small. About 8 percent of the mills having a daily capacity of 10 to 19 thousand board feet are included in the equipment samples; the percentages for mills having a daily capacity of less than 10 thousand board feet are about half this magnitude. The very small mills which serve neighborhood markets are inadequately represented in the samples; however, the large numerical representation of small mills tends to compensate this inadequacy.

The sample used for data on unit labor requirements is somewhat smaller than the equipment samples. Of the 8,702 mills in the territory, 651, or $7\frac{1}{2}$ percent, were included in the sample. In terms of size groups, 45 percent of the large, 23 percent of the medium, and 4 to 5 percent of the small mills were covered.

The life-expectancy sample covers $97\frac{1}{2}$ percent of the mills. Coverage of each size group exceeds 95 percent and in one case (mills with a daily capacity of 40 to 79 thousand board feet) is as high as 100 percent.

Geographic Distribution

An analysis was also made in order to determine the geographic representativeness of the equipment and unit-labor-requirement samples (table D-7). The Southern Forest Survey territory is divided into four regions (see figure D-1). The longleaf-slash pine region includes the area bordering on the Gulf coast and Florida and constitutes the core of the naval-stores industry. The eastern pine-hardwood region encompasses the northern portions of Alabama, Georgia, and Mississippi; it contains over half the mills in the territory, but about 99 percent of its mills have a daily capacity of less than 40 thousand board feet. The western pine-hardwood region (western portions of Arkansas and Louisiana and eastern portions of Oklahoma and Texas) contains, on the other hand, nearly three-fifths of the mills having a daily capacity of at least 80 thousand board feet. The Delta hardwood region (eastern Arkansas and Louisiana, southeastern Missouri, and western Mississippi) has a larger than average proportion of mills with a daily capacity of 40 to 79 thousand board feet but only one mill in the largest size group.

Only 8,112 of the 8,702 mills in the Southern Forest Survey territory could be distributed by region, but it is believed that these 8,112 mills

truly represent the existing distributions. For purposes of table D-7, therefore, the regional distribution of 8,112 mills was assumed to represent the distribution of all mills in the territory.

Examination of table D-7 reveals that the regional distributions of the four samples are approximately the same within each size group. In general the regional distributions of all mills and of sample mills are roughly similar. Pronounced differences in the regional distributions occur primarily in size classes containing large numbers of mills. Conversely, total and sample distributions agree rather closely in the large-size groups which contain comparatively small numbers of mills. It may also be recalled that coverage was greatest for large mills.

Because the eastern pine-hardwood region contains the largest proportion of small mills, it is not surprising to find that this region is relatively underrepresented in the samples. On the other hand the Delta hardwood region, which has a comparatively small proportion of small mills, is relatively overrepresented in the samples.

Of the four samples, the regional distributions of the unit-labor-requirement sample compare least favorably with the distributions for all mills, regardless of size group. In this respect it may be recalled that the coverage of this sample was less complete than that of the others.

Species Cut

Sample mills in the various size groups were distributed according to the species of lumber dominating the mills' output (table D-8). Similar distributions were made for 8,112 mills in the territory.³ Comparisons revealed that the distributions agreed closely and that on the whole the various species predominated in the output of sample mills to the same degree as in the output of all mills in the territory. To some extent, however, among mills having a daily capacity of less than 40 thousand board feet, mills cutting pine were relatively underrepresented and those cutting hardwood were relatively overrepresented.

³See pp. 188-9.

Table D-1.- NUMBER OF OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY REPORTING SPECIFIED SHORT-HAUL EQUIPMENT, BY SPECIES OF LUMBER CUT AND DAILY MILL CAPACITY, 1934

