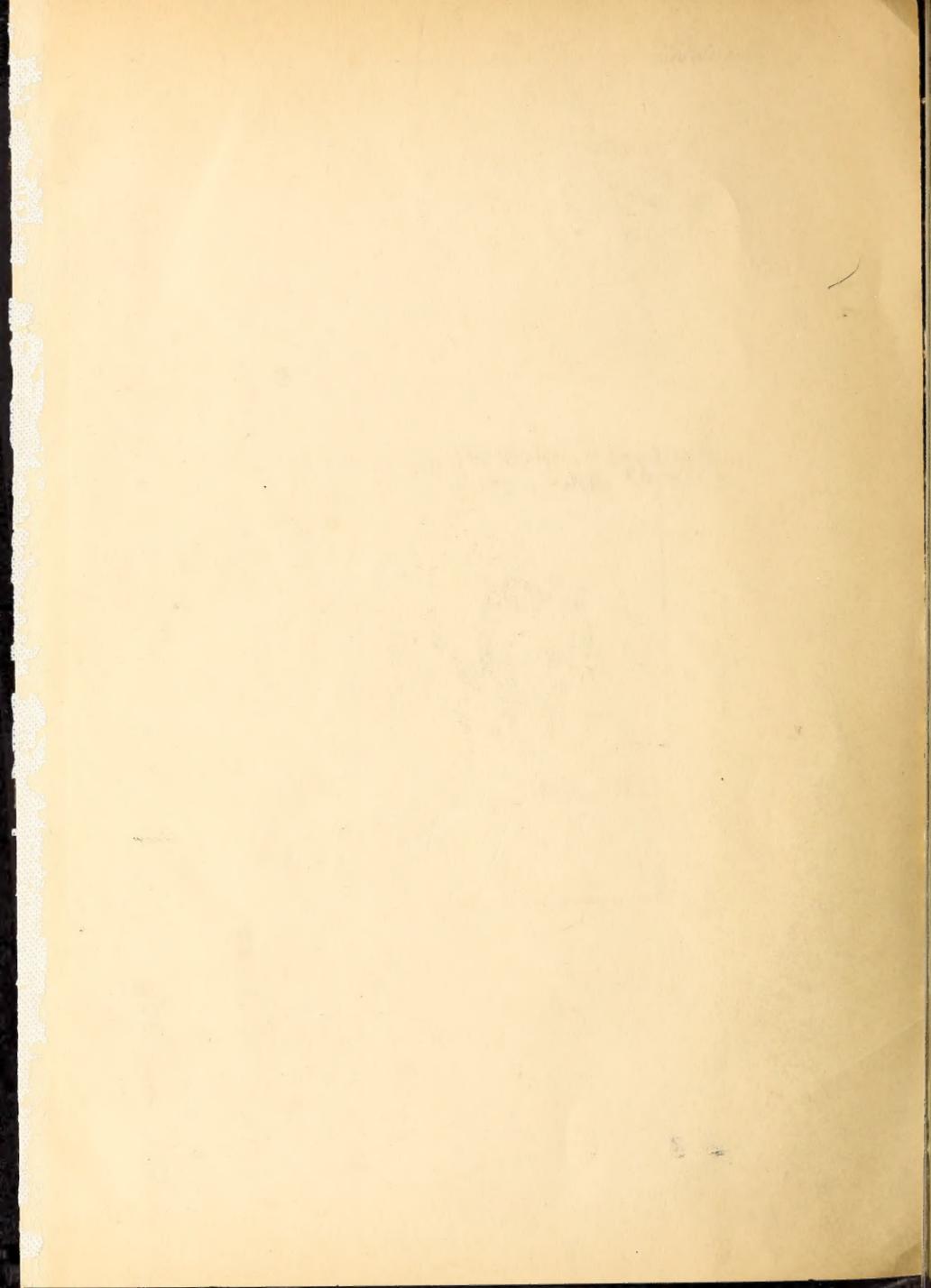


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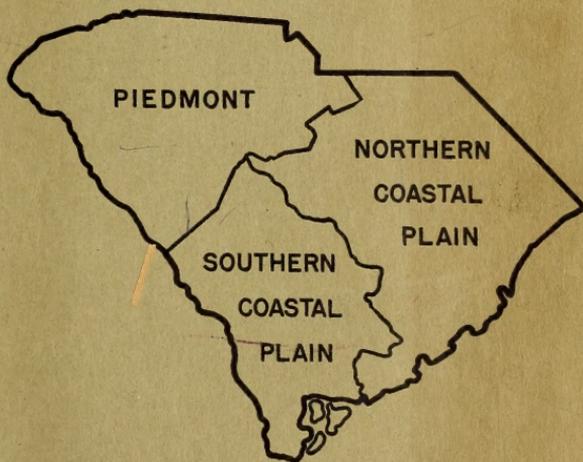
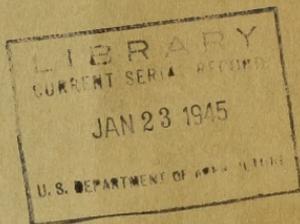
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# South Carolina FOREST RESOURCES and INDUSTRIES

A



FOREST SERVICE

United States Department of Agriculture

Miscellaneous Publication No. 552

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# South Carolina

## Forest Resources and Industries



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APPALACHIAN FOREST EXPERIMENT STATION

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# The Forest Survey

THE war has emphasized the fact that timber is one of the indispensable resources of the United States. Even in normal times 10 million people draw at least part of their livelihood from harvesting, transporting, manufacturing, and distributing forest products. War requirements far outweigh those of peace.

One-third of the Nation's productive land is available for and suited to the growing of timber. Maintenance of timber supplies on this vast area for future needs is both a public and private responsibility. This involves long-time planning and ample and reliable knowledge of forest conditions and forest-products requirements. Authentic facts must be gathered as to the location and condition of existing and prospective forests and forest lands, depletion and growth, and present and probable future requirements for forest products. With a view to obtaining such facts, Congress by the McSweeney-McNary Forest Research Act of May 22, 1928, authorized the Nation-wide Forest Survey.

The fivefold purpose of the survey is: (1) To determine the extent, location, and condition of forest lands, and species, quantity, and quality of timber on these lands; (2) to ascertain the current and probable future productivity of forest areas; (3) to determine the quantity of timber cut for industrial and domestic uses, and the losses from fire, insects, disease, suppression, and other causes; (4) to ascertain the present and probable future trend in requirements for forest products by all classes of consumers; and (5) to interpret these findings and correlate them with other economic factors as a basis for formulating public and private policies for effective and rational use and management of land suitable for forest production.

The rapidly changing economic and social conditions incident to the war have increased the need for publishing the facts already gathered and the conclusions to which they lead. Results of the Forest Survey are published in a series of reports that aim to supply general information for a long-time program of planning for timber production. Other values of forest land, such as grazing and watershed protection, are not covered by this study.

The information presented here is applicable to South Carolina and to large units within the State; it furnishes the background for intensive studies of critical situations, but it may not correctly reflect conditions in subdivisions as small as counties. Also, the recommendations made here presuppose normal peacetime conditions. Hence any that are not in keeping with war requirements are obviously in abeyance for the present.

All phases of this investigation except the requirements study—which is handled on a national basis from Washington, with the assistance of the forest experiment stations and the Forest Products Laboratory—are conducted in their respective regions by the experiment stations of the Forest Service. The South Carolina survey was made by the Appalachian Forest Experiment Station with headquarters at Asheville, N. C.

RAYMOND D. GARVER,  
*Director, Forest Survey.*

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## Summary of Survey Findings

**F**ORESTS are one of South Carolina's most important natural resources. They form an inseparable part of the social and economic structure of the State. Under proper management the forest resource is renewable, and because of its vital contribution to the welfare of the people, both private citizens and public officials should be more active in initiating and putting into effect conservative and permanently productive plans of forest use.

The methods used in collecting the Survey data for South Carolina are similar to those previously employed in other Southeastern States, following careful tests to establish their reliability and efficiency. The field work on the inventory phase of the Survey was completed in 1936, and in preparing the present publication the original figures had to be used; in other respects the latest available information has been drawn upon.

The following summary of the survey data emphasizes the importance of the forest resource to the economy of South Carolina and the welfare of its people.

### *Land Use*

The land area of South Carolina (fig. 1) is approximately 19½ million acres. About 55 percent is forest land, 3 percent abandoned cropland, 36 percent agricultural land, and 6 percent is devoted to other uses. Much of the forested area has progressed through several cycles of clearing, cultivation, and abandonment, but for the State as a whole the acreages in forest and cropland have remained relatively constant for the past century. Decline in cotton production and farm prices generally, however, has resulted in a greater diversification in land use. Moreover, there has been a steady increase in the utilization and value of forest products and a tendency to convert the less productive cropland to forest.

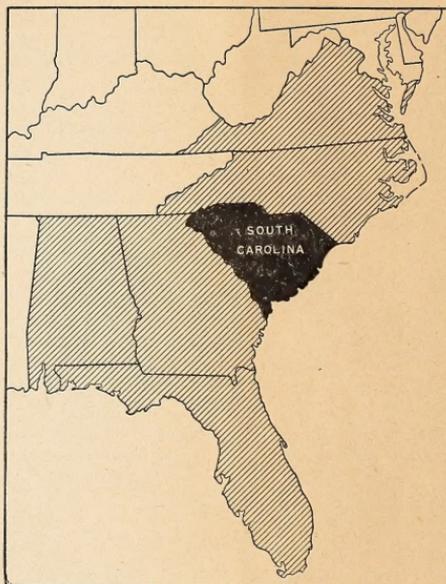


FIGURE 1.—South Carolina and other Southeastern States.

### *Forest Land*

Almost all of South Carolina's 11 million acres of forest land is capable of commercial timber production. Three-fourths is classed as pine types—loblolly pine being the most extensive—and one-fourth as hardwood types, chiefly bottom-land hardwoods.

Stands of sawlog-size<sup>1</sup> timber are found on 58 percent of the forest land (15 percent is classed as old growth and 43 percent as second growth); cordwood-size stands occupy about 34 percent; re-

<sup>1</sup> Definitions of the terms used will be found in the appendix, p. 63.

production 7 percent; and clear-cut 1 percent. Sawlog stands are most extensive in the Coastal Plain, cordwood in the Piedmont Plateau.

### *Timber Volume*

There are approximately 30 billion board feet of saw timber in the State, about three-fifths pine and two-fifths hardwood and cypress. More than a third of the total volume is loblolly pine.

Of the saw-timber volume, one-fourth of the pine and six-tenths of the hardwood-cypress is in old-growth stands; but more than half of these have been partly cut over, leaving much of their volume in small or inferior trees.

Most of the saw-timber volume is in small trees. One-third of the pine is in trees of 10- and 12-inch diameter classes, and half of the hardwood is in the 14- to 18-inch classes.

Most of the board-foot volume is commercially operable. Ninety-two percent is in stands of 2 M board feet or more per acre, and over half in stands of 6 M board feet or more. The average volume is 1,871 board feet per acre on the piedmont and 3,235 on the Coastal Plain.

The total volume of living trees 5 inches d. b. h.<sup>2</sup> and larger is 158 million cords. Pines constitute 43 percent, hardwoods 53 percent, and cypress 4 percent. Twelve percent, however, is in cull trees, principally hardwoods. Thirty-five million pine trees meet the specifications of the American Standards Association for poles; three-fourths are in the 20- and 25-foot length classes.

### *Forest Growth*

For the period 1936-40, the saw-timber growth in South Carolina averaged 1.7 billion board feet per year. This was reduced almost a fifth through mortality, leaving a net growth of 1.4 billion board feet. Growth in cubic feet of all sound trees that had a diameter of 5 inches or more, after deduction for mortality, averaged 360 million feet annually.

The average net growth per acre of saw-timber trees in all types of stands was 135 feet, and of all sound trees 5 inches and larger about 34 cubic feet annually. These figures reflect the generally understocked condition of timber stands in South Carolina. In contrast, stands of loblolly pine growing at a yearly rate of 500 to 600 board feet, or 100 to 150 cubic feet per acre, are not uncommon for small areas in the State.

<sup>2</sup> D. b. h. = diameter at breast height, outside bark,  $4\frac{1}{2}$  feet above ground level.

More net growth accrued to the pine than to the hardwoods. Proportions differed among survey units, but for the State as a whole 72 percent of the board foot volume and 66 percent of the cubic foot volume was pine increment.

### *Forest Industries*

The wood-using industries, as a group, rank next to textiles among the manufacturing industries of South Carolina. Forest industries are found in every county (in contrast to the concentration of most other industries in a few sections of the State) and lumber is the principal product. In 1942 there were 1,267 operating sawmills which cut a total of 1.1 billion board feet. Twenty-eight percent of the cut came from the 26 larger mills that had an average daily production of 30 M board feet or more. The remaining 72 percent was produced by small mills that had an average daily production of 8 M board feet or less.

Pulp and paper manufacture ranks next to lumber in the value of product. Expansion of mills at Charleston and Georgetown has increased the requirement of pine pulpwood to a million cords per year.

Nearly half of the total volume of wood used in the State in 1936 was consumed as fuel; probably half of it came from dead and cull trees and half from sound growing stock.

South Carolina's wood-using industries in 1940 provided a total employment of 8.2 million man-days, equivalent to full-time work by 31,600 persons. The number of persons benefiting from forest and mill employment is much larger, however, because of many part-time workers. Farmers furnish much of the part-time labor.

### *Forest Growth and Commodity Drain*

Comparisons between the net growth and commodity drain show that there is a slight surplus of growth for the State as a whole and for all forest types combined. But the growth-and-drain relation differs between forest types, size classes, and Survey units. Thus, on the northern Coastal Plain the average yearly growth of saw-timber-size-pine during the 5-year period 1936-40 exceeded the average drain by 8 percent; for saw-timber-size hardwoods the growth was 25 percent less than the drain. But when trees 5 inches in diameter and larger are considered, the growth of both pines and hardwoods is less than the drain. This means that

there is excessive cutting of the smaller size trees that should be left to build up reserves of saw timber.

The situation is better on the southern Coastal Plain and much better on the piedmont, where the growth of both the total stand and the saw timber materially exceeds the drain. A substantial part of this surplus should be left to increase the amount of growing stock and the size and quality of the timber. The remainder would justify a moderate expansion in the utilization of both pine and hardwood, provided the expansion, particularly in the piedmont, is based upon the use of a large proportion of low-quality material.

In several localities on the Coastal Plain overcutting has been so great that the timber tributary to large mills is approaching exhaustion, and unless logs can be obtained elsewhere the industrial contraction that has already started must inevitably continue. Forest Survey data do not fully reveal

the seriousness of this situation, which needs more careful analysis.

### *Measures for Safeguarding Forest Production*

South Carolina must adopt a more positive and inclusive program with respect to her forests if they are to approach reasonably high productivity. In some sections and forest types, there is insufficient material in the State to meet current needs. Elsewhere, measures are needed to build up the growing stock so as to insure ample supplies for future industrial expansion. The program should include provisions for halting the general practice of indiscriminate cutting in immature stands, for adequate fire control, reduction of waste in utilization, increase in technical assistance to woodland owners, and the removal of inequities of taxation and other financial barriers to good forest management. To be successful, the program must have a full measure of support from State agencies, from the Federal Government, and from the landowners themselves.

# Physical Environment Of The State

## *Physiographic Divisions*

**S**OUTH Carolina has four distinct physiographic divisions: the Coastal Plain, the Sand hills, the

Piedmont Plateau, and the Appalachian Mountains (fig. 2). These regions differ in topography, drainage, climate, soils, and forest vegetation.

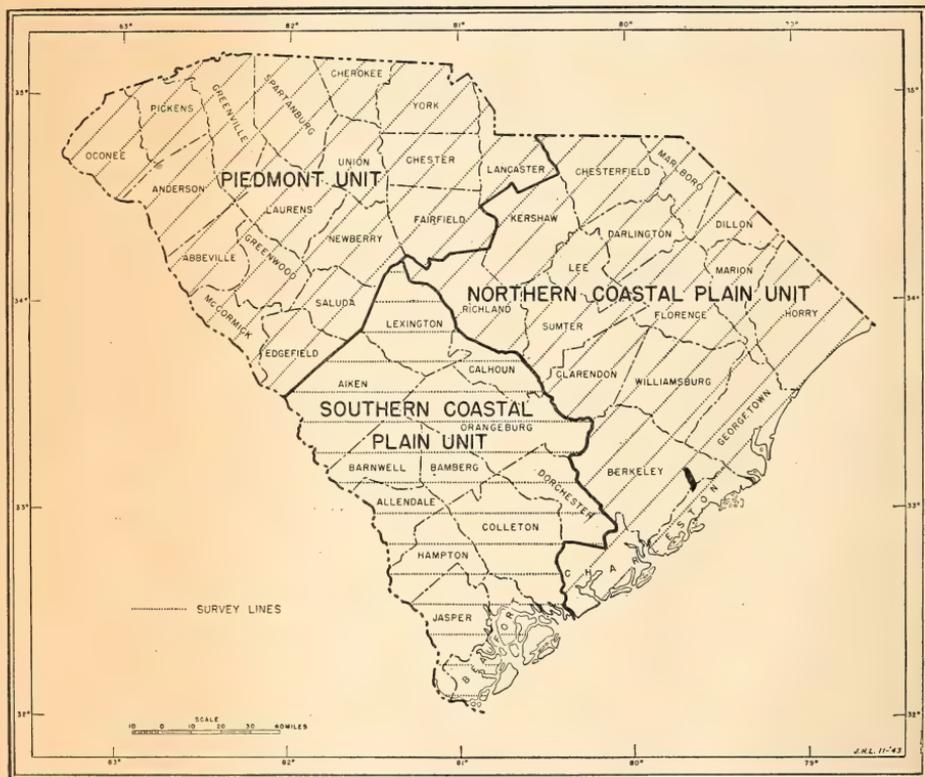
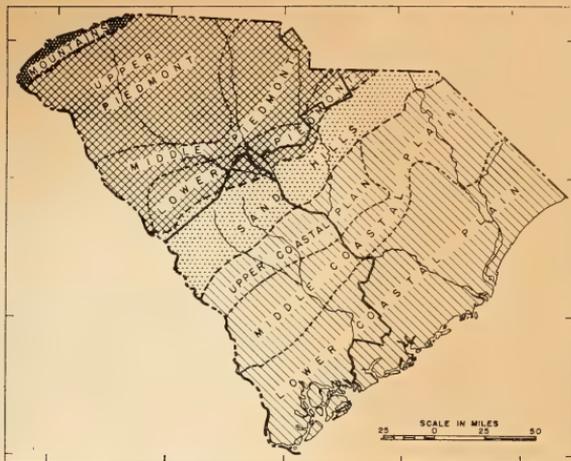


FIGURE 2.—Location of units and approximate survey lines in South Carolina.

FIGURE 3.—Physiographic divisions of South Carolina.



The Coastal Plain extends 100 to 125 miles inland from the Atlantic Ocean and occupies about two-thirds of the State's area. It was divided, for the purposes of the Forest Survey, into northern and southern units (fig. 3), the former somewhat larger than the latter. The Coastal Plain is heavily wooded, containing 70 percent of the State's forest area. Loblolly pine is the predominant type, but there are many scattered bodies of longleaf pine, and in the extreme southeastern counties, slash pine. Along the rivers are broad strips of bottom-land hardwoods.

For some distance from the coast, the Coastal Plain is practically level; but in the western part it is gently rolling, reaching in places an altitude of 500 feet. The eastern part or lower Coastal Plain is mostly less than 100 feet above sea level. Its soils, except for the deep muck in the river bottoms, are sedimentary loamy sands or sandy loams. Much of it is too poorly drained for agriculture; pine flatwoods and river-bottom swamps of hardwoods and baldcypress cover the greater part (fig. 4). The middle and upper Coastal Plain is higher and has more pronounced slopes, is better drained, and has somewhat heavier soils, though generally not as heavy as those of the piedmont. More land is cultivated on the upper than on the lower Coastal Plain.

A belt of sand hills, 20 to 30 miles wide, which once formed the Atlantic coastline, fringes the western edge of the Coastal Plain. Here soil suit-

able for agriculture is limited; most of the land is better adapted to forests, but these are inferior, as a rule, to the forests in other parts of the State. Much of the sand hill forest is of scrub oak or open longleaf pine stands. In this report the sand hill region is included in the northern and the southern Coastal Plain units, about half in each.

The Piedmont Plateau includes the western third of South Carolina, up to the narrow mountainous strip along the northwestern boundary (fig. 3). The terrain is distinctly rolling (fig. 5) and the elevation ranges from 500 to 1,000 feet above sea level. The soils are basically fertile, and most of the land has been cultivated at one time or another during the past century, but the agriculture customarily practiced has made the region one of the most severely eroded in the United States. The Soil Conservation Service estimated in 1934 that 700,000 acres had been virtually ruined for tillage (17)<sup>3</sup>. Erosion has been especially severe in the middle and lower portions of the piedmont. Here much of the land is distinctly submarginal for agriculture, although capable of supporting productive forest stands.

The piedmont, including the mountains, contains 30 percent of the State's forest area. Loblolly pine gives way to shortleaf pine on the middle piedmont and the latter to Virginia pine on the upper piedmont.

The Blue Ridge Mountains and their foothills in the extreme western part of South Carolina include

<sup>3</sup> Italic numbers in parentheses refer to Literature Cited, p. 62.



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FIGURE 4.—Pine flatwoods (A) and hardwood bottom lands (B) are two characteristic features of the Coastal Plain of South Carolina.

some 300,000 acres in Oconee, Pickens, and Greenville Counties. Most of this rugged area is in forest, agriculture being largely confined to the valleys. The forest is principally of the upland hardwood type (fig. 6).

A network of highways and railroads penetrates to practically all sections of South Carolina. Hard-surface roads traverse every county, and local, improved county roads give year-round access to most areas. The Southern Railway, Seaboard Air Line,



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FIGURE 5.—Rolling upland with forest and cropland intermingled is typical of the Piedmont Plateau and the upper Coastal Plain.



F372720

FIGURE 6.—Commercial and scenic values are combined in the mountain forests of South Carolina.



FIGURE 7.—Improved roads permit the trucking of forest products from the woods to the mill, supplementing the hauling by railroads.

and Atlantic Coast Line, together with interconnecting carriers, serve the State so well that the only extensive regions more than 6 miles from a railroad are along the coast and in the mountains. Most forest areas, therefore, can be reached by rail and highway, and their products are easily transported to market (fig. 7).

Water transportation is possible along the coast and up the channels of the larger rivers of the Coastal Plain. The Intercoastal Waterway skirts the coast from Savannah to the North Carolina line, thus providing a channel between the mouths of the navigable rivers for small power boats, barges, and rafts. The Congaree, Wateree, and other rivers are navigable for short distances; completion of the Santee-Cooper River hydroelectric project makes possible an improved waterway from Charleston to Columbia. In recent years little use has been made of these waterways for transporting forest products, although the construction of pulp mills at Georgetown and Charleston has increased the barging of pulpwood.

### *Climate*

The climate of South Carolina is marked by local variations from the coast to the mountains. The growing seasons are generally long, the summers warm, the winters mild, and the rainfall abundant and well distributed. The interval between the last severe frost in the spring and the first killing frost in the fall ranges from 294 days in the extreme southern part to 186 days in the extreme northwestern part of the State. South Carolina's mean temperature is 63° F.; the January average is 45° and the July average 80°. Coastal areas have even relatively temperatures, but farther inland the seasonal variation is marked.

Rainfall averages about 48 inches per year for the State as a whole, with a recorded minimum of 36 and maximum of 64 inches (in 1929). The heaviest rainfall is in the upper piedmont and the mountains, a factor that contributes to the erosion problem of the region. Although the rainfall usually reaches its peak in the summer, it is fairly evenly distributed throughout the year. In general, the climate favors a relatively rapid growth of the forest.

# The Social And Economic Setting

## Population

**I**N 1940 South Carolina had a population of 1,899,804, an increase of 9 percent over 1930.

This increase was in the nonfarm population, and can be attributed chiefly to the current industrial expansion and the concentration of factory workers in towns and cities. Between 1930 and 1940 the farm population decreased slightly—from 914,098 to 913,312.

The distribution of farm and nonfarm population is related to the proportion of the land in forest. In 1940 the 26 counties that were 50 percent or more forested (figs. 8 and 18) contained only 45 percent of the total and 37 percent of the nonfarm population, although they included more than half (58 percent) of the State's area. These counties averaged only 48 persons per square mile, while the counties less than half forested averaged 82; the State average was 62. The decade 1930-40 witnessed an increase of 4 percent in farm population in the counties 50 percent or more forested, and a decrease of 4 percent

in those less than half forested. Sixty-three percent of the State's nonfarm increase was in the counties less than half forested. Although these figures do not tell the whole story, they suggest the growing concentration of industry (chiefly textile) in counties with smaller areas of forest. In many of these, however, agriculture is practiced with greater intensity than in the more sparsely settled but more heavily forested counties.

## Agriculture

Until about 1875, South Carolina, one of the earliest settled areas of the New World, was an almost purely agricultural State. Room for subsistence crops was provided by clearings in the dense forest. Agricultural development, however, was attended by much exploitation and wasteful liquidation of the forests, and by overcropping of cleared lands. Much agricultural land—in the light soils of the Coastal Plain as well as the heavier ones of the Piedmont Plateau—was abandoned when it became infertile

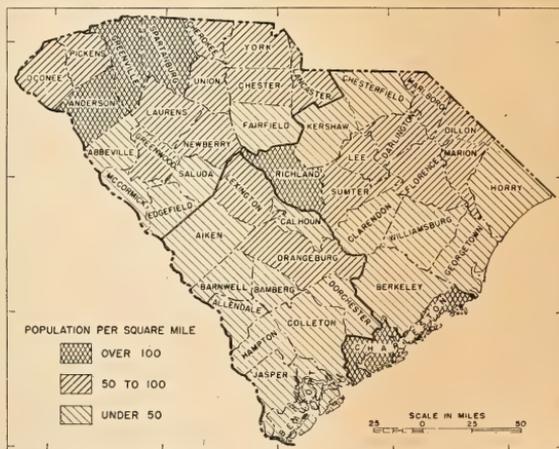


FIGURE 8.—Population per square mile in South Carolina, 1940.



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FIGURE 9.—More than 500,000 acres of abandoned fields, some badly eroded, were reported by the Forest Survey in South Carolina. Almost half the area was on the piedmont.

from constant cropping. On the steeper slopes and rolling lands of the piedmont, lack of adequate terracing, failure to use close-growing crops, and the custom of letting land lie idle without proper vegetative cover, frequently resulted in such serious erosion that cultivation was no longer practicable (fig. 9).

Agricultural specialization started in the Colonial period with rice and indigo, which were raised in the low country of the Coastal Plain. The invention of the cotton gin at the end of the eighteenth century soon made cotton farming profitable in most of South Carolina. Indeed, cotton became the chief money crop (fig. 10) and its widespread production led to further clearing of the forest. Considerable areas were eventually abandoned, however, because of soil impoverishment and erosion and these rapidly reverted to forest. Thus, in spite of a fairly dense population and the fact that a small amount of virgin timber remains, over half of South Carolina's 19.4 million acres is even now covered with forest.

In 1940, according to the U. S. Census of Agriculture, the State had 137,558 farms, which occupied

57 percent of the land area and were valued at nearly \$338,500,000. The area in woodland on the average farm was 41 acres in the 26 counties that were more than half forested and 29 acres in the 20 less forested counties. In contrast, the average areas of cropland were 29 acres per farm in the more forested, 35 acres in the less forested counties. There was little difference between the two groups of counties in the size of the average farm—83 acres in the more and 80 acres in the less forested counties. Figure 11 shows the percent of the total land area, by counties, that was producing agricultural crops in 1939, according to the U. S. Census of Agriculture.

Cotton and corn are South Carolina's principal farm crops. For many years cotton led in acreage, occupying 42 percent of the improved farm land in 1909 and 1919, and 37 percent of the land available for crops in 1929; but in 1939 the cotton-producing area fell to 21 percent while the corn-producing area rose to 32 percent of the available cropland (9, 10, 11, 12). In 1939 cotton was raised on 81 percent and corn on 95 percent of South Carolina's farms. Other important crops are small grains, hay, and tobacco, in the order named, though tobacco was produced



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FIGURE 10.—Cotton, a crop with an uncertain future, still furnishes about two-fifths of the cash income to that half of the population of South Carolina which lives on farms.

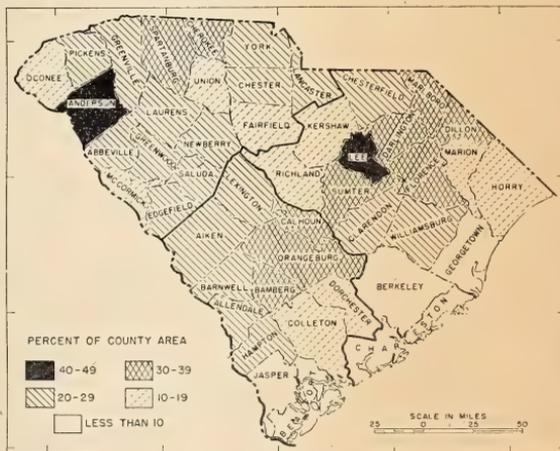


FIGURE 11.—Percent of land area producing agricultural crops in 1939.

on only about 3 percent of the total cropland harvested in 1939.

The average cotton acreage per farm has steadily decreased. It was 14.5 acres in 1909, 13.7 in 1919, 12.5 in 1929, and 8.6 in 1939. For the same years the average acreage in corn was 8.9, 9.1, 8.8, and 12.8. While these figures indicate a trend toward greater crop diversification, cotton still retains a

dominant position in South Carolina's agriculture. This is as it should be, in view of the importance of cotton raising to the textile industry. Though greater diversification is desirable, it should be sought not at the expense of cotton, but rather through the expansion of other crops and land uses. In some places, the expansion of the livestock industry seems to offer the best opportunities. But

where suitable agricultural land is limited, the broadening of the source of farm income depends largely upon the development of forest resources. The fact that the population is usually more familiar with forest product operations than with other activities, except cotton, corn, or tobacco cultivation, increases the practicability of such development.

### Manufacturing Industries

The aggregate value of South Carolina's industrial products in 1939, including the value added by manufacture, was \$567,359,482, according to the U. S. Census of Manufactures. Of this total, textiles comprised \$390,002,074, or 69 percent; forest products 14 percent (13) (fig. 12); food and beverages 6; fertilizers and cottonseed products 4; and all others 7 percent. Textile manufacture assumed the leading place among the State's industries after the migration of the northern cotton mills to the sources of supply. The value of cotton-textile products, including the value added by manufacture, has exceeded \$300,000,000 in at least 4 out of the 10 United States biennial census studies since 1921. For many decades the value of cotton products, number of wage earners, and salaries and wages paid in the cotton-textile industry have exceeded 50 percent of the State totals for manufacturing industries. South Carolina is outranked only by North Carolina in the volume and value of its cotton manufactures.

Even excluding the small portable sawmills, the combined forest industries ranked next to cotton textiles. The value added by manufacture in the principal forest industries is shown in figure 13.

Overspecialization in cotton is evident from the above figures. An economy based so largely upon one industry is not in the best interest of the State

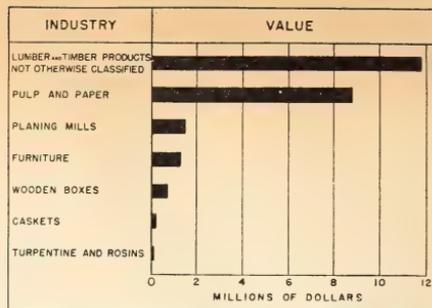


FIGURE 13.—Value added by manufacture for principal forest industries in South Carolina, 1939.

since the market for any commodity or group of related products is subject to wide fluctuations and the income of people dependent upon it may decline at times to tragically low levels. One means of relief from overspecialization is offered by the more effective use of South Carolina's largest land resource—the forest.

Wood-using industries are found in every county in the State, but nearly half the production of textiles (based on the value of the annual product) has in the past come from Greenville, Spartanburg, and Anderson Counties, and 80 percent from 11 counties of the upper piedmont (6). Other manufacturing industries are similarly concentrated, four-fifths being located in the 15 most industrialized counties.

### Forests and Cropland Abandonment

In many places throughout the State second-growth forests have already seized, or are encroaching on, abandoned farm lands (fig. 14). Large areas,

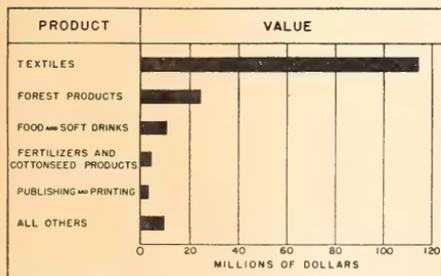


FIGURE 12.—Value added by manufacture for principal industries in South Carolina, 1939.



FIGURE 14.—Abandoned and eroded fields are gradually taken over by the forest, but the process may be a long one.

abandoned during economic upheavals such as those of the Civil War and the depressions of the 1890's and early 1920's, are now covered with pine stands. Excellent stands of blackgum, sweetgum, and other hardwoods may be seen in the river swamps, behind the levees of old rice plantations. Altogether, a large part of South Carolina has gone through several cycles of clearing, cultivating, and abandonment, and a considerable portion of the forests is on land that has been cultivated at one time or another.

In spite of the fact that a large area has been alternately in cultivation or in forest, the acreage devoted to agriculture at any time has remained fairly constant during the past century. In 1940 the area available for crops was 5,529,833 acres; in 1850 the improved area was 4,072,651 acres. The abandonment of old land and the clearing of new have tended to offset each other, though in recent years abandonment has exceeded clearing. According to the Forest Survey, about 551,800 acres of former cropland were in a definite state of abandonment in 1936 (fig. 15), although only 57,400 acres had been cleared and prepared for crops during the preceding 5 years (table 30, Appendix).

The tendency of abandonment to exceed the rate of clearing is the result not only of soil erosion and exhaustion, but also of changing economic conditions, leading to a decrease in the area under cultivation. Until the advent of World War II, cotton had for some time faced a steadily declining market with a correspondingly low price. This accounts

for the fact that in 1938 the harvested acreage of cotton in South Carolina was less than in any year since 1878 (14). It has been difficult to divert much cotton land to other cultivated crops, partly because of the relatively small areas subject to rehabilitation under the provisions of the Agricultural Conservation Program.

### Value of Farm Woodlands

The farm woodlands of South Carolina, as shown in table 1, contribute only about 5 percent of the farm value of all crops; but this figure is quite misleading. The large area in farm woods—more than 50 percent of the State's total productive forest area—indicates that it is of great importance as a source of forest products (table 2). To the farmers the woodlands have the advantage of cheap production and maintenance, so that the harvest of wood materials represents more nearly clear profit than the harvest of other crops. There is no expense of fertilizing or cultivating, and little risk of loss from adverse weather. Forest planting is relatively inexpensive. Thinnings and other improvement measures can pay for themselves, completely or in part, through farm use (fig. 16) or sale of the materials removed. Work can be done in the winter or at other periods when farm activities are light. In short, farm woods, if properly handled, will yield a continuous annual profit with comparatively little investment.