Equipment	Species of lumber cut and daily capacity (M. ft. b. m. per 10-hr. day)														
	Pine					Hardwood					Cypress				
	1-9	10-19	20-39	40-79	80 or over	1-9	10-19	20-39	40-79	80 or over	1-9	10-19	20-39	40-79	80 or over
Total number of operations reporting	116	189	154	45	51	57	48	84	55	7	9	8	8	4	3
Number reporting -															
Animals	96	152	121	38	33	54	46	74	40	4	6	9	1	1	0
Animals only	86	108	65	18	13	43	27	19	13	3	5	2	0	0	0
Tractors	4	17	22	7	12	2	9	20	21	3	1	0	2	1	2
Tractors only	1	7	7	2	4	1	0	2	3	0	1	0	1	0	0
Steam skidders	0	2	1	5	16	0	0	4	4	2	0	1	2	3	3
Steam skidders only	0	0	0	2	8	0	0	2	3	1	0	0	1	1	0
Gas skidders	9	31	43	6	4	1	4	19	3	0	1	4	2	2	0
Gas skidders only	2	5	2	0	0	0	1	1	1	0	1	3	1	0	0
Trucks	16	33	28	11	12	11	10	26	11	0	1	1	1	0	0
Trucks only	15	24	23	2	3	0	0	4	5	0	0	0	0	0	0
Pullboats	0	0	0	0	0	0	0	1	6	0	0	1	2	0	1
Pullboats only	0	0	0	0	0	0	0	0	3	0	0	1	1	0	0
Floats or water	0	1	0	1	0	1	2	4	1	1	1	0	0	1	0
Hand logging	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Animals and mechanical equipment	10	46	56	20	20	11	13	54	26	1	1	1	1	1	0
Combinations of mechanical equipment	0	0	2	0	3	1	1	1	1	1	0	1	3	1	3

Table D-2.- NUMBER OF OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY REPORTING SPECIFIED LONG-HAUL EQUIPMENT, BY SPECIES OF LUMBER CUT AND DAILY MILL CAPACITY, 1934

Equipment	Species of lumber cut and daily capacity (M ft. b. m. per 10-hr. day)														
	Pine					Hardwood					Cypress				
	1-9	10-19	20-39	40-79	80 or over	1-9	10-19	20-39	40-79	80 or over	1-9	10-19	20-39	40-79	80 or over
Total number of operations reporting	123	194	155	48	53	54	51	88	58	6	9	9	7	4	3
Number reporting -															
Trucks	100	188	151	31	31	50	48	80	40	4	6	6	2	1	1
Trucks only	93	169	131	11	2	25	33	21	9	1	4	4	1	1	0
Railroads	1	7	11	33	49	5	5	52	41	5	0	2	4	2	3
Common carriers	0	3	10	9	15	5	5	46	31	2	0	1	2	0	2
Logging	1	4	1	25	44	0	0	9	21	4	0	1	3	2	3
Railroads only	0	1	0	14	20	0	0	6	10	2	0	1	3	2	2
Animals	29	13	6	1	1	23	9	1	0	0	4	1	0	0	0
Animals only	23	7	2	0	0	3	2	0	0	0	2	0	0	0	0
Water	1	6	6	4	5	4	5	18	20	1	2	3	3	1	0
Water only	0	0	2	3	1	1	1	2	5	0	1	2	2	1	0
Tractors	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Railroads and trucks	1	6	11	19	29	5	5	48	28	3	0	1	1	0	1
Trucks and animals	5	6	4	1	0	20	7	1	0	0	2	1	0	0	0
Water, and trucks or railroads	1	6	4	1	4	3	4	18	15	1	1	1	1	0	0

APPENDIX D

Table D-3.- NUMBER OF OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY REPORTING SPECIFIED SAWMILL EQUIPMENT,
BY SPECIES OF LUMBER CUT AND DAILY MILL CAPACITY, 1934

Equipment	Species of lumber cut and daily capacity (M ft. b. m. per 10-hr. day)														
	Pine					Hardwood					Cypress				
	1-9	10-19	20-39	40-79	80 or over	1-9	10-19	20-39	40-79	80 or over	1-9	10-19	20-39	40-79	80 or over
Total number of operations reporting	125	201	162	48	56	63	51	95	60	7	9	10	7	4	3
Number reporting -															
Saws and accessories only	79	49	15	0	2	51	37	44	7	0	9	7	4	0	0
Resaws	1	8	31	27	27	2	3	13	41	5	0	0	0	2	1
Resaws only ^a	0	1	1	1	0	2	0	4	11	1	0	0	0	0	0
Gang saws	0	0	5	8	27	0	0	0	3	2	0	1	0	2	3
Gang saws only ^a	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
Planers	46	148	140	47	53	9	12	44	34	5	0	2	3	4	2
Planers only ^a	32	58	22	1	0	6	8	17	3	1	0	2	2	0	0
Dry kilns	13	91	118	43	53	4	4	24	28	3	0	0	1	2	2
Dry kilns only ^a	0	2	5	0	0	1	2	3	3	0	0	0	0	0	0
Hand saws	2	1	30	33	51	1	9	23	59	7	0	1	6	4	3
Circular saws	123	200	132	15	5	62	42	12	1	0	9	9	1	0	0