FIGURE 15.—Land area classified by use.

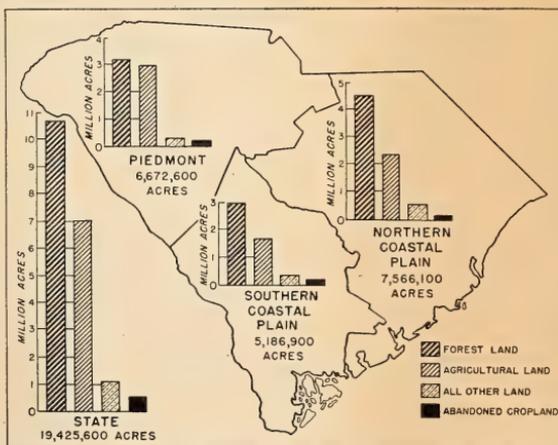




FIGURE 16.—Fuel for the kitchen stove comes from the farm wood lot.

### Forests and Water Resources

In South Carolina, where industries depend largely upon water supplies and water power, forest or other vegetal cover must be maintained on watersheds to help control erosion, regulate stream flow, and improve the purity of the water.

TABLE 1.—Farm value of South Carolina agricultural products, 1937

Commodity	Farm value	
	Dollars	Percent
Cotton and cottonseed.....	52,840,000	37.7
Tobacco.....	122,481,000	16.0
Corn.....	118,709,000	13.3
Forest products.....	26,623,000	4.7
All other farm products.....	339,747,000	28.3
Total gross income.....	140,400,000	100.0
Total cash income.....	104,700,000	-----

<sup>1</sup> Estimates by the Bureau of Agricultural Economics (14).

<sup>2</sup> Of the amount shown, 25 percent (\$1,639,842) represents cash income from sale of forest products. (U. S. Forest Service and Bureau of Agricultural Economics. FARM FOREST PRODUCTS, 1937. (Processed.) 1940.)

<sup>3</sup> This figure duplicates in part the item of forest products.

TABLE 2.—Forest products sold from South Carolina farms, and grown and used on farms, 1937<sup>1</sup>

SOLD FROM FARMS		
Commodity	Quantity	Value
		Dollars
Standing timber..... M bd. ft. ....	127,180	554,505
Sawlogs..... do. ....	58,462	298,156
Lumber..... do. ....	8,500	119,840
Fuel wood..... cords .....	159,759	359,458
Pulpwood..... do. ....	70,852	93,525
Poles..... number .....	104,206	87,533
Cross ties..... do. ....	124,956	33,738
Posts..... do. ....	308,732	30,873
Other products.....		62,214
Total.....		1,639,842
GROWN AND USED ON FARMS		
Fuel wood..... cords .....	1,580,546	3,556,228
Lumber..... M bd. ft. ....	60,697	849,758
Posts..... number .....	4,845,977	484,598
Shingles..... million pieces .....	20,799	63,021
Other products.....		29,791
Total.....		4,983,396

<sup>1</sup> U. S. Forest Service and Bureau of Agricultural Economics. FARM FOREST PRODUCTS, 1937. (Processed.) 1940.

The State's water needs are supplied chiefly by four fairly large river systems and numerous smaller streams. The Pee Dee River cuts across the northern part of the Sand hills and the Coastal Plain. The Santee, formed by the confluence of the Wateree and Congaree, drains the larger part of the piedmont through numerous tributaries, notably the Catawba, Broad, and Saluda Rivers, and flows southeasterly through the middle of the State to the Atlantic. The Edisto bisects the Coastal Plain south of the Santee; and the Savannah, with many South Carolina tributaries, forms the southwestern boundary of the State.

The relation of forests to water resources is particularly close in the mountains and on the piedmont, which, together with the mountain and piedmont regions of North Carolina and Georgia, forms one of the major water-power regions of the United States. In South Carolina numerous important streams either rise in or cross this region. High annual rainfall, combined with available sites for reservoirs, are favorable to the development of abundant, inexpensive hydroelectric power. Although only about half of its potential power had been harnessed<sup>4</sup>, South Carolina ranked sixth among the

<sup>4</sup> United States National Resources Committee. INVENTORY OF THE WATER RESOURCES OF THE UNITED STATES. (South Atlantic and Eastern Gulf Drainage Areas.) (Processed.) 1935.

States in developed water power in 1938, being exceeded by California, New York, Washington, Alabama, and North Carolina (16).

Though the best power sites are on the piedmont and along the fall line that separates the piedmont from the Coastal Plain, commercial distribution of electricity has made possible the use of hydroelectric power by factories throughout most of the State, including many textile plants (table 3).

In 1920 water furnished 92 percent of the power produced at central generating plants (3, 16). The Santee-Cooper River hydroelectric project further increases the range of distribution and the value of the water resources on the lower Coastal Plain.

A large quantity of surface water is required by both industrial and domestic users in all parts of the State. Seventy percent of the water consumed in the 84 South Carolina cities having waterworks comes from surface supplies<sup>5</sup>. Private water systems, both domestic and industrial, further augment the demand for pure water, emphasizing the problem of adequate watershed protection, particularly in the mountains and on the piedmont.

In the western part of the State rapid runoff, soil erosion, excessive silting, and variable flow of the streams constitute a pressing need for watershed protection and soil conservation measures. Watershed protection has been started through the Federal acquisition of forest lands in 11 piedmont and mountain counties to form the Sumter National Forest. Further public ownership of watershed forests by the State, counties, or Federal Government would help to insure the stability of South Carolina's industries and encourage their expansion.

TABLE 3.—Power-plant capacity and power generated in South Carolina, 1940<sup>1</sup>

Source	Installed capacity		Power generated	
	Kilowatts	Percent	1,000 kw.	Percent
Hydroelectric plants.....	2515,528	79.8	997,038	68.1
Steam plants.....	127,630	19.7	460,824	31.5
Internal-combustion plants	3,320	.5	6,503	.4
Total.....	646,478	100.0	1,464,365	100.0

<sup>1</sup> South Carolina Public Service Commission figures (7).

<sup>2</sup> Does not include installed capacity of Santee-Cooper project, which will be approximately 150,000 kw., of which 86,000 kw. will be primary power.

The Forest Survey reported damage from erosion on 40 percent of its sample plots on agricultural land

<sup>5</sup> See footnote 4, p. 14.

and on 68 percent on abandoned cropland. Even on the forested plots, 17 percent showed indications of active erosion, chiefly because of thin stocking, the removal of forest cover without providing for adequate restocking to protect the soil, or the too slow recapture of abandoned fields by the forest (fig. 17). Any comprehensive watershed improvement program in the State must provide for planting to aid reclamation of much of the abandoned cropland and the prevention of clearing or too severe cutting on eroding forest land. Maintaining well stocked forest stands on uncultivated lands is often the most practicable means of regulating runoff and controlling erosion.

### Multiple Use of Forests

Recreation, hunting, fishing, grazing, and wildlife sanctuaries can often be combined with timber production and watershed protection, or may even take precedence over them as purposes of forest management. The importance of providing forest recreational facilities has grown in recent years; it now governs the management of the State parks and is considered in the administration of the national forests. Numerous clubs and estates, particularly on the lower Coastal Plain, are maintained chiefly or solely for hunting. Grazing provides a source of income from many forest lands; according to the U. S. Census for 1935, the pastured area of farm woodland in South Carolina totaled more than 1,350,000 acres. Because livestock may damage tree reproduction and growth and thereby bring about erosion and accelerated runoff, grazing should be coordinated with such other uses as may be included in the plan of management, which may require very light grazing or none in the mountains.

There are various opportunities for multiple use of the forests, and in most localities two or more uses can be combined profitably.

### Agencies for the Solution of Land-Use Problems

Local land use programs are being fostered by several governmental agencies in different parts of South Carolina. They are studying such problems as whether, in specific instances, forests or farm crops will provide the greater ultimate return; or how best to use idle land suitable for forests so as to realize a continuous income from it.

These programs are sponsored by such agencies as the State Commission of Forestry, the State Agricultural Extension Service, the Soil Conservation



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FIGURE 17.—(A), Gully formed in depleted and abandoned cotton land. (B), Erosion from the gully has filled the stream bed with silt, destroying its capacity to carry flood water and causing overflow of adjacent valley land.

Service, Farm Security Administration, Agricultural Adjustment Administration, and the Forest Service. Submarginal lands have been withdrawn from cultivation; payments for reforestation on certain lands are being made under the Agricultural Conservation Program; and the acreage of woodland on cooperating farms is increasing in Soil Conservation districts. Several agencies are helping individual landowners to increase the returns from forest land. Within the boundaries of the Francis Marion and Sumter National Forests, submarginal farm land and cut-over areas purchased by the United States are becoming reforested. The combined effect of these ac-

tivities is to increase the forest area and develop an appreciation of the need and use of forests in the land-use program of the State.

Although progress has been made, too many landowners still look upon forests as wild growth—fortunately of value—to be cut and sold at the earliest opportunity. Consequently, the fact must be emphasized that forests, like other crops, yield much greater returns when properly managed for permanent production than when left untended, to be cut over, whenever there are a few merchantable trees in the stands, without adequate provision for succeeding cuts.

# Characteristics Of The Forest

## Origin of the Present Forest

ACCORDING to the records of early settlers, luxuriant forests covered all of South Carolina except the salt marshes, occasional meadows, and Indian clearings. Of the original timber on the piedmont, probably the greater part was cut to clear land for agriculture. Toward the end of the last century, lumbering grew to large proportions in the Coastal Plain; today, only scattered vestiges of the virgin forest remain. Much of the cut-over area, however, as well as a large part of the abandoned farm land, has been reclaimed by extensive second-growth forests, usually pine on the previously cultivated areas. Second-growth stands now supply most of the commercial timber cut in the State.

## Forest Area

The Forest Survey, in 1936, classified 10,704,100 acres (55 percent of South Carolina's land area) as forest. A small portion, aggregating 25,500 acres of brush-covered swamps, sand dunes, and other re-

gions which seemed to be incapable of producing merchantable timber, is not discussed in this report.

The areas classified as forest and nonforest in the three survey units are shown in table 30 and the percent of land area forested in the individual counties in figure 18.

The most heavily timbered part of South Carolina is on the Coastal Plain, where nearly 60 percent of the land is under forest and five counties are more than 70 percent forested. The piedmont is the most intensively developed part of the State, agriculturally and industrially, and so has the smallest proportion of forest. Even here, however, forests cover 45 percent of the land surface.

## Forest-Land Ownership

About two-fifths of the forest area is owned in relatively large tracts by pulp and lumber companies, hunting clubs, investment corporations, and private estates (table 4), the greater part of it near the coast. Farther inland, on the middle and upper

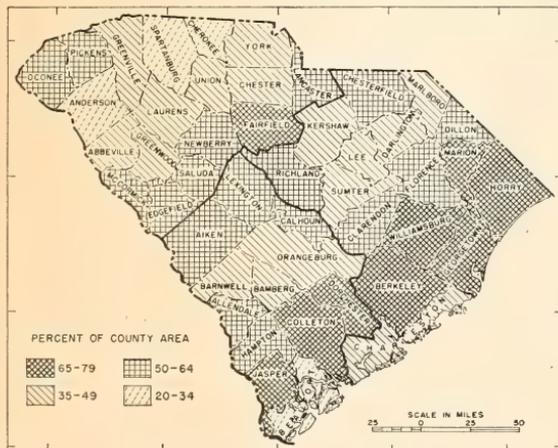


FIGURE 18.—Percent of land in forest, by counties, 1940.

Coastal Plain and the piedmont, most of the forest is in small tracts held by farmers, although there are a few large holdings in the mountains. National forests make up almost 5 percent, and State, county, and municipal forests more than 2 percent of the forest area.

### Forest Types

The distribution of major forest types is shown on the map inside the back cover of this report. Their areas, and proportionate distribution among the three survey units are given in table 5.

On the map the major type names are loblolly pine-hardwoods, longleaf pine, bottom-land hardwoods, shortleaf pine-hardwoods, Virginia pine-hardwoods, and mountain hardwoods. Some modifications of these have been made in the text for the sake of brevity and convenience. Thus the mountain hardwoods are combined with many small bodies of hardwoods on upland soils under the term "upland hardwoods;" the relatively small area of Virginia pine-hardwood is combined with shortleaf pine-hardwood under the name "shortleaf pine type;" and the loblolly pine-hardwood is referred to as "loblolly pine type." The major types are really groups of types, including more or less well defined and characteristic aggregates of species, not belonging to the major type, whose areas are too small to be adequately shown on the map.

TABLE 4.—Forest-land ownership in South Carolina, 1938<sup>1</sup>

Ownership	Area	
	Acres	Percent
Industrial, estate, etc.....	4,421,000	41.3
Farm.....	5,689,100	53.1
National forest.....	520,000	4.9
Other Federal.....	51,000	.5
State, county, and municipal.....	23,000	.2
Total.....	10,704,100	100.0

<sup>1</sup> Unpublished manuscript, Forest Service.

TABLE 5.—Distribution of the area in each major forest type, by region, condition, and age class, 1936

Item	Loblolly pine	Longleaf pine	Shortleaf pine	Bottom-land hardwoods	Upland hardwoods
	Acres	Acres	Acres	Acres	Acres
Forest area.....	4,006,200	1,762,100	2,026,300	2,160,200	723,800

TABLE 5.—Distribution of the area in each major forest type, by region, condition, and age class, 1936—Continued

Item	Loblolly pine	Longleaf pine	Shortleaf pine	Bottom-land hardwoods	Upland hardwoods
Region:					
Southern Coastal Plain.....	Percent 30.6	Percent 54.4	Percent -----	Percent 32.0	Percent 16.4
Northern Coastal Plain.....	51.8	45.6	6.7	58.5	30.4
Piedmont.....	17.6	-----	93.3	9.5	53.2
Total.....	100.0	100.0	100.0	100.0	100.0
Condition:					
Sawlog size:					
Old growth.....	9.6	8.0	7.7	36.7	17.2
Second growth.....	53.9	38.2	44.2	33.5	20.7
Under-sawlog-size:					
Cordwood.....	28.5	43.7	43.0	22.8	52.8
Reproduction.....	7.1	6.7	4.7	6.0	9.2
Clearcut.....	.9	3.4	.4	1.0	.1
Total.....	100.0	100.0	100.0	100.0	100.0
Age class (years):					
Less than 10.....	10.0	15.3	4.3	9.6	2.8
10-29.....	25.5	32.4	35.8	8.6	18.1
30-49.....	32.0	30.0	31.5	9.5	16.4
50-69.....	20.6	11.6	17.5	14.8	17.8
70-89.....	6.1	5.2	6.1	15.1	13.2
90 and older.....	5.8	5.5	4.8	42.4	31.7
Total.....	100.0	100.0	100.0	100.0	100.0

Each major type varies considerably in the proportions of different tree species. Average proportions of the species in the several types in terms of cubic volume are shown in table 6.

### Loblolly Pine Type

The loblolly pine (fig. 19) is South Carolina's most important forest type, both in size and value. It occupies slightly more than 4 million acres, or 38 percent of the State's forest.

The loblolly pine type covers 41 percent of the forest in the southern Coastal Plain and 46 percent in the northern Coastal Plain. On the piedmont, it occupies 22 percent of the forest land but is confined to the eastern half, where it is the dominant type. The loblolly pine areas include pure stands, mixed stands of loblolly and hardwoods (in which the pine is predominant), and small, often pure stands of pond pine. Loblolly pine forms about 69 percent of the cubic volume in the type; the remainder is shortleaf, pond, and longleaf pines, blackgum, sweetgum, oaks, and other associated species.



F221424

FIGURE 19.—Loblolly pine, shown here, is the predominant species on more than a third of South Carolina's forest area. This open, old-field stand is 50 to 70 years old.

The proportion of loblolly in the present stands is probably considerably higher than it was in the original forest. Much of the area now classed as loblolly was originally in hardwoods with a pine intermixture. Loblolly, because of its prolific seeding and its ability to thrive on poor soils, quickly established itself on lands which were cleared, cultivated, and abandoned. The resulting even-aged stands were as a rule almost pure loblolly (old-field pine); in many of the present stands evidences of previous cultivation (planting rows, old fence rows, and abandoned dwelling sites) can still be seen, particularly on the upper Coastal Plain and the piedmont.

The proportion of hardwoods has increased, however, because of more effective protection from fire and the present practice of cutting only the pine, frequently to low diameter limits. Because the hardwoods are usually of less value than the pines, maintenance of a high proportion of pine is a desirable objective of forest management and at the same time a difficult silvicultural problem.

#### Shortleaf Pine Type

Shortleaf pine occupies over 2 million acres, or 19 percent of the State's forest area and 59 percent of the forest area of the piedmont.

TABLE 6.—Species composition of the principal forest types, in percent of net cubic volume for each type, 1936<sup>1</sup>

Species	Long-leaf pine	Loblolly pine	Bottom-land hardwoods	Cypress	Short-leaf pine	Virginia pine	Upland hardwoods
Softwoods:							
Longleaf and slash pines.....	Percent 80.6	Percent 2.9	Percent 0.1	Percent 0.6	Percent 15.3	Percent 8.0	Percent 0.3
Loblolly pine.....	10.6	68.6	5.8	1.0	5.0	1.5	1.5
Pond pine.....	3.0	6.2	.9	.3	-----	-----	-----
Shortleaf pine.....	.5	4.6	.3	.1	70.7	15.3	8.0
Virginia pine.....	-----	-----	-----	-----	1.5	60.4	.5
White pine.....	-----	-----	-----	-----	.2	.2	1.2
Hemlock.....	-----	-----	-----	-----	.1	-----	.8
Cypress and cedar.....	-----	-----	-----	-----	-----	-----	-----
Hardwoods:							
Blackgum and tupelo.....	.7	4.6	29.6	44.0	-----	-----	-----
Sweetgum.....	.3	4.3	21.3	4.3	3.6	1.7	8.9
Yellow-poplar.....	.3	.8	2.5	-----	4.2	4.9	14.2
Red oaks.....	.4	2.8	8.9	.8	4.2	3.9	18.1
White oaks.....	.8	1.5	5.0	1.7	4.2	7.4	20.6
Scrub oaks.....	2.2	.3	.3	-----	-----	-----	-----
Ash.....	-----	.1	5.1	2.9	-----	-----	-----
Hickory.....	-----	-----	-----	-----	1.6	2.9	12.9
Other hardwoods.....	.6	2.5	15.3	6.1	3.2	3.0	12.8
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0

<sup>1</sup> Net cubic volume outside bark of sound trees at least 5 inches d. b. h., tops and limbs of hardwoods omitted. The percents are based upon the volumes in survey units where the type predominates.

Although stands of shortleaf pine are found on the Coastal Plain, the species predominates on the middle and upper piedmont (fig. 20). It occurs there in pure stands or intermingled with hardwoods, loblolly or Virginia pine. Of the net cubic volume in the type on the piedmont, 71 percent is shortleaf pine, 2 percent Virginia pine, 6 percent other softwoods, and 21 percent hardwoods. The shortleaf, like the loblolly, is predominantly of old-field origin, and exhibits a similar tendency toward a large increase in the proportion of hardwoods with each succeeding generation.

Virginia pine, as a type, covers only 4 percent of the State's forest area and is included in the shortleaf pine type. It is most abundant in a small region (Pickens, Greenville, and Spartanburg Counties) in the intensively cultivated northwestern part of South Carolina.

#### Longleaf Pine Type

The longleaf pine type is found on 1,762,100 acres or 16 percent of South Carolina's forest area. This type, too, was once much more abundant. Land clearing, naval stores operations, and cutting have depleted the original stands and the more prolific and rapidly growing loblolly has taken over abandoned fields and clear-cut areas formerly in longleaf.



F304733

FIGURE 20.—Shortleaf pine type—a 100-year-old stand on the piedmont.

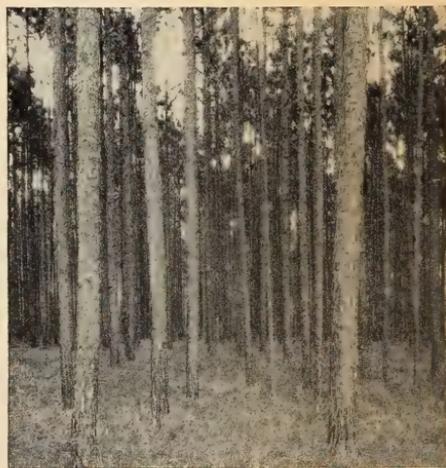
The longleaf pine occupies 32 percent of the forested area in the southern Coastal Plain and 18 percent in the northern Coastal Plain. Along the lower and middle Coastal Plain it occurs chiefly on low, level land, often poorly drained, where it is associated with loblolly and pond pines, blackgum, and cypress. Slash pine, absent from the northern Coastal Plain, is an important associate on the southern Coastal Plain, where it forms 18 percent of the net cubic-foot volume in the type.

The most extensive remaining area of longleaf occurs in the sand-hill belt extending northeasterly across the State. Here the stands are generally very thin, with a dense understory of scrub oak which effectively prevents restocking of pine. In places the pine has been entirely eliminated by cutting, naval stores operations, and fires, leaving only scrub hardwoods of little present commercial value or promise. The better stands of longleaf (fig. 21) are found in scattered tracts in Georgetown, Charleston, and Berkeley Counties.

### Bottom-land Hardwood Type

The bottom-land hardwoods cover 2,160,200 acres, or 20 percent of the State's forested area; 26 percent of that in the Coastal Plain, 28 percent in the northern and 23 percent in the southern part. Bottom-land hardwoods are of much less consequence on the piedmont, where they occur on only 6 percent of the forest area. The remaining high-quality swamp hardwoods (fig. 22) are found largely along the major rivers, particularly the Pee Dee, Santee, Edisto, Combahee, Savannah, and their tributaries, whose bottom lands comprise about a third of the area in this type. Blackgum and sweetgum are the principal species, associated with oaks, water tupelo, and cypress. Cypress, in pure stands or predominating in mixed stands, forms about 13 percent of the major bottom-land hardwoods on the Coastal Plain. Approximately 10 percent of the river-bottom area has been withdrawn from forest production to form a lake for the Santee-Cooper hydroelectric project.

About a million acres of the bottom-land type is in swamps, bays, and ponds containing, as a rule, timber of lower grade than the river bottoms. Blackgum and sweetgum predominate, associated with other hardwoods and with loblolly, pond pine, and cypress. The remaining bottom-land hardwoods



F372821

FIGURE 21.—Longleaf pine type—a second-growth stand approaching sawlog size.



F 429882

FIGURE 22.—Bottom-land saw timber, principally tupelo gum.

occupy occasional stands in the flatwoods of the Coastal Plain and narrow belts along the rivers and streams of the piedmont.

#### *Upland Hardwood Type*

The upland hardwood type covers 723,800 acres, or 7 percent of the South Carolina forest. This type includes the small area of mountain hardwoods along the northwestern border of South Carolina and scattered stands on the higher lands of the Coastal Plain and the rolling hills of the piedmont. The species most generally prevalent throughout the type are various oaks—notably white, scarlet, black, and southern red—hickories, yellow-poplar, red maple, blackgum, and numerous others, intermixed with pines and other softwoods characteristic of different parts of the State. In the mountains, additional species are chestnut oak, northern red oak, basswood, shortleaf pine, Virginia pine, white pine, and hemlock; on the piedmont and Coastal Plain, sweetgum, willow oak, and sycamore mixed with the other species in the moister situations. Winged elm, shortleaf pine, and loblolly are common associates on dry, as well as moist soils. In the sand hills, turkey oak and other scrub oaks predominate on 152,600 acres formerly occupied by longleaf pine (fig. 23).



F 429883

FIGURE 23.—Upland hardwood type—mixed oak.

## Forest Conditions

Determination of forest conditions is based upon the volume of timber per acre, the age of dominant trees, past cutting history, and degree of stocking. Its purpose is to indicate the quality and availability of the timber, and in a general way, the productivity of the forest in the immediate future.

Two broad condition classes were recognized by the survey: (1) sawlog-size, and (2) under-sawlog-size. The areas in each are shown in table 7.

### *Sawlog-size Condition*

Areas with at least 600 board feet per acre, assigned by the survey to the sawlog-size condition class, aggregated 6,203,100 acres, or 58 percent of the South Carolina forest (61 percent on the Coastal Plain and 52 percent on the piedmont). Old growth and second growth occupied, respectively, 26 and 74 percent of the sawlog-size timber area.

In South Carolina as a whole the larger part of the old growth is in hardwoods. On the northern Coastal Plain, old-growth hardwoods cover more than twice as much land as old-growth pine, but on the southern Coastal Plain and the piedmont the latter is somewhat more abundant.

Of the old-growth pine, more than half is in loblolly pine type, the remainder about equally divided between shortleaf and longleaf pine types. Old-growth pine is found in small scattered tracts throughout the State and in a few relatively large blocks owned by estates, game clubs, and lumber companies on the lower Coastal Plain. Of the old-growth hardwood area, more than 80 percent is in bottom-land hardwoods of the Coastal Plain, the remainder chiefly in the mountains. The high proportion of the bottom-land hardwood type is due to the predominance of gums which, until rather recently, had little market value.

Old-growth stands are classed as uncut and partly cut. Uncut old growth (fig. 24) contains, as a rule, more and better material than second growth. Partly-cut old growth, which, as shown in table 7, occupies more than half the old-growth area of South Carolina, has suffered reduction in quality from the removal of selected trees of the more valuable species, as, for example, in cypress logging by early operators. Many old-growth stands are over-mature and defective, and others are of inferior quality because of poor site conditions.



FIGURE 24.—Uncut old-growth loblolly pine on the Coastal Plain.

Three-fourths of the sawlog-size area is second growth (table 7), and four-fifths of this is pine (fig. 25).



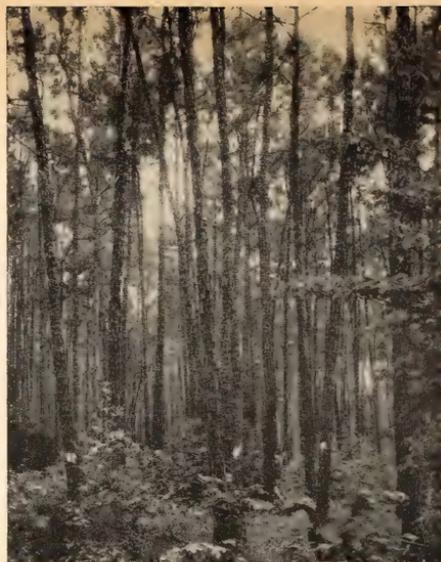
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FIGURE 25.—Second-growth sawlog-size longleaf pine on the Coastal Plain. This stand is in the period of most rapid board-foot growth, and many of the trees with their long, straight boles are valuable for poles and piles.

#### *Under-sawlog-size Condition*

Forests with less than 600 board feet per acre have been classified as under-sawlog-size and subdivided into three condition classes: cordwood, reproduction, and clear-cut.

The cordwood class—stands of small trees with occasional sawlog trees (fig. 26)—comprises 34 percent of the South Carolina forest, ranging from 28 percent on the northern Coastal Plain to 44 percent on the piedmont. The high proportion on the piedmont results partly from intensive utilization which is being practiced in this region, and partly from the



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FIGURE 26.—Cordwood size loblolly pine. The marked trees are removed in thinning.

large areas of young timber on land that was abandoned after the boom cotton years of the first World War. Some of these old fields were slow in restocking, hence the resulting stands are thin and the trees limby; nevertheless there are many excellent stands of young timber. Pine types predominate in 72 percent of the cordwood condition class area on the Coastal Plain and in 82 percent on the piedmont.

Forest areas bearing only seedlings and sprouts less than 1 inch in diameter were assigned to the reproduction class (fig. 27) which occupies 692,400 acres, or 6.5 percent of the South Carolina forest. Since most unburned cut-over areas have enough trees exceeding 1 inch in diameter to qualify as cordwood condition, the reproduction class is found chiefly on abandoned fields that have reseeded within the last few years and on recently burned, cut-over areas.

FIGURE 27.—*Reproduction of loblolly pine.*



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TABLE 7.—*Distribution of forest area by forest condition and type*

Forest condition	Loblolly pine	Shortleaf pine <sup>1</sup>	Longleaf pine <sup>2</sup>	Bottom-land hardwoods <sup>3</sup>	Upland hardwoods	All types	
						Acres	Percent
<b>State:</b>							
<b>Sawlog size:</b>							
Old growth:							
Uncut.....	177,300	52,500	23,300	394,000	55,000	702,100	6.6
Partly cut.....	209,600	104,300	117,200	398,100	69,300	898,500	8.4
Second growth.....	2,157,600	896,100	673,800	725,100	149,900	4,602,500	43.1
Total.....	2,544,500	1,052,900	814,300	1,517,200	274,200	6,203,100	58.1
<b>Under-sawlog size:</b>							
Cordwood.....	1,143,400	870,500	770,400	492,900	382,300	3,659,500	34.3
Reproduction.....	283,800	94,800	118,000	129,300	66,500	692,400	6.5
Clear-cut.....	34,500	8,100	59,400	20,800	800	123,600	1.1
Total.....	1,461,700	973,400	947,800	643,000	449,600	4,475,500	41.9
All conditions.....	4,006,200	2,026,300	1,762,100	2,160,200	723,800	10,678,600	100.0
	Percent 37.5	Percent 19.0	Percent 16.5	Percent 20.2	Percent 6.8	Percent 100.0	
<b>Southern Coastal Plain:</b>							
<b>Sawlog size:</b>							
Old growth:							
Uncut.....	103,600		16,100	96,500	1,600	217,800	7.3
Partly cut.....	66,800		61,800	101,300	4,000	233,900	7.8
Second growth.....	684,000		356,800	280,400	12,900	1,334,100	44.6
Total.....	854,400		434,700	478,200	18,500	1,785,800	59.7
<b>Under-sawlog size:</b>							
Cordwood.....	293,300		461,500	171,100	69,900	995,800	33.3
Reproduction.....	73,100		53,800	37,100	30,500	194,500	6.5
Clear-cut.....	3,200		8,900	4,800		16,900	.5
Total.....	369,600		524,200	213,000	100,400	1,207,200	40.3
All conditions.....	1,224,000		958,900	691,200	118,900	2,993,000	100.0

<sup>1</sup> Includes Virginia pine type.

<sup>2</sup> Includes slash pine type, on southern Coastal Plain.

<sup>3</sup> Includes cypress type.

TABLE 7.—Distribution of forest area by forest condition and type—Continued

Forest condition	Loblolly pine	Shortleaf pine <sup>1</sup>	Longleaf pine <sup>2</sup>	Bottom-land hardwoods <sup>3</sup>	Upland hardwoods	All types	
						Acres	Percent
Northern Coastal Plain:							
Sawlog size:							
Old growth:		Acres	Acres	Acres	Acres	Acres	Percent
Uncut.....	65,000	4,800	7,200	268,800	5,700	351,500	7.8
Partly cut.....	136,400	5,600	55,400	284,900	12,800	495,100	11.0
Second growth.....	1,150,700	61,000	317,000	377,900	22,400	1,929,000	42.9
Total.....	1,352,100	71,400	379,600	931,600	40,900	2,775,600	61.7
Under-sawlog size:							
Cordwood.....	525,600	47,300	308,900	231,900	151,700	1,265,400	28.1
Reproduction.....	169,300	10,400	64,200	85,100	26,500	355,500	7.9
Clear-cut.....	29,700	6,500	50,500	14,400	800	101,900	2.3
Total.....	724,600	64,200	423,600	331,400	179,000	1,722,800	38.3
All conditions.....	2,076,700	135,600	803,200	1,263,000	219,900	4,498,400	100.0
Piedmont:							
Sawlog size:							
Old growth:							
Uncut.....	8,700	47,700		28,700	47,700	132,800	4.2
Partly cut.....	6,400	98,700		11,900	52,500	169,500	5.3
Second growth.....	322,900	835,100		66,800	114,600	1,339,400	42.0
Total.....	338,000	981,500		107,400	214,800	1,641,700	51.5
Under-sawlog size:							
Cordwood.....	324,500	823,200		89,900	160,700	1,398,300	43.9
Reproduction.....	41,400	84,400		7,100	9,500	142,400	4.5
Clear-cut.....	1,600	1,600		1,600		4,800	.1
Total.....	367,500	909,200		98,600	170,200	1,545,500	48.5
All conditions.....	705,500	1,890,700		206,000	385,000	3,187,200	100.0

<sup>1</sup> Includes Virginia pine type.

<sup>2</sup> Includes slash pine type, on southern Coastal Plain.

<sup>3</sup> Includes cypress type.

The clear-cut condition class is found on cut-over lands that do not contain enough seedlings or sprouts to qualify as reproduction. Only 1.1 percent (123,-600 acres) of the State's forest land was classed as clear-cut and nearly half was in the longleaf pine type, chiefly in the sand-hill region of the northern Coastal Plain, where dense stands of scrub oak have prevented pine reproduction (fig. 23).

### Site Quality

Like cultivated soils, forest soils have varying degrees of fertility and productivity. Next to soil, climate most influences the productivity of the forest. The combined effects of soil, climate, drainage conditions, and other factors are reflected in the quality of the site and the rate of forest growth. For example, the short, slow-growing stands are usually found on poor, dry soils, whereas long-bodied, fast-growing stands are on moist but fairly well drained soils.

Site quality is measured in several ways, most commonly for pine in the height of average dominant trees at 50 years of age and for hardwoods by the length of merchantable stems of mature trees. The height of pine stems at 50 years is determined from height-on-age curves, based on measurements of many trees at different ages and sites.

The areas of pine types have been classified as to site quality on the basis of the ability to produce trees at 50 years, as follows:

Loblolly pine:	Feet
Good.....	75 or more
Fair.....	55 to 75
Poor.....	Under 55
Other pines:	
Good.....	65 or more
Fair.....	55
Poor.....	Under 55

For the hardwoods, sites capable of producing trees making at least 3 merchantable 16-foot logs at

50 years were classed as good, 1½ to 3 logs as fair, and 1 log or less as poor.

The results of this classification are summarized in table 8. Thus, roughly half the area in each forest type is classed as fair, but there is considerable variation in the proportion of good and poor sites. The poor site quality of much of the shortleaf and upland hardwood types may be attributed to the fact that they are most common on the abandoned old fields of the piedmont whose productivity has been decreased by cultivation and erosion. Similarly, the longleaf pine has a large proportion of poor site quality because much of it is on the dry, sandy soils of the sandhills.