^aIn addition to saws and accessories.

**Table D-4.-- LOGGING AND SAWMILL UNIT LABOR REQUIREMENTS
OF OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY,
BY SPECIES OF LUMBER CUT AND DAILY
MILL CAPACITY, 1934**

Species of lumber cut and daily capacity (M ft. b. m. per 10-hr. day)	Number of mills	Number of man-hours per thousand board feet		
		Total	Logging	Sawmill
Total, including cypress				
1- 9	169	26.0	11.5	14.5
10-19	173	26.6	10.8	15.8
20-39	164	32.5	13.8	18.7
40-79	60	37.0	14.9	22.1
80 or over	45	31.0	9.9	21.1
Pine				
1- 9	136	24.5	10.9	13.6
10-19	142	25.8	10.2	15.6
20-39	92	30.3	12.8	17.5
40-79	39	39.7	15.5	24.2
80 or over	37	31.1	9.9	21.2
Hardwood				
1- 9	49	30.1	13.1	17.0
10-19	29	29.2	13.0	16.2
20-39	67	35.1	14.9	20.2
40-79	39	32.9	13.6	19.3
80 or over	5	26.4	10.8	15.6

**Table D-5.-- UNIT LABOR REQUIREMENTS OF OPERATIONS IN SOUTHERN
FOREST SURVEY TERRITORY AND IN THE LAKE STATES,
BY DAILY MILL CAPACITY, 1934^a**

Daily capacity (M ft. b. m. per 10-hr. day)	Southern Forest Survey territory		Lake States	
	Number of operations	Man-hours per M ft. b. m. ^b	Number of operations	Man-hours per M ft. b. m.
1-19	362	26	44	34
20-39	164	32	9	59
40 or over	125	35	5	44

^aData cover both logging and sawmill activities of each of the operations.

^bFigures represent weighted averages of those for more detailed size classifications in table D-4, the numbers of mills being used as weights.

Table D-6.- DISTRIBUTION OF ALL AND OF SAMPLE OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY,
BY DAILY MILL CAPACITY, 1934

Daily capacity (M ft. b. m. per 10-hr. day)	Total number of oper- ations	Number of operations in sample					Sample operations as percent of all operations				
		Short- haul equip- ment	Long- haul equip- ment	Sawmill equip- ment	Unit labor require- ments	Length of life	Short- haul equip- ment	Long- haul equip- ment	Sawmill equip- ment	Unit labor require- ments	Length of life
Total	8,702	839	862	901	651	8,486	9.6	9.9	10.4	7.5	97.5
1- 9	4,466	182	186	197	189	4,372	4.1	4.2	4.4	4.2	97.9
10-19	3,243	245	254	262	173	3,150	7.6	7.8	8.1	5.3	97.1
20-39	715	246	250	264	164	691	34.4	35.0	36.9	22.9	96.6
40-79	174	105	110	112	80	174	60.9	63.2	64.4	46.0	100.0
80 or over	104	61	62	66	45	99	56.7	59.6	63.5	43.3	95.2

Table D-7.- DISTRIBUTION OF ALL AND OF SAMPLE OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY,
BY DAILY MILL CAPACITY AND REGION, 1934