TABLE 8.—Proportion of forest-type areas in three site classes, 1936

Forest Type	Good	Fair	Poor
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Loblolly pine.....	42.1	57.5	0.4
Longleaf pine.....	21.1	54.5	24.4
Shortleaf pine.....	8.1	51.1	40.8
Bottom-land hardwoods.....	45.4	49.1	5.5
Upland hardwoods.....	8.6	66.3	25.1

Altogether, 85 percent of South Carolina's forest area shows site qualities favorable to the production of commercial timber. Of the remaining 15 percent

(1.6 million acres), classified as poor site, a portion will improve as the depleted soils are rebuilt by litter decomposition; but this is a long, slow process, and for many years the timber produced in these areas will be short-boled and of poor quality, suitable only for fuel wood or pulpwood.

### Stocking

Most of South Carolina's forests are understocked (fig. 28), particularly the younger stands; that is, they do not contain the number of trees or volume of timber that the soil is capable of producing. Poor regeneration on abandoned farm land, repeated fires, and heavy cutting have left widely spaced, branchy, and often poorly formed trees.

An index to the degree of understocking for all pine types combined is given in table 9. The average cordwood volume per acre of uncut stands by age classes is compared with the average volume on the most heavily stocked 10 percent of the area. The volumes are weighted so as to take into account variations in site quality. The table shows that younger stands in particular are understocked; the 21- to 30-year class averages only 29 to 33 percent of the volume contained in the best 10 percent. Even in the 61- to 70-year group, the average uncut stand is only half as well stocked as the best 10 percent.

FIGURE 28.—Understocked loblolly pine. Compare it with the denser stand shown in figure 26.



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TABLE 9.—Average stocking in the pine types compared with stocking in the best 10 percent of stands (uncut condition)<sup>1</sup>

Survey unit and age class (years)	Average volume per acre—uncut condition		Relation of all pine stands to best 10 percent
	All pine stands	Best 10 percent of pine stands	
<b>Southern Coastal Plain:</b>	<i>Cords</i>	<i>Cords</i>	<i>Percent</i>
21-30.....	5	17	29
41-50.....	15	33	45
61-70.....	23	44	52
All ages.....	12	29	41
<b>Northern Coastal Plain:</b>			
21-30.....	7	19	37
41-50.....	16	36	44
61-70.....	20	42	48
All ages.....	12	27	44
<b>Piedmont:</b>			
21-30.....	6	13	33
41-50.....	14	28	50
61-70.....	16	31	52
All ages.....	9	21	45

<sup>1</sup> These figures are only approximate and give no conception of the proportion of the total area in pine types (uncut condition) that is reasonably well stocked and poorly stocked.

It is unlikely that all the pine lands in South Carolina can be raised to the density of the best 10

percent without intensive management. Table 9 suggests, however, that stocking throughout the State can be greatly improved by the general adoption of cutting methods that will insure abundant reproduction, thus producing not only greater yields per acre but also better quality timber through the development of long, clear boles. Cutting in strips or groups, or clear cutting if provision for adequate seed trees is made, will provide a satisfactory initial crop of seedlings on most pine sites. But unless the restocking areas are protected in their early stages from uncontrolled fires, establishment of harvestable stands is greatly delayed. Even in young sapling and pole stands of the less resistant pine species, fires often reduce the number of stems far below desired density. Unquestionably, failure to provide for adequate reseeding and protection after logging have been among the major causes of the present understocked stands.

No analysis has been made of stocking in hardwood types, but from observation in the field it appears that in these types, too, low average densities prevail, and that there is a great opportunity through management for increasing the density as well as the proportion of the more desirable species.

# Timber Volume

**E**STIMATES of the standing timber volume in this report are for the year 1936. The volume is expressed in three units of measure—board feet, cords, and cubic feet. These units apply in part to identical stands of trees and to parts of trees. Thus the estimates for sawlogs in board feet (table 10), cords (table 14), and cubic feet (table 15) are identical volumes, with the following exceptions: the cordwood volume includes bark; the cordwood and cubic-foot volumes include the tops of sawlog trees, cull trees, and trees too small for sawlogs.

The board-foot volume of sawlog material for pine is in trees 9 inches d. b. h. and larger, and for hardwoods 13 inches and larger. The volume of cordwood is net, including bark, of all living trees 5 inches d. b. h. and larger. The cubic foot volume provides the most accurate measure of the timber stand; it facilitates growth calculation and comparison of survey units.

Volumes are also classified by species, size of trees, and forest condition (old growth, second growth, etc.)

TABLE 10.—*Net board-foot volume, International 1/4-inch rule, by forest condition classes, survey units, and species groups, 1936*

Survey unit and species group	Sawlog size			Under-sawlog-size	All conditions
	Old growth, uncut	Old growth, partly cut	Second growth		
<i>State:</i>	<i>Million board feet</i>				
Pines.....	2,637.0	2,073.5	12,961.5	852.2	18,524.2
Hardwoods.....	3,839.2	2,246.9	3,950.7	247.6	10,284.4
Cypress.....	586.7	276.4	490.6	33.9	1,387.6
All species.....	7,062.9	4,596.8	17,402.8	1,133.7	30,196.2
<i>Southern Coastal Plain:</i>					
Pines.....	1,241.6	538.3	3,744.2	239.2	5,763.3
Hardwoods.....	985.7	525.6	1,564.4	79.7	3,155.4
Cypress.....	119.8	72.0	279.9	19.1	490.8
All species.....	2,347.1	1,135.9	5,588.5	338.0	9,409.5

TABLE 10.—*Net board-foot volume, International 1/4-inch rule, by forest condition classes, survey units, and species groups, 1936*  
—Continued.

Survey unit and species group	Sawlog size			Under-sawlog-size	All conditions
	Old growth, uncut	Old growth, partly cut	Second growth		
<i>Northern Coastal Plain:</i>	<i>Million board feet</i>				
Pines.....	959.3	1,115.9	6,101.0	347.9	8,524.1
Hardwoods.....	2,443.1	1,408.1	1,465.9	84.4	5,401.5
Cypress.....	466.9	204.4	210.7	14.8	896.8
All species.....	3,869.3	2,728.4	7,777.6	447.1	14,822.4
<i>Piedmont:</i>					
Pines.....	456.1	419.3	3,116.3	265.1	4,236.8
Hardwoods.....	410.4	313.2	920.4	83.5	1,727.5
All species.....	846.5	732.5	4,036.7	348.6	5,964.3

## Board-Foot Volume of Saw Timber

In 1936 South Carolina had 30.2 billion board feet of saw timber,<sup>6</sup> when scaled by the International 1/4-inch log rule (tables 10, 11 and fig. 29). This rule approximates the actual recoverable volume in green-lumber tally for the wide range of species and diameters included in the inventory. It is materially higher than the estimates obtained by the Scribner and Doyle rules (Appendix, table 31).

## Volume by Species

Pines comprise 18.5 billion board feet, or 61 percent of the total volume of saw timber; hardwoods almost 10.3 billion board feet, or 34 percent; and cypress almost 1.4 billion board feet, or 5 percent (table 10).

<sup>6</sup> Saw-timber estimates in board feet are net log scale. Only merchantable trees containing acceptable sawlogs have been included, with deductions for material that would be left in the woods because of rot, fire scar, crook, limbliness, etc., and for loss in sawing at the mill because of sweep and interior defects

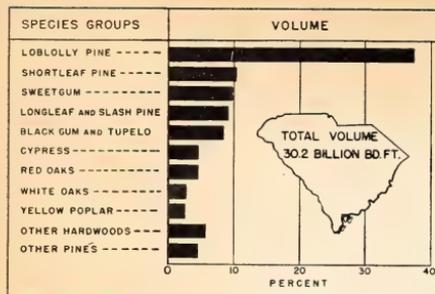


FIGURE 29.—Percent distribution of saw-timber volume by species groups, International  $\frac{1}{4}$ -inch rule.

**Loblolly pine.**—Loblolly pine, totaling over 11 billion board feet, is by far the leading species in the State both in volume and lumber production. Loblolly comprises 61 percent of the pine and 37 percent of all species in volume. It leads on the Coastal Plain, and is second to shortleaf pine on the piedmont.

On favorable soils and in well stocked areas, loblolly, as we have seen, grows rapidly, develops a clear bole, and produces lumber of good quality. In thin stands on impoverished soils the trees are limby and short-boled, yielding lumber of only common grades. Much of the lumber sold in Eastern markets as North Carolina pine is loblolly.

**Shortleaf pine.**—Shortleaf pine accounts for over 3 billion board feet, or 10 percent of the total saw-timber stand of South Carolina, and 17 percent of the pine volume (62 percent on the piedmont). Most shortleaf pine lumber is sawn by small mills and marketed through concentration yards for general construction purposes. Shortleaf, like loblolly, seeds well on abandoned fields and will grow on worn-out cropland and dry ridges, though its growth here is slow and the lumber poor.

**Longleaf and slash pines.**—The volume of longleaf and slash pines—the turpentine pines—amounted to 2.8 billion board feet in 1936. Eighty-eight percent of their combined volume is longleaf. These species are worked for naval stores and are prized for the dense yellow pine structural timbers which the old-growth produces. They are almost entirely restricted to the Coastal Plain, slash pine to the southern Coastal Plain. Longleaf and slash pines comprise 15 percent of the board-foot pine volume and 9 percent of the volume of all species in the State.

**Other pines.**—This group consists chiefly of pond and Virginia pines and includes the small quantities

TABLE 11.—Net board-foot volume, International  $\frac{1}{4}$ -inch rule, by species and Survey units, 1936

Species	Southern Coastal Plain	Northern Coastal Plain	Piedmont	State
	Million board feet	Million board feet	Million board feet	Million board feet
<b>Pines:</b>				
Loblolly	3,703.3	6,322.4	1,253.3	11,279.0
Shortleaf	150.0	315.0	2,644.5	3,109.5
Longleaf	1,024.5	1,341.0	73.7	2,439.2
Slash	321.1			321.1
Virginia			168.8	168.8
All other	564.4	545.7	96.5	1,206.6
<b>Total</b>	<b>5,763.3</b>	<b>8,524.1</b>	<b>4,236.8</b>	<b>18,524.2</b>
<b>Hardwoods:</b>				
Sweetgum	931.1	1,714.0	309.6	2,954.7
Blackgum	723.9	1,074.4	28.1	1,826.4
Tupelo	269.8	429.3		699.1
Yellow-poplar	161.5	218.2	448.4	828.1
Red oak	458.5	620.0	301.5	1,380.0
White oak	170.2	397.9	289.0	857.1
Ash	97.2	282.5	(1)	379.7
All other	343.2	665.2	350.9	1,359.3
<b>Total</b>	<b>3,155.4</b>	<b>5,401.5</b>	<b>1,727.5</b>	<b>10,284.4</b>
<b>Cypress</b>	<b>490.8</b>	<b>896.8</b>		<b>1,387.6</b>
<b>All species</b>	<b>9,409.5</b>	<b>14,822.4</b>	<b>5,964.3</b>	<b>30,196.2</b>

<sup>1</sup> Included with "All other" in this unit.

of white pine and hemlock found in the mountains. Pond pine, which is common in the shallow swamps (bays or pocosins) of the lower Coastal Plain, is short-boled and limby, with a high proportion of red heart rot. On better sites it produces timber of saw-log quality and the lumber is marketed with other southern pines.

Virginia pine, which is scattered in many places throughout the State, is most abundant in Pickens, Greenville, and Spartanburg Counties. Here some of it is used for rough construction lumber, although the trees are usually very limby.

White pine and hemlock are found only on the slopes of the Blue Ridge Mountains, along the western border of the State. Except for old-growth stands on a few private tracts, hemlock and white pine are not commercially important in South Carolina.

In addition to sawlogs, the common pines also supply the greater part of the pulpwood used in the State.

**Sweetgum.**—Sweetgum, with a volume of almost 3 billion board feet, comprises nearly 10 percent of the saw-timber stand of South Carolina. Its use was long avoided because of the tendency to twist and

warp in drying, but with the development of improved kiln-drying methods, sweetgum has become one of the most valuable of southern hardwoods. The dark heartwood of mature trees is marketed as red gum, and the lighter wood of young trees as well as the sapwood of old trees as sap gum. Sweetgum is extensively used as lumber and veneer in furniture, interior trim, baskets, and crates. It is found to a limited extent on the moister soils of the piedmont, but is most prevalent, and reaches its best development, in the bottom-land swamps bordering the Coastal Plain rivers.

*Blackgum and tupelo.*—Although blackgum and tupelo can be readily distinguished from each other in the forest, their woods are similar in appearance and few lumbermen attempt to distinguish between them. In 1936 South Carolina had an estimated 1.8 billion board feet of blackgum and 700 million board feet of tupelo.

Commercial use of these species, like that of sweetgum, was limited until modern seasoning methods solved the problem of warping. Now they are a major factor in the production of southern hardwoods. The lumber is used chiefly in furniture, planking, planing-mill products, and boxes and crates.

Tupelo grows in the deep swamps of the lower Coastal Plain, frequently associated with cypress. Blackgum does best in the shallower swamps and well drained terraces along the coastal rivers. It grows also on the upper Coastal Plain and piedmont, but here seldom reaches saw-timber quality.

*Oaks.*—Oaks account for 7 percent of the board-foot volume of the State. The numerous species are divided into two groups: white oaks, comprising 8 percent, and red oaks, 13 percent of the hardwood volume of South Carolina. In the latter group the leading components are water, willow, and cherrybark oaks on the Coastal Plain, and southern red, black, scarlet, and northern red oaks on the piedmont. The important white oaks include overcup, swamp chestnut, white, and post oaks on the Coastal Plain, and white, post, and chestnut oaks on the piedmont. Cherrybark, northern red, swamp chestnut, and white oaks are most in demand for lumber and veneer. Other species are usually defective, but are extensively used for lumber, timbers, and ties.

*Yellow-poplar.*—Although yellow-poplar comprises less than 3 percent of the State's saw-timber volume, its rapid growth and wide use put it among the leading hardwoods. Yellow-poplar is in great

demand for aircraft and as lumber and veneer in furniture and interior woodwork. It is also an excellent pulpwood, though little used for this purpose in South Carolina. Yellow-poplar abounds in the mountain coves and piedmont valleys, but also occurs in the Coastal Plain bottom lands.

*Other hardwoods.*—Nearly 6 percent of the timber volume of South Carolina consists of other hardwoods which, except for ash; do not occur in sufficient quantity to justify separate estimates in this survey. The principal species, ash, red maple, hickories, and elms, are used for furniture, handle stock, ski stock, and specialty uses.

*Cypress.*—Because of its durability and excellent texture, cypress has been a valuable wood since the arrival of the first white men. It still ranks among the best construction woods of the South, although the old-growth timber, on which the reputation of cypress has been based, is gradually becoming exhausted.

The cypress stand, as we have seen, comprises 5 percent of the saw-timber volume of South Carolina. It is common in the bottom-land swamps of the Coastal Plain, occasionally in pure stands but usually associated with water tupelo, blackgum, and other hardwoods. There are two species, baldcypress and pondcypress, the latter amounting to only 6 percent of the combined volume of cypress. Pondcypress, which occurs most frequently in shallow peat swamps, is inferior to baldcypress in the form of the tree as well as quality of the wood.

#### *Volume by Condition Class*

*Old-growth.*—Nearly 40 percent of South Carolina's saw-timber volume is in old-growth, including a fourth of the pine and three-fourths of the hardwood and cypress board-foot volume (table 10). The total of 11.7 billion board feet of old-growth includes young trees in old-growth stands. Nearly two-fifths of the old-growth volume is in partly-cut stands from which trees of the more desirable species and sizes have been removed.

Of the old-growth pine, 4.7 billion board feet or four-fifths, is on the Coastal Plain, about equally divided between the northern and southern units. By species, 59 percent is loblolly, 15 percent longleaf, 15 percent shortleaf, and 11 percent other pines.

The volume of old-growth hardwoods and cypress come to nearly 7 billion board feet. About 65 percent of this volume is on the northern Coastal Plain, chiefly in bottom-land swamps along the Pee Dee, Black, and Santee Rivers and their tributaries;

twenty-five percent is on the southern Coastal Plain; and the remaining 10 percent on the piedmont. About half the volume is in sweetgum and blackgum. Most of the old-growth timber is owned by operating lumber companies for current or future mill supply, or by timber companies for investment or speculation.

*Second-growth.*—Second-growth sawlog-size stands contain 17.4 billion board feet, or 58 percent of South Carolina's volume. Three-quarters consists of pine, a preponderance due partly to extensive cutting of old-growth pine in former years, partly to the use of a lower diameter limit for pine saw-timber, and partly to the tendency of abandoned fields to reseed to pine rather than to hardwoods.

*Under-sawlog-size timber.*—As shown in table 10 there is a small quantity of saw timber (1.1 billion board feet) in the under-sawlog-size class. This group contains sawlog-size trees left on cut-over areas and young trees in cordwood stands that have reached minimum saw-timber diameter. The volume per acre is rarely sufficient to justify commercial logging operations, so that little of the under-sawlog-size volume is merchantable at the present time.

#### Volume by Tree Size and Density Class

More than two-thirds of the pine saw-timber volume in South Carolina is in trees less than 19 inches in diameter (fig. 30 and table 12). Many sawmills operate in timber stands of much smaller average diameter than 19 inches. Small logs are more expensive to saw per thousand board feet than large

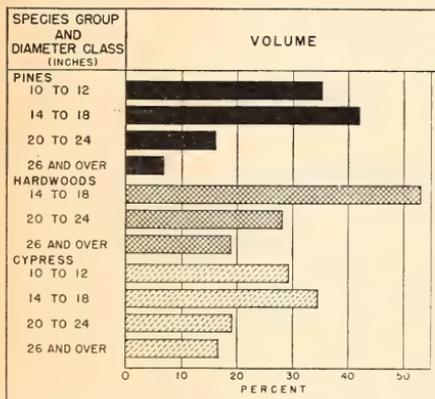


FIGURE 30.—Percent net board-foot volume, International  $\frac{1}{4}$ -inch rule, by species groups and diameters.

ones, and yield a higher proportion of narrower boards and lower grades, but the demand for the lower grades of pine lumber is usually heavy enough to support active logging in stands of relatively small trees.