Daily capacity (M ft. b. m. per 10-hr. day) and region	Number of operations					Percent of group total				
	All operations ^a	Sample operations				All operations	Sample operations			
		Short- haul equip- ment	Long- haul equip- ment	Sawmill equip- ment	Unit labor require- ments		Short- haul equip- ment	Long- haul equip- ment	Sawmill equip- ment	Unit labor require- ments
1-19	7,309	427	440	459	362	100	100	100	100	100
Longleaf-slash pine	1,347	112	120	122	129	18	26	27	27	36
Pine hardwood, east	4,213	162	166	170	114	58	38	38	37	31
Delta hardwood	517	82	83	89	62	7	19	19	19	17
Pine hardwood, west	1,232	71	71	78	57	17	17	18	17	18
20-39	561	246	250	264	164	100	100	100	100	100
Longleaf-slash pine	121	72	71	75	57	22	29	29	29	36
Pine hardwood, east	207	88	88	93	33	37	36	35	35	20
Delta hardwood	47	27	30	35	30	8	11	12	13	18
Pine hardwood, west	186	59	61	61	44	33	24	24	23	27
40-79	153	105	110	112	80	100	100	100	100	100
Longleaf-slash pine	43	28	29	28	21	28	26	26	25	26
Pine hardwood, east	30	15	16	15	9	20	14	15	13	11
Delta hardwood	38	31	31	32	29	25	30	28	29	37
Pine hardwood, west	42	31	34	37	21	27	30	31	33	26
80 or over	89	61	62	66	45	100	100	100	100	100
Longleaf-slash pine	25	22	23	23	15	28	36	37	35	33
Pine hardwood, east	12	9	9	9	6	14	15	14	14	13
Delta hardwood	1	1	1	1	3	1	2	2	1	7
Pine hardwood, west	51	29	29	33	21	57	47	47	50	47

^aSee pp. 188-9.

Table D-8.- DISTRIBUTION OF ALL AND OF SAMPLE OPERATIONS IN SOUTHERN FOREST SURVEY TERRITORY,
BY DAILY MILL CAPACITY AND SPECIES OF LUMBER CUT, 1934

Daily capacity (M ft. b. m. per 10-hr. day) and species of lumber cut	Number of operations					Percent of group total				
	All oper- ations ^a	Sample operations				All oper- ations	Sample operations			
		Short- haul equip- ment	Long- haul equip- ment	Sawmill equip- ment	Unit labor require- ments		Short- haul equip- ment	Long- haul equip- ment	Sawmill equip- ment	Unit labor require- ments
1-19	7,309	427	440	459	362	100	100	100	100	100
Pine	6,158	305	317	326	280	84	71	72	71	77
Hardwood	1,127	105	105	114	78	16	25	24	25	22
Cypress	24	17	18	19	4	*	4	4	4	1
20-39	561	246	250	264	164	100	100	100	100	100
Pine	413	154	155	162	92	74	63	62	61	58
Hardwood	135	84	88	95	67	24	34	35	36	41
Cypress	13	8	7	7	5	2	3	3	3	3
40-79	153	105	110	112	80	100	100	100	100	100
Pine	66	45	48	48	39	43	43	44	43	49
Hardwood	80	56	58	60	39	52	53	53	54	49
Cypress	7	4	4	4	2	5	4	3	3	2
80 or over	89	61	62	66	45	100	100	100	100	100
Pine	76	51	53	56	37	86	84	85	85	82
Hardwood	10	7	6	7	5	11	11	10	11	11
Cypress	3	3	3	3	3	3	5	5	4	7

^aSee p. 189.

*Less than 0.5 percent.

APPENDIX E

RELATION OF SIZE TO UNIT LABOR REQUIREMENTS OF PACIFIC COAST SAWMILLS

The determination of the relationship between labor productivity and size of mill is complicated by differences in the character of product and the conduct of auxiliary activities. Thus relatively high unit labor requirements in larger mills may reflect a greater degree of finishing and byproduct production rather than less efficient utilization of labor.