For the principal uses of hardwoods and cypress large logs are required, yet about half the hardwood and two-thirds of the cypress saw-timber volume in the State are in trees less than 19 inches in diameter. Depletion of the large trees will probably force plants now dependent upon them to curtail operations until new local supplies become available through the growth of younger stands.

TABLE 12.—Net board-foot volume, International  $\frac{1}{4}$ -inch rule, by tree-diameter classes, survey units, and species groups, 1936

Survey unit and species group	Size of trees				
	10-12 inches d. b. h.	14-18 inches d. b. h.	20-24 inches d. b. h.	26+ inches d. b. h.	All classes
State:	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Pines.....	6,522.6	7,754.9	3,007.2	1,239.5	18,524.2
Hardwoods.....	5,454.3	2,889.4	1,940.7	10,284.4	10,284.4
Cypress.....	407.4	480.3	266.6	233.3	1,387.6
All species.....	6,930.0	13,689.5	6,163.2	3,413.5	30,196.2
Southern Coastal Plain:					
Pines.....	1,623.6	2,291.7	1,184.0	664.0	5,763.3
Hardwoods.....	1,748.0	921.7	485.7	3,155.4	3,155.4
Cypress.....	198.9	171.3	77.9	42.7	490.8
All species.....	1,822.5	4,211.0	2,183.6	1,192.4	9,409.5
Northern Coastal Plain:					
Pines.....	2,772.2	3,847.1	1,435.9	468.9	8,524.1
Hardwoods.....	2,733.8	1,456.4	1,211.3	5,401.5	5,401.5
Cypress.....	208.5	309.0	188.7	190.6	896.8
All species.....	2,980.7	6,889.9	3,081.0	1,870.8	14,822.4
Piedmont:					
Pines.....	2,126.8	1,616.1	387.3	106.6	4,236.8
Hardwoods.....	972.5	511.3	243.7	1,727.5	1,727.5
All species.....	2,126.8	2,588.6	898.6	350.3	5,964.3

The average densities (board feet per acre) of pine and hardwoods in the State and survey units are shown in table 13 and figure 31. The pine stands are generally better stocked than the hardwood stands; and the Coastal Plain forests, on the average, are denser than those of the piedmont. Second-growth and partly cut old-growth stands average approximately 3,400 to 5,600 board feet per acre on the Coastal Plain and somewhat less on the piedmont. The density of uncut old-growth is naturally much greater. The pine types average from 11 M to

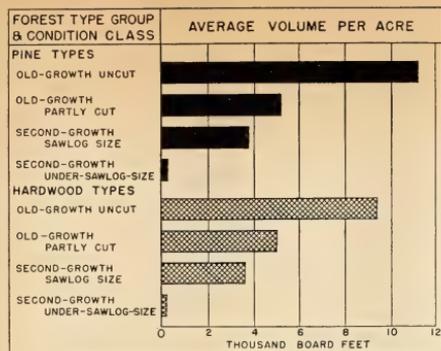


FIGURE 31.—Average net board-foot volume, International  $\frac{1}{4}$ -inch rule, by condition classes.

13 M board feet on the Coastal Plain, and about 7 M board feet on the piedmont, compared with 8 to 11 M board feet for hardwoods on the Coastal Plain and less than 6 M board feet on the piedmont.

Data obtained by the survey make it possible to classify the saw-timber stands of South Carolina according to the proportion occupied by density classes (volume per acre) and the total area in each class. The results are shown in figure 32 and table 32 (Appendix).

There is a wide difference in accessibility and ease of logging operations between the coastal swamps or rugged mountain regions of South Carolina and the flat or gently rolling terrain of the piedmont and Coastal Plain. In the swamps, logging may be unprofitable even in stands bearing 10 M board feet per acre, but in dry level areas where trucks can often be driven to individual scattered trees, pine stands

of a few hundred board feet per acre can often be logged profitably.

Since most timber areas in the State are readily accessible, density figures offer a rough index of availability. As a rule, 2 M board feet per acre—less in some instances—may be considered the minimum operable stand, though persons familiar with western forests may find it difficult to believe that this relatively low density can justify logging. From the standpoint of working toward continuous forest production in unmanaged stands, such areas should not be logged, even though operations yield an immediate profit. Continuous cuttings on low-density stands tend to reduce the forest to its lowest productive level by removing seed trees and also trees which have reached the minimum sawlog diameter but have not attained full seed-bearing age.

For South Carolina as a whole, almost 27 percent of the saw-timber area is stocked with less than 2 M board feet per acre, and these stands contain about 8 percent of the sawlog-size volume in the State. This density class is more prevalent, for pine and hardwoods alike, in the piedmont than on the northern or southern Coastal Plain.

Forty-eight percent of the saw-timber area of South Carolina bears 2 to 6 M board feet per acre, and these stands contain nearly 36 percent of the sawlog-size volume. Stands of 2 to 6 M board feet per acre are most prevalent in the piedmont and somewhat less prevalent on the Coastal Plain (fig. 32).

Almost 15 percent of South Carolina's saw-timber area is stocked 6 to 10 M board feet per acre, but these stands comprise almost 24 percent of the sawlog-size volume. This density class is more common on the Coastal Plain than in the piedmont.

TABLE 13.—Average net board-foot volume per acre, International  $\frac{1}{4}$ -inch rule, by condition class, pine and hardwood types, 1936

Survey unit and type group	Sawlog size			Under sawlog size	Average, all conditions		
	Uncut old growth	Partly cut old growth	Second growth		All species	Pines	Hardwoods
State:							
Pines.....	11,210	5,200	3,800	260	2,590	88	12
Hardwoods.....	9,410	5,040	3,680	220	3,480	8	92
Southern Coastal Plain:							
Pines.....	13,060	4,920	4,060	290	3,060	85	15
Hardwoods.....	7,990	4,780	4,660	240	3,370	4	96
Northern Coastal Plain:							
Pines.....	11,260	5,580	4,190	280	2,890	92	8
Hardwoods.....	10,940	5,460	3,440	200	4,120	8	92
Piedmont:							
Pines.....	7,210	4,800	3,070	230	1,830	85	15
Hardwoods.....	5,760	3,540	2,630	220	2,040	17	83

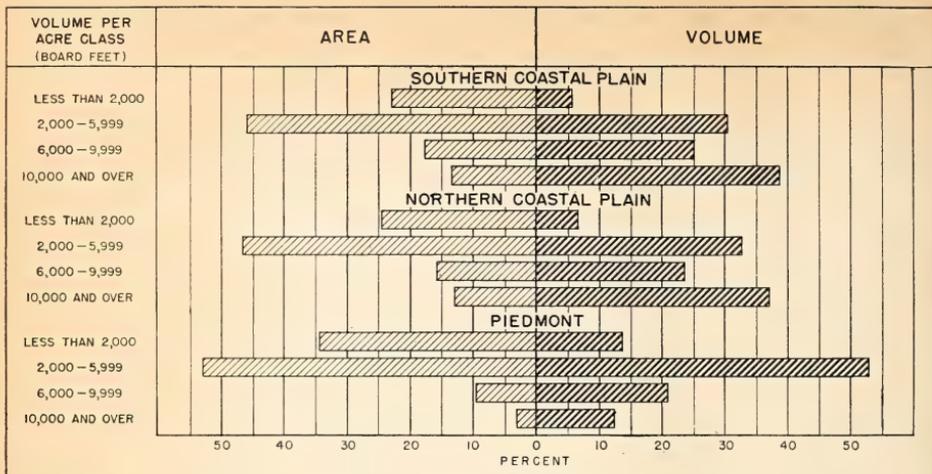


FIGURE 32.—Saw-timber area and volume, by percent units and density classes, 1936.

Only 10.5 percent of the State's timber area bears 10 M board feet or more per acre, but it contains 33 percent of the sawlog-size volume. Stands of 10 M board feet and up per acre are rare in the piedmont but more common on the Coastal Plain.

From the above figures we can see that, as might be expected, stands with 6 M board feet and more per acre contain over half of South Carolina's saw-timber volume, but occupy only a quarter of the saw-timber area. The larger proportion is found on the Coastal Plain; the piedmont has only 33 percent of its volume and less than 13 percent of its area in these denser stands.

The most important conclusion to be drawn from the data is that, although most of the sawlog-size volume in the State is unquestionably in operable stands, more than a fourth of the saw-timber area bears less than 2 M board feet per acre.

### Cordwood Volume

Measured in cords, the total volume of trees 5 inches d. b. h. and larger, including bark, is 158 million standard cords. Fifty-three percent is hardwood. This contrasts with the board-foot volume, which is 61 percent pine, largely because the minimum sawlog tree diameter is less for pine than for hardwoods, and the proportion of cull trees (which are included in the cordwood volume) is much higher for hardwoods than for pines (fig. 33).

### Volume by Class of Material

Table 14 shows the net cordwood volumes of pines, hardwoods, and cypress, by class of material, for the three survey units and the State as a whole. Sawlog material, which furnishes the bulk of current supplies—lumber, veneer, etc.—for the wood-using industries, makes up 62 percent of the cordwood volume for pines, 31 percent for hardwoods, 59 percent for cypress, and 45 percent for all species combined. About 15 percent of the volume is in tops of sawlog trees. This top wood is being used increasingly for pulp and fuel, but is, of course, available only as the sawlog trees are cut.

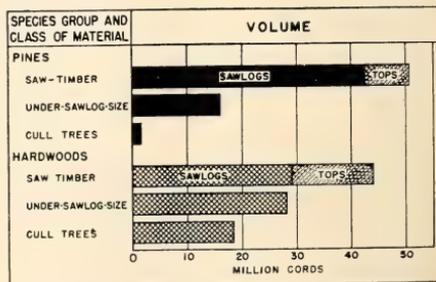


FIGURE 33.—Cordwood volume by species groups and class of material.

TABLE 14.—*Net cordwood volume (including bark) of all living trees 5 inches d. b. h. and larger, by class of material, 1936*

Survey unit and species groups	Sawlogs	Tops of saw-timber trees	Under- sawlog-size trees	Cull trees	Total	
	<i>Thousand cords</i>	<i>Thousand cords</i>	<i>Thousand cords</i>	<i>Thousand cords</i>	<i>Thousand cords</i>	<i>Percent</i>
State:						
Pines.....	42,365.2	8,345.8	16,014.6	1,632.5	68,358.1	43.2
Hardwoods.....	25,767.2	13,980.0	27,455.7	17,007.0	84,209.9	53.2
Cypress.....	3,324.9	986.2	860.7	489.5	5,661.3	3.6
All species.....	71,457.3	23,312.0	44,331.0	19,129.0	158,229.3	100.0
Southern Coastal Plain:						
Pines.....	12,863.1	2,591.2	4,041.0	145.1	19,640.4	41.7
Hardwoods.....	7,834.9	4,186.0	9,411.2	3,806.2	25,238.3	53.5
Cypress.....	1,228.2	385.0	464.3	173.4	2,250.9	4.8
All species.....	21,926.2	7,162.2	13,916.5	4,124.7	47,129.6	100.0
Northern Coastal Plain:						
Pines.....	18,983.7	3,767.4	4,966.0	588.7	28,305.8	38.0
Hardwoods.....	13,559.1	7,451.0	12,191.0	9,658.6	42,859.7	57.4
Cypress.....	2,096.7	601.2	396.4	316.1	3,410.4	4.6
All species.....	34,639.5	11,819.6	17,553.4	10,563.4	74,575.9	100.0
Piedmont:						
Pines.....	10,518.4	1,987.2	7,007.6	898.7	20,411.9	55.9
Hardwoods.....	4,373.2	2,343.0	5,853.5	3,542.2	16,111.9	44.1
All species.....	14,891.6	4,330.2	12,861.1	4,440.9	36,523.8	100.0
Summary by units:	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
Southern Coastal Plain.....	46.5	15.2	29.5	8.8	100.0	
Northern Coastal Plain.....	46.5	15.8	23.5	14.2	100.0	
Piedmont.....	40.7	11.9	35.2	12.2	100.0	
State average.....	45.2	14.7	28.0	12.1	100.0	

From the 44 million cords in under-sawlog-size trees will come the sawlogs of the future. Thinning and short-rotation management for pulpwood or other material may justify cutting young stands before they reach sawlog size; otherwise, under-sawlog-size trees should be reserved as growing stock, to be cut later for lumber, veneer, or other saw-timber products.

The 19 million cords in cull trees are largely an economic loss, since only occasionally can this class of material be salvaged profitably. The 1.6 million cords of cull pine are suitable for pulpwood and fuel wood, and some of it is being used for these purposes, particularly in stands cut for sawlogs or pulpwood. A large proportion, however, of the cull pines is contained in widely scattered trees in thin stands that cannot be logged economically.

Utilization of cull hardwoods, which constitute 20 percent of the hardwood volume, presents a more difficult problem. These trees are unsuited for saw timber because of crook, rot, excessive limbliness, or other defects. In the extensive hardwood swamps

of the Coastal Plain there is little opportunity for utilizing culls, except occasionally, for small dimension or coeprage bolts, cut when the areas are logged for saw timber. In the nearly pure stands of black-gum, known locally as "gumheads," which are found in many smaller swamps, the trees are usually of poor form and unsuited for sawlogs. They make good pulpwood, however, and occur in heavy stands which are often accessible to public roads. The tendency of southern pulp mills to use increasing proportions of soft-textured hardwoods may provide a market for these otherwise unmerchantable stands. Another effective outlet for cull trees, particularly oak and other hard-textured hardwoods in the upper Coastal Plain and piedmont regions, is the market for fuel wood, both for home use and for curing brightleaf tobacco.

#### *Volume by Diameter Class*

Distribution of the cordwood volume of sound trees (culls excluded) by diameter class for the State

as a whole is shown in figure 34, and for the three survey units in table 33 (Appendix).

Over half the cordwood volume in the State is in trees of less than 13 inches diameter; the 6- to 8-inch group alone accounts for nearly a quarter of the total. The diameter distribution by species groups is rather uniform for the State, but the physiographic regions show considerable variation. For example, over 70 percent of the pine volume on the piedmont is in trees less than 13 inches in diameter, compared with less than 50 percent on the Coastal Plain. Conversely, the proportion of the volume of pine trees of large diameter is much smaller on the piedmont than on the Coastal Plain because the piedmont forest is more accessible and the utilization more intensive.

The large volume in sound trees, both pine and hardwood, in the smaller diameter classes, promises a continued supply of saw timber for South Carolina, provided fires are controlled and excessive cutting for fuel wood, pulpwood, and small sawlogs does not prematurely deplete these young stands.

### Cubic-foot Volume

The cubic foot, although seldom used commercially, is a more accurate measure than the board foot or cord, and therefore is the best method of computing forest growth and drain and comparing the timber volume of one region with another. Table 15

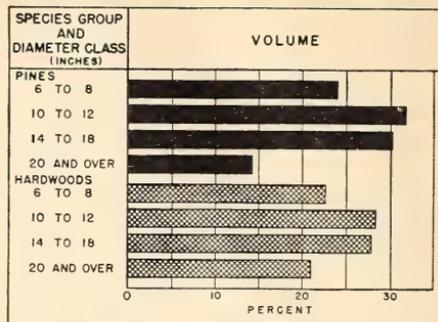


FIGURE 34.—Distribution of cordwood volume, by species groups and diameter class.

TABLE 15.—Net cubic volume (inside bark) of living trees 5 inches d. b. h. and larger, by class of material, 1936

Survey unit and species group	Sawlogs	Tops of saw-timber trees	Under-sawlog-size trees	Cull trees	Total	
					Thousand cubic feet	Percent
<b>State:</b>						
Pines.....	5,108,300	636,810	1,081,200	116,380	4,942,690	46.0
Hardwoods.....	1,748,400	843,200	1,734,790	1,055,890	5,382,280	50.1
Cypress.....	255,640	63,480	60,810	36,880	416,810	3.9
All species.....	5,112,340	1,543,490	2,876,800	1,209,150	10,741,780	100.0
<b>Southern Coastal Plain:</b>						
Pines.....	991,170	198,380	282,440	10,990	1,482,980	45.2
Hardwoods.....	536,410	262,350	589,660	246,630	1,635,050	49.8
Cypress.....	92,520	26,930	32,480	12,680	164,610	5.0
All species.....	1,620,100	487,660	904,580	270,300	3,282,640	100.0
<b>Northern Coastal Plain:</b>						
Pines.....	1,380,540	270,710	328,170	42,080	2,021,500	40.4
Hardwoods.....	919,650	443,550	776,140	592,500	2,731,840	54.6
Cypress.....	163,120	36,550	28,330	24,200	252,200	5.0
All species.....	2,463,310	750,810	1,132,640	658,780	5,005,540	100.0
<b>Piedmont:</b>						
Pines.....	736,590	167,720	470,590	63,310	1,438,210	58.6
Hardwoods.....	292,340	137,300	368,990	216,760	1,015,390	41.4
All species.....	1,028,930	305,020	839,580	280,070	2,453,600	100.0
<b>Summary by units:</b>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
Southern Coastal Plain.....	49.3	14.9	27.6	8.2	100.0	
Northern Coastal Plain.....	49.2	15.0	22.6	13.2	100.0	
Piedmont.....	42.0	12.4	34.2	11.4	100.0	
State average.....	47.6	14.4	26.8	11.2	100.0	

summarizes the cubic-foot volume of sound wood, exclusive of bark, in pine, hardwood, and cypress trees 5 inches d. b. h. and larger, and in the different classes of material.