Closer examination of the size-productivity relationship was possible for 37 of the large Pacific Coast sawmills covered in the NRP-NBER logging-camp and sawmill survey.¹ The man-hour ratios used for these mills are standard man-hour ratios based on equivalent production and were obtained from survey data.² The 1935-36 edition of the *Handbook and Directory of the Western Lumber Industries* was used to determine daily capacity and equipment of each of the mills.³

Table E-1 shows the average standard sawmill man-hour ratios for 18 mills having a daily capacity of 70 to 249 thousand board feet and for 19 mills having a daily capacity of 250 thousand board feet or more. From this table it appears that when differences in equipment are disregarded the average ratio for the larger mills is about 15 percent higher than that for the smaller ones. This is consistent with the findings of a 1929 study of Pacific Coast mills conducted by the United States Bureau of Labor Statistics.⁴ In the latter study it was found that man-hour productivity decreases with size of plant as measured by number of wage earners employed. This relationship held especially for mills which produced their own logs; man-hours spent in logging were included in the totals for those mills. In the case of the southern mills, also, as shown by data presented in chapter IV, labor productivity tended to decrease with an increase in the size of mill, although labor productivity was high in the group of largest mills.

It seems possible, however, that in the lumber industry the man-hour ratio for a mill is an inadequate measure of the efficiency of utilization of labor in that mill. It was pointed out in chapter III that differences in the degree of manufacture, waste utilization, manufacture of timber products other than lumber, and the extent to which maintenance

¹No small mills were covered in this survey. For a description of the survey see appendix A.

²For a description of the "standard" man-hour ratio see table E-1, fn. b.

³For a description of the data from the West Coast directories see appendix C.

⁴"Man-Hour Productivity in the Lumber Industry in the Pacific Coast States in 1929," *Monthly Labor Review*, Vol. 35, No. 4 (Oct. 1932), pp. 818-25.

work is done by the mill's own employees may affect the mill's man-hour ratio.

In the NRP-NBER logging-camp and sawmill survey the effect of variations in the proportion of lumber surfaced was largely eliminated by computing man-hour ratios on the basis of equivalent production. An effort was also made to exclude man-hours expended in the production of byproducts and special products, but it was not possible to separate and exclude such labor time completely. (See appendix A.) Since the larger mills carry on such auxiliary activities to a greater extent than the smaller ones, it seems likely that factors other than relative efficiency in the utilization of labor could account, at least in part, for the difference in average unit labor requirements observed in table E-1.

The existence of differences between size groups in the degree of finishing, extent of manufacture of byproducts and special products, and the volume of activity auxiliary to the production of lumber may be indicated in a rough fashion by differences in the kinds of equipment used. Table E-2 indicates the nature of some of these differences in 1936. There are no pronounced differences in the type of power and type of headsaw employed at the two groups of mills. However, the proportion of the mills having a daily capacity of at least 250 thousand board feet that used the labor-saving gang saw was much greater than the corresponding proportion for the smaller mills. This is the only difference in equipment which would indicate a basis for higher output per man-hour in the larger mills.

On the other hand, the fact that relatively more of the larger mills had planing mills and dry kilns indicates that a larger portion of the lumber produced by this group was seasoned and finished. Lath mills were more generally employed at the larger mills, suggesting that the utilization of waste through the manufacture of byproducts was more widespread. Few of the smaller mills had shingle mills or box factories, whereas a considerable fraction of the large mills did have them. A much greater percentage of the larger mills than of the smaller ones had their own machine shops, perhaps indicating that more of the maintenance and repair work was carried on by the mill itself in the case of the larger mills.

The presence or absence of these items of special equipment may be taken as a general indicator of the degree of manufacture and integration of activities at the sawmill. Table E-3 presents average standard unit labor requirements of the 37 mills grouped according to the number of items of special equipment employed.⁵ The data in this table suggest,

⁵Gang saws and planing mills were not taken into account in this and the following table. Mills reporting the use of each of the special-equipment items reported the use of the following five items: Box factory, dry kiln, lath mill, machine shop, and shingle mill.

though by no means conclusively, that these factors, rather than size as such, are responsible for the differences in average labor requirements.

This conclusion is strengthened by an examination of table E-4. Thus, when a comparison is made of the standard average unit labor requirements of mills in the two size groups on the basis of the number of different items of special equipment reported, it appears that the larger mills have somewhat lower average unit labor requirements.

Of the 37 mills considered in this appendix, 7 did not report the use of dry kilns in 1936 (each of the 7 also did not report the use of at least one of the four other items of special equipment used in tables E-3 and E-4).⁶ These seven mills had an average standard man-hour ratio of 5.25, a figure strikingly lower than the average of 7.91 for all 37 mills. This suggests that mills which use dry kilns and thereby, presumably, accomplish a reduction in time-in-process, an improvement in quality, and a reduction in shipping weights do so at the expense of labor productivity.