In 1936 South Carolina had 10.7 billion cubic feet of growing stock: 4.9 billion pine, 5.4 billion hardwood, and 0.4 billion cypress. The Coastal Plain had 71 percent of the pine and 81 percent of the hardwood. For the State as a whole, 48 percent was in sawlogs, 14 percent in tops of saw-timber trees, 27 percent in under-sawlog-size trees, and 11 percent in cull trees.

### Poles

An estimated 35 million trees, with the form and freedom from defects required for poles and piles, according to the specifications of the American Standards Association, are scattered throughout the pine stands of South Carolina, principally on the better sites. Nearly three-fourths are in the 20- to 25-foot classes and less than 1 percent are 45 feet or longer (tables 16 and 34, Appendix). Nearly 80 percent of

all pine poles, and over 90 percent of those 40 feet or longer, are on the Coastal Plain. Since much of this material will be cut for sawlogs or other products, the information is presented chiefly because it indicates the relative distribution of trees by length and diameter classes. The timber volume of pole trees has been included in the tables showing board-foot, cordwood, and cubic-foot volume.

TABLE 16.—Estimated number of pine poles in South Carolina forests, by length and tree-diameter class, 1936

Tree-diameter class (inches)	20-25 feet	30-35 feet	40 feet or over	All lengths	
				1,000 poles	Percent
8-10.....	1,000 poles	1,000 poles	1,000 poles	1,000 poles	Percent
12-14.....	18,877	2,689	137	21,703	61.9
16-18.....	6,447	4,118	799	11,364	32.4
	629	1,091	285	2,005	5.7
Total.....	25,953 Percent 74.0	7,898 Percent 22.5	1,221 Percent 3.5	35,072	100.0
					100.0

# Forest Industries

FOR more than two centuries South Carolina forests have supplied industrial and domestic needs for wood products. Before the industrial era, logs, hewn timbers, and lumber sawn by hand or water power were the mainstay of building construction; fuel wood was the universal source of heat; and live oak knees and timbers, pine masts and spars, lumber, and naval stores were essential requirements for shipbuilding. In the State's subsequent industrial development, the forest was drawn upon continuously and heavily, and generally without conscious attention to proper forestry practices with sustained yield in view. Today, South Carolina's forests are supplying raw material for hundreds of sawmills, several large pulp and paper mills and numerous plants which manufacture veneer, cooperage, and other products. The expansion of the pulp and paper industry in the Southeast, including the coastal region of South Carolina, has created a permanently increased pulpwood demand. The

purchase of extensive forest areas by pulp companies will have a material influence upon trends of wood utilization.

The vital need for timber reserves for war purposes is being widely demonstrated today. War demands, in fact, may tax the forest to the limit of its capacity for early recuperation.

## Production of Forest Commodities

One phase of the work of the Forest Survey was to determine the production of South Carolina's wood-using industries. Lumber, veneer, cooperage, naval stores, pulpwood, and piece-product operations were canvassed; and estimates were made of the fuel wood cut annually for both commercial and domestic consumption. The new pulp mills came into operation after the first canvass had been made, so that the production figures for 1936 do not show the full significance of the present-day pulpwood requirements. Table 17 shows production and value

TABLE 17.—Volume and estimated value of forest products processed in South Carolina, by industries and number of plants, 1940.

Product	Plants	Quantities produced or used				Estimated value
		Southern Coastal Plain	Northern Coastal Plain	Piedmont	State	
	<i>Number</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>Dollars</i>
Lumber <sup>1</sup> .....	1,149	262,500	389,000	222,000	873,500	20,197,000
Veneer.....	30	22,300	52,900		75,200	3,610,000
		<i>Pieces</i>	<i>Pieces</i>	<i>Pieces</i>	<i>Pieces</i>	
Poles and piles.....		131,000	248,000	20,000	399,000	798,000
Hewn cross ties.....		154,000	169,000	97,000	420,000	420,000
		<i>Cords</i>	<i>Cords</i>	<i>Cords</i>	<i>Cords</i>	
Fuel wood.....		533,300	1,117,200	1,251,300	2,901,800	9,895,000
Pulp.....	3		588,100		588,100	11,762,000
Cooperage.....	4	13,300	29,000		42,300	423,000
Dimension stock.....	6	6,700	7,200	300	14,200	355,000
Shingles.....	14		6,200	200	6,400	64,000
Shuttle blocks.....	6			600	600	18,000
Handles.....	3	100	200		300	9,000
Miscellaneous farm use.....		17,600	34,400	37,400	89,400	179,000
Total.....	1,215					47,730,000

<sup>1</sup> Lumber includes sawn ties.

of forest products and the number of wood using plants in South Carolina in 1940; and figure 35 the location of manufacturing plants in 1942.

### Lumber

The major expansion of South Carolina's lumber industry has taken place since 1890. Previously, a lack of power and of cheap, easy transportation had largely confined the manufacture of lumber to local requirements, with only a small volume for shipment out of the State. With the development of steam power and band saws in the latter part of the nineteenth century, and the rapid expansion of the railroads, the number of mills and the volume of production increased rapidly.

Census records indicate that the annual production of lumber, which prior to 1890 had not exceeded 200 million board feet, reached a peak of about 900 million feet in 1909 (fig. 36). Production slackened during the first World War and the depression years that followed, but reached a new high of over a billion board feet in 1923 and again in 1929. The depression of the early thirties reduced the cut to less than 400 million feet, the lowest point in four decades; but by 1936 the industry had nearly attained its predepression level. More recently the stimulus of defense and war needs has accelerated production, which in 1940 (table 18) approached 900 million board feet, and in 1941, according to Forest Service estimates, reached 1.1 billion feet, valued at more than \$25,000,000. Output amounted to 1.1 billion feet in 1942, and an estimated 1 billion feet in 1943.

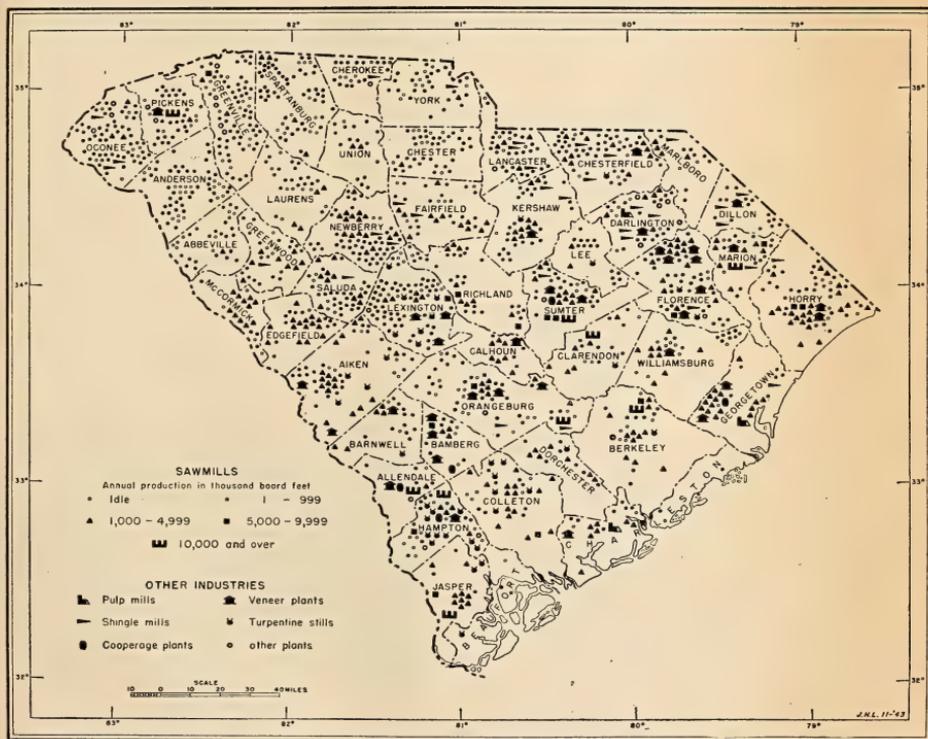


FIGURE 35.—Distribution of forest industries in South Carolina, 1942.

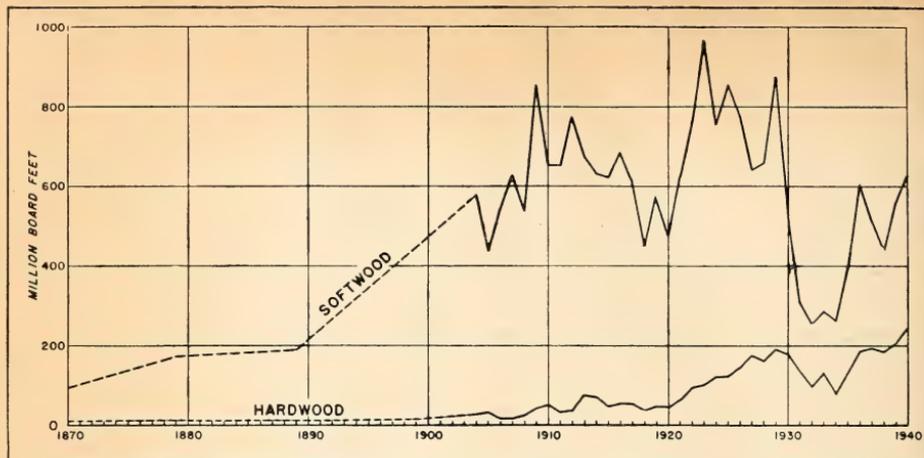


FIGURE 36.—Lumber production of South Carolina, 1870-1940.

TABLE 18.—South Carolina lumber production and value at mill, by species, 1940

Species	Production <sup>1</sup>	Value <sup>2</sup>
	<i>M board feet</i>	<i>Dollars</i>
Yellow pines.....	625,690	12,720,278
Sweetgum.....	83,330	2,554,064
Cypress.....	55,290	1,899,212
Tupelo.....	42,540	1,107,316
Oak.....	22,450	556,086
Yellow-poplar.....	15,810	448,055
Maple.....	10,220	335,931
Ash.....	9,260	343,176
Cottonwood.....	3,580	90,216
Sycamore.....	2,190	57,926
Hemlock.....	1,220	29,012
All other.....	1,920	55,834
Total.....	873,500	20,197,106

<sup>1</sup> Estimates by the Forest Service based upon the 1940 Census returns.

<sup>2</sup> Forest Service and Census Bureau. LUMBER, LATH, AND SHINGLES, 1940. (Processed.) 1942.

Seventy-eight percent of the average annual lumber production during the 5-year period 1936-40 was on the Coastal Plain, 52 percent on the northern and 26 percent on the southern unit (table 36, Appendix). The bulk of the cut was pine; hardwoods made up only about a quarter of it. Prior to 1913, hardwoods formed less than 10 percent and before 1927, less than 20 percent of the lumber cut in South Carolina. Since the development of modern kiln-

drying methods the cut of hardwoods has increased, and they are now in strong demand for both lumber and veneer (fig. 37).

Despite the difficulties and restrictions inevitable in wartime, the sawmill industry has maintained a high level of production. In 1942 the cut amounted to 1.1 billion board-feet (table 19), and this would probably have been greatly exceeded because of stimulated war demands, but 221 mills were idle in the State and many operated far below capacity, owing largely to the shortage of competent labor, particularly in the woods.



FIGURE 37.—Logging bottom-land hardwoods on the Coastal Plain. About one-fifth of the lumber cut in South Carolina in 1942 was hardwood.

TABLE 19.—Production of lumber by species and mill capacity class, South Carolina, 1942<sup>1</sup>

Species	Mill-capacity class <sup>2</sup>						Total	Percent
	0	1	2.	3	4	5+		
<b>Softwoods:</b>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	<i>M bd. ft.</i>	
Cedar.....	5	18	13	10			46	(3)
Cypress.....	3	664	261	11,225	18,195	29,594	59,942	5.5
Hemlock.....		12		1	521	692	1,226	.1
Pine, white.....	16	315	275	153	68	1	828	.1
Pine, yellow.....	4,478	74,967	153,687	471,038	51,296	65,579	821,045	76.1
Total.....	4,502	75,976	154,236	482,427	70,080	95,866	883,087	81.8
<b>Hardwoods:</b>								
Ash.....		56	43	526	10,006	4,310	14,941	1.4
Basswood.....			15		85	26	126	(2)
Beech.....	3	20		2	9	43	77	(2)
Birch.....	1	10		102	2	8	123	(2)
Chestnut.....		10	50	1	1	33	95	(2)
Cottonwood.....	7	35	25	958	2,637	1,525	5,187	.5
Elm.....	1			82	389	654	1,126	.1
Gum, red.....	70	1,411	3,130	11,373	23,121	47,763	86,868	8.1
Hickory.....	8	152		85	145	520	910	.1
Maple.....	3	59	147	895	2,470	2,924	6,498	.6
Oak.....	406	3,926	4,065	7,209	8,817	11,265	35,688	3.3
Sycamore.....	1	113	50	266	1,083	685	2,198	.2
Tupelo and blackgum	11	373	2,733	7,778	6,996	7,657	25,548	2.4
Walnut.....	1	1	5	251	5		263	(3)
Yellow-Poplar.....	139	1,401	1,210	5,495	5,469	2,474	16,188	1.5
Other.....		5		22	148	253	428	(3)
Total.....	651	7,572	11,473	35,045	61,383	80,140	196,264	18.2
All species.....	5,153	83,548	165,709	517,472	131,463	176,006	1,079,351	100.0

<sup>1</sup> Data obtained by the U. S. Forest Service in cooperation with Statistics Division, War Production Board, and the Bureau of the Census.

<sup>2</sup> Class 0 cut 1-49 M board feet annually; class 1, 50-499 M board feet; class 2, 500-999 M board feet, class 3, 1,000-4,999 M board feet class 4, 5,000-9,999 M board feet; and class 5, 10,000 M board feet or more.

<sup>3</sup> Negligible.

Of the 1,488 mills in the State in 1942, 98 percent averaged 8 M board feet per day or less (fig. 38), while 2 percent averaged 30 M board feet or more per day. Small mills produced 72 percent of the lumber cut in South Carolina in 1942 (table 20).

TABLE 20.—Production of lumber in South Carolina by mill-capacity class, 1942

Mill class, annual production (M bd. ft.)	Mills	Average daily production	Average days operated	Production
	<i>Number</i>	<i>M bd. ft.</i>		<i>Percent</i>
1-49.....	262	3	7	0.5
50-499.....	429	4	54	7.7
500-999.....	236	5	443	15.4
1,000-4,999.....	314	8	207	47.9
5,000-9,999.....	17	31	248	12.2
10,000+.....	9	70	279	16.3
Total.....	1,267			100.0

<sup>1</sup> Does not include 221 mills idle during entire year.

The number of large sawmills is decreasing as the old-growth timber accessible to them diminishes. In 1936 there were 18 operating band mills with



FIGURE 38.—Portable sawmill cutting shortleaf pine on the piedmont, capacity 6 M board feet a day.

daily capacities of 40 M board feet or more which cut about two-thirds of the hardwood and cypress lumber and nearly a fifth of the pine sawed in South Carolina. In 1940 the number was reduced to 12, and in 1942 to 9, but in that year band mills cut almost one-half of the hardwood and cypress and less than one-tenth of the pine.

The depletion of old-growth stands will eventually force the remaining large mills to shut down or to adjust their operations to the productive capacity of tributary areas. Discontinuance of large mills, however, does not necessarily mean a decrease in lumber production. The 1,488 mills in the State have sufficient capacity to double or treble production if adequate labor is made available. Such increased production, however, could be justified only by urgent war needs: if continued for more than a few years the present slightly favorable balance of growth over drain in South Carolina would be reversed, with distinctly unfavorable consequences.

The sawmill industry in South Carolina is based largely on pine utilization; 76 percent of 1942 production came from species known commercially as yellow pine. Of the lumber produced by Class 3 and smaller mills, most of which are portable, 93 percent was from softwood species, principally pine. This heavy and continued pressure on pine stands, together with the natural tendency for hardwood components gradually to assume dominance, indicates that future stands will have a greater proportion of hardwoods, particularly on the poorer sites. This undesirable trend can be retarded under intensive forest management, and possibly with the judicious use of fire.

#### *Distribution of Lumber*

The distribution of the lumber produced in South Carolina in 1940 is shown in table 21. For the period 1924-40 about 30 percent of South Carolina's annual lumber cut was consumed in the State, according to biennial Census reports. The proportion was least (18 percent) in 1928 and highest (54 percent) in 1940.

In the four biennial-census years 1934, 1936, 1938, and 1940, the average distribution of lumber was as follows: 42 percent consumed in the State, 12 percent shipped to North Carolina, 9 percent to Pennsylvania, 10 percent to New York, 6 percent to Virginia, 4 percent to New Jersey, 3 percent to Georgia, 2 percent to Maryland, 2 percent to Ohio, 6 percent to other States, and 4 percent to foreign destinations.

TABLE 21.—*Distribution of lumber produced in South Carolina, 1940*<sup>1</sup>

Destination	Distribution	
	<i>M bd. ft.</i>	Percent
South Carolina.....	461,893	54
North Carolina.....	96,795	11
Pennsylvania.....	68,708	8
New York.....	63,492	8
Virginia.....	44,142	5
New Jersey.....	24,778	3
Ohio.....	19,512	2
New England States.....	15,004	2
Maryland.....	12,680	2
Delaware.....	11,764	1
West Virginia.....	10,416	1
Other States <sup>2</sup> .....	5,690	1
Foreign.....	15,809	2
Total.....	850,683	100

<sup>1</sup> Preliminary statistics for 1940, Bureau of the Census and Forest Service.

<sup>2</sup> Florida, District of Columbia, Georgia, Tennessee, and Michigan.

The larger mills have their own sales organizations and ship directly to their customers in or out of the State. Some of the portable mills do custom sawing for local timber owners, but most of them cooperate with a concentration yard to which they sell their entire output on a green, mill-run basis. The concentration yards assemble the production of a number of mills, dry it if necessary, surface and grade it, and either retail the finished lumber locally or ship to other markets.

#### *Veneer*

In contrast with lumber, the manufacture of veneer is an expanding industry which has been stimulated by new developments in the use of the product, such as plywood for prefabricated houses and a great variety of other peacetime products, and more recently aircraft construction for war use. In 1940 South Carolina's 30 veneer mills consumed 75 million board feet of logs and bolts (table 17). Their production was about equally divided between veneer for furniture and for baskets and crates. Hardwoods, largely sweetgum, blackgum, and yellow-poplar, have been used in considerable quantity for high-grade furniture veneer and plywood, for which the South Carolina furniture factories and the highly developed furniture industry of North Carolina provide a market. Both hardwoods and second-growth pine go into the manufacture of veneer crates and baskets, consumed largely in South Carolina and adjoining States.

The war has greatly stimulated the demand for veneer, particularly for plywood in the construction of training, combat, and cargo aircraft. Existing mills have been stepped up nearly to capacity operation, and new units have been added. In June 1942 a veneer and plywood plant that is one of the largest producers of aircraft plywood in the Southeast went into production at Hampton, S. C.

The principal source of veneer logs and bolts has been the old-growth river-swamp hardwoods of the Coastal Plain; and with the reduction of these supplies by logging, the veneer industry has lowered its specifications to include bolts of smaller diameters and shorter lengths. Old-growth still provides the greater part of the raw material, although more and more veneer is being produced from second-growth trees.

Few veneer companies own their own timberlands. Most of them buy logs or bolts delivered at the mill, or purchase stumpage and contract the cutting and delivery. Logs are obtained also from lumber companies, whose best-quality material usually brings higher prices for veneer than for lumber. Prices for veneer bolts, which average about 18 inches in diameter and are usually cut in 4-foot lengths, range at the mill from \$15 to \$30 per thousand and board feet, Doyle scale, depending upon the quality. Logs suitable for aircraft veneer bring much higher prices, often between \$75 and \$100 per thousand.

#### *Pulp and Paper*

In the latter part of the 1930's a new demand was placed upon southern forests through the establishment of large pulp and paper mills, mostly along the Coastal Plain. Before 1937, there was only one small pulp mill in South Carolina, operated by the Carolina Fiber Company at Hartsville. This produced corrugated board and wrapping paper from blackgum by the semi-chemical process. Mills in adjoining States drew but lightly on South Carolina for their supplies, although some wood was shipped by water to New York.

Two new paper mills were completed in 1937—the West Virginia Pulp and Paper Company mill at Charleston and the Southern Kraft Division mill of the International Paper Company at Georgetown—with a combined daily capacity of 1,015 tons of sulfate pulp and 950 tons of kraft paper and container board, representing annual wood requirements of about 575,000 cords of pine (fig. 39). Because of growing demands for kraft paper, the mills nearly

reached their capacity in 1939. Since the outbreak of the war, demand has increased further and to meet it, production has been stepped up through greater efficiency of operation and the construction of additional units. In 1942 their combined capacity was almost 2,000 tons of sulfate pulp every 24 hours. The effect of this stepped-up output on the State's pulpwood supplies has been intensified by the demands of new mills in Georgia which get some of their raw material from South Carolina. In 1940 pulpwood production in South Carolina amounted to 588,100 cords; in 1941, 805,000 cords; and in 1942, it reached 946,000 cords.

Since the establishment of the kraft mills, more than 90 percent of the pulpwood produced in South Carolina has been of pine, most of it from the Coastal Plain. A portion comes from timberlands owned and managed by the paper companies, but the greater part is obtained by purchase. Stumpage prices range from \$0.25 to \$1.50 a cord, depending upon location and condition of the stands and the bargaining ability of the owners.

The hardwoods of the South Carolina Coastal Plain have hitherto been little used for pulp, but recent developments at kraft mills in other Southern States indicate that pulping of hardwoods by the sulfate process is practicable and that hardwoods can contribute increasingly to future pulpwood production. The large volume of cull hardwoods on the Coastal Plain would help meet the present heavy demand for pine pulpwood without depleting the hardwood growing stock suitable for other purposes. Cull blackgum, in particular, is abundant throughout the region, frequently in pure stands which are readily accessible and suitable only for pulpwood. Thinnings in both hardwood and mixed pine-hardwood stands could furnish large quantities of pulpwood and, at the same time, improve the quality and growing conditions of the remainder of the stand.

#### *Naval Stores*

The production of turpentine and rosin in South Carolina dates from the colonial period, but its most rapid growth took place between 1850 and 1880. The peak—4,600,000 gallons of turpentine—was reached in 1879. Output declined in the following decades because of the rapid expansion of lumbering, which greatly reduced the quantity of turpentine pines (longleaf and slash). In the year April 1936 to March 1937, South Carolina produced 728,500 gallons of turpentine and 45,040 barrels of rosin, the



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FIGURE 39.—Delivering pulpwood to the Southern Kraft Division mill of the International Paper Company at Georgetown, S. C. In 1942 almost a million cords of pulpwood were produced in South Carolina.

output of 43 stills, all but 8 of which were on the southern Coastal Plain (8). In 1939-40 production was estimated by the Southern Forest Experiment Station at 426,500 gallons of turpentine and 28,400 barrels of rosin, the output of 39 stills.

#### *Miscellaneous Industries*

Nearly all of the 400,000 pine poles and piles produced in the State in 1940 were bought by treating plants and utility companies. About 95 percent of the poles came from the Coastal Plain.

Railroads and treating plants purchased 420,000 hewn ties, of which slightly more than half were pine. No data are available for sawn ties, since they were included in the lumber production reported by sawmills. All of the hewn ties were treated except for a few thousand used by the smaller common carriers and logging railroads. Most of the ties were for replacements in South Carolina and adjoining States; the remainder were shipped to northern railroads.

The four cooperage mills in the State in 1940 were located on the Coastal Plain. They produced slack cooperage for a variety of uses, chiefly for sugar, vegetable, rosin, and tobacco barrels. Hardwoods, mostly sweetgum and blackgum, supplied about two-thirds of the 42,300 cords of wood used.

Smaller wood-using industries operating in South Carolina in 1940 included 14 shingle mills making pine and cypress shingles, 6 small-dimension mills cutting furniture stock, and 6 shuttle bolt and 3 handle plants. These small plants used a total of 21,500 cords annually, largely pine. Most of them were on the Coastal Plain.

#### *Fuel Wood and Miscellaneous Farm Products*

As indicated in table 17, more wood is used every year for fuel than for any other purpose. Of the 2.9 million cords consumed in South Carolina in 1940, about 65 percent was used by farm families, 30 percent by rural nonfarm and urban families, and the rest by commercial establishments, institutions, and in curing tobacco. About half the fuel wood was

pine; much of it came from mill waste, tops, and dead and cull trees. The proportion obtainable from these sources could be vastly increased, particularly from cull trees whose removal frequently improves the growing conditions of the better stock. This practice is especially recommended to farm families, who are the principal users of fuel wood, because their woodlands as a rule are readily accessible, and labor is available during slack seasons. Farmers can also improve the composition and quality of their timber by using as fuel wood cull trees, undesirable species, and weaker trees removed from young stands.

Other farm commodities supplied directly from the forests include fence posts; stakes for peanuts, forage, and truck crops; poles for bracing fences and buildings; logs for building tobacco barns and other structures; wood for repairing farm implements and vehicles; splints for baskets; and many others. Although the total volume of wood annually cut for these purposes is not large, its availability in nearby woodlands means a saving of time and expense to many farmers.

### Employment in Forest Industries

South Carolina's forest industries employed the equivalent of about 31,600 full-time workers in 1940,

assuming that all part-time workers were converted to full-time labor on the basis of 260 eight-hour working days per year (table 22). The lumber industry was the largest commercial employer, using the equivalent of 10,400 full-time workers, more than half of them in the mills (fig. 40); pulp and paper was next, with 9,400 workers. Fuel-wood cutting probably used the largest proportion of part-time labor, equivalent to the full time of 7,400 persons, nearly a quarter of all those engaged in wood-using occupations.

TABLE 22.—Estimated full-time labor required for South Carolina's output of forest products, 1940<sup>1</sup>

Product	Woods	Mill	Total
	Men per year	Men per year	Men per year
Lumber.....	4,600	5,800	10,400
Pulp and paper.....	4,900	4,500	9,400
Fuel wood.....	7,400		7,400
Veneer.....	830	1,660	2,490
Cooperage.....	220	380	600
Poles and piles.....	460		460
Hewn cross ties.....	320		320
Others.....	200	330	530
Total.....	18,930	12,670	31,600

<sup>1</sup> Part-time converted to full-time yearly employment on basis of 8 hours per day, 260 working days per year.

FIGURE 40.—Loading loblolly pine pulpwood for truck haul to the railroad. Woods and wood-using establishments in South Carolina provided more than 8 million man-hours of employment in 1940.



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In 1940 the forest industries of the State supplied the principal livelihood for about 6 percent of all gainfully employed males 14 years and older, according to the United States Census of Population (fig. 41). By contrast, agriculture gave work to 45 percent and manufacturing (other than forest industries) to 18 percent of South Carolina's male employees. The proportion in wood-using industries was undoubtedly larger than the chart indicates, since many agricultural workers are employed part time in the many small sawmills which are operated as a side line to farming or are dependent on farm labor.

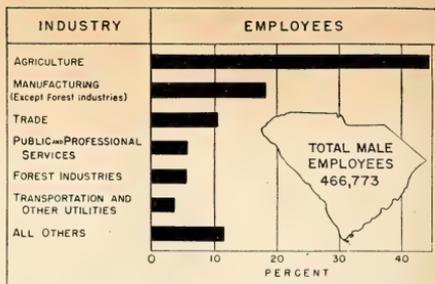


FIGURE 41.—Male employment in major South Carolina industries, 1940.

# Forest Growth And Commodity Drain

THE forest products industries are an important part of the economic structure of South Carolina. The timber resources on which they depend have been estimated in the section on timber volume. These resources may be considered as quantities immediately available for utilization or as growing, interest-bearing capital that without destruction can yield a constant annual profit. However, unless the net growth exceeds the average drain on the forest, the wood-using industries of the State must inevitably decline for lack of raw material. The following sections are an attempt to evaluate the net forest growth and drain upon the timber stands of South Carolina, as of 1936 and during the 5-year period 1936-40.

## Forest Growth

Growth was calculated in two ways—for sawlog material in board feet and for all sound material in trees 5 inches d. b. h. and over, in cubic feet. Board-foot growth includes the increment in all saw-timber trees and the volume in sound trees reaching the minimum saw-timber diameters (9 inches d. b. h. for pines and 13 inches d. b. h. for hardwoods) during the year. Cubic-foot growth includes the increment in all sound trees 5 inches d. b. h. and larger, and those reaching 5 inches d. b. h. during the year. Cull trees and the tops of hardwoods and cypress were excluded from the calculations.

Forest growth may be expressed as gross and net, the difference being the loss incurred through mortality of sound trees. Mortality, as defined here, includes death from any cause except cutting for industrial use or to improve the stand. Fire, insects, disease, wind, old age, and tree competition are the principal causes of mortality. Fire is the chief man-made and avoidable cause of forest mortality (fig. 42), particularly in the reproduction and under-saw-log-size classes. Among the larger trees, insects and



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FIGURE 42.—Effects of fire on cypress and pine. Fire is the most destructive of all the agencies that cause mortality and reduce the growth rate of South Carolina forests.

disease destroy much timber, though these losses are usually inconspicuous because they are dispersed among healthy stands.

Growth and mortality in the South Carolina forests in 1936 are estimated in figure 43, and for the 5-year period 1936-40 in table 23. Net growth for the State in 1936, by condition classes, is indicated in table 24, and for the three survey units in Appendix table 35.

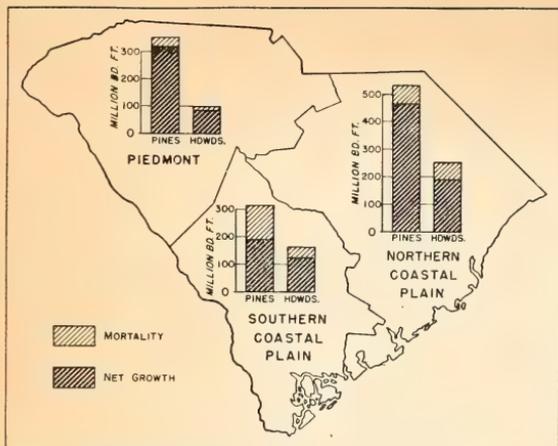


FIGURE 43.—Gross and net growth in board feet, International  $\frac{3}{4}$ -inch rule, by species groups and survey units, 1936.

TABLE 23.—Average annual gross growth, mortality, and net growth during the 5-year period 1936-40

Item	Sawlog-size trees			All trees <sup>1</sup>		
	Pines	Hardwoods	All species	Pines	Hardwoods	All species
State:						
Gross growth.....	1,225.4	522.1	1,747.5	293.33	171.71	465.04
Mortality.....	191.5	118.6	310.1	55.37	49.21	104.58
Net growth.....	1,033.9	403.5	1,437.4	237.96	122.50	360.46
Southern Coastal Plain:						
Gross growth.....	329.0	171.2	500.2	74.07	58.73	132.80
Mortality.....	85.4	41.0	126.4	22.66	19.19	41.85
Net growth.....	243.6	130.2	373.8	51.41	39.54	90.95
Northern Coastal Plain:						
Gross growth.....	534.8	250.2	785.0	107.75	71.01	178.76
Mortality.....	67.6	62.9	130.5	16.57	23.55	40.12
Net growth.....	467.2	187.3	654.5	91.18	47.46	138.64
Piedmont:						
Gross growth.....	361.6	100.7	462.3	111.51	41.97	153.48
Mortality.....	38.5	14.7	53.2	16.14	6.47	22.61
Net growth.....	323.1	86.0	409.1	95.37	35.50	130.87

<sup>1</sup> All sound trees 5 inches d. b. h. and larger (inside bark).

TABLE 24.—Net growth, International  $\frac{3}{4}$ -inch rule, of the saw-timber stand and all sound trees, by condition classes, 1936

Condition class	Saw-timber stand			All sound trees		
	Pine	Hardwood	Total	Pine	Hardwood	Total
Sawlog size:				1,000	1,000	1,000
Old growth.....	60,400	157,900	218,300	11,240	29,190	40,430
Second growth.....	697,700	209,800	907,500	135,670	61,680	197,350
Under-sawlog size.....	217,900	36,900	254,800	78,490	29,080	107,570
Total.....	976,000	404,600	1,380,600	225,400	119,950	345,350

#### Growth in Board Feet

During the period 1936-40 South Carolina's saw-timber stand grew at an average gross rate of about 1.7 billion board feet per year. Almost a fifth of the volume was lost through mortality, leaving a net growth of about 1.4 billion board feet. About 72 percent of this increment was in pine and 28 percent in hardwoods.

For the State as a whole, mortality was proportionately higher for hardwoods (23 percent) than for pines (16 percent), but the heaviest losses (26 percent) were in the pine stands of the southern Coastal Plain. This heavy mortality may be attributed chiefly to frequent fires and to naval stores operations in the longleaf and slash pine stands. Considerable reduction in mortality may be expected as organized fire control is further developed and ex-

tended throughout the State and forestry practices are more widely adopted.

In 1936, two-thirds of the net increment (tables 24 and 35, Appendix) was in second-growth sawlog-size stands, 16 percent in old-growth (equally divided between uncut and partly cut) and the remaining 18 percent in sawlog-size trees scattered in under-sawlog-size stands. Nearly half the total growth was made by the forests in the northern Coastal Plain.

Net board-foot increment by pines and hardwoods varied widely among condition classes. For example, 71 percent of the net growth of pine was in second-growth saw-timber, and only 6 percent in old-growth stands; while for hardwoods 52 percent was in second-growth and 39 percent in old-growth stands.

#### *Growth in Cubic Feet*

Measured in cubic feet, the gross annual growth of all sound trees 5 inches d. b. h. and larger in the 5-year period 1936-40 (table 23) averaged 465 million cubic feet, 63 percent in pine, and 37 percent in hardwoods. Since over a fifth was lost by mortality, the net growth amounted to 360 million cubic feet. In the pine stands of the southern Coastal Plain the loss reached 31 percent. As in the saw-timber stands, the net cubic-foot growth made by pines and hardwoods varied considerably between old-growth and second-growth stands; hardwoods accounted for nearly three-fourths of the cubic-foot increment in old-growth stands but for less than a third in the second-growth stands.

The net growth of cull trees, and the tops of hardwoods and cypress above sawlog limits, was not included in the above figures. Rough estimates indicate that it amounted in 1936 to 53 million cubic feet, or about 15 percent of the total net growth of sound trees.

Theoretically, a volume equivalent to net growth may be cut