Whether or not the higher labor productivity apparently associated with the smaller mills employing fewer items of special equipment compensates for the loss of the advantages associated with the use of such equipment probably depends on the character of the market which these mills seek to enter. Thus the materially lower man-hour ratios of the mills employing less special equipment need not reflect more efficient use of labor despite the fact that these mills have a greater volume of output per unit of labor time expended.

Table E-1.- UNIT LABOR REQUIREMENTS OF 37 LARGE PACIFIC COAST SAWMILLS, BY DAILY CAPACITY, 1936^a

Daily capacity (M ft. b. m.)	Number of plants	Standard man-hour ratio ^b
Total	37	7.91
70-249	18	7.34
250 or over	19	8.45

^aIn this and subsequent tables the man-hour ratios of the mills are based upon the NRP-NBER logging-camp and sawmill survey (see appendix A); the capacity and equipment data for the mills were obtained from the 1935-36 edition of the *Handbook and Directory of the Western Lumber Industries* (see appendix C).

^bRatios shown are unweighted averages of standard ratios for individual mills. Standard ratios for each mill were calculated by computing the weighted average of the mill's man-hour ratios for those years during the period 1928-30 in which the percentage of capacity utilized by the mill was between 70 and 89. Thus the effects on unit labor requirements of differences in capacity utilization and of random year-to-year fluctuations were minimized.

^cOf the seven, three had a daily capacity of at least 250 thousand board feet; the other four were in the smaller-size group.

Table E-2.- DISTRIBUTION OF 37 LARGE PACIFIC COAST SAWMILLS, BY DAILY CAPACITY AND TYPE OF EQUIPMENT REPORTED, 1936^a

Type of equipment reported	Daily capacity (M ft. b. m.)			
	70-249		250 or over	
	Number of mills	Percent of total	Number of mills	Percent of total
Type of power	16	100.0	16	100.0
Steam power	2	12.5	2	12.5
Electric power	4	25.0	2	12.5
Steam and electric power	10	62.5	12	75.0
Type of headsaw	16	100.0	19	100.0
Band saw	16	88.9	17	89.5
Circular saw	2	11.1	0	0
Band and circular saws	0	0	2	10.5
Special equipment	16	-	19	-
Box factory	2	11.1	4	21.1
Dry kiln	14	77.8	16	84.2
Gang saw	5	27.8	13	68.4
Lath mill	11	61.1	17	89.5
Machine shop	8	44.4	15	78.9
Planing mill	17 ^b	94.4 ^b	19	100.0
Shingle mill	0	0	8	42.1

^aSee table E-1, fn. a.

^bAlthough each of the NRP-NBER mills engaged in surfacing, one of the mills did not have a complete planing mill attached.

Table E-3.- UNIT LABOR REQUIREMENTS OF 37 LARGE PACIFIC COAST SAWMILLS, BY NUMBER OF TYPES OF SPECIAL EQUIPMENT REPORTED, 1936^a

Number of types of special equipment reported ^b	Number of mills	Standard man-hour ratio
All five reported	10	10.21
Four reported	8	7.72
Three reported	12	7.10
Two or less reported	7	6.26

^aSee table E-1, fnns. a and b.

^bThe five types of special equipment considered in this table are box factories, dry kilns, lath mills, machine shops, and shingle mills.

Table E-4.- UNIT LABOR REQUIREMENTS OF 37 LARGE PACIFIC COAST SAWMILLS, BY NUMBER OF TYPES OF SPECIAL EQUIPMENT REPORTED AND DAILY CAPACITY, 1936^a

Number of types of special equipment reported ^b and daily capacity	Number of mills	Standard man-hour ratio
Five or less reported (all 37 mills)		
70-249	18	7.34
250 or over	19	8.45
Four or less reported		
70-249	17	7.29
250 or over	10	6.88
Three or less reported		
70-249	13	7.29
250 or over	6	5.70

^aSee table E-1, ftms. a and b.

^bSee table E-8, ftm. b.

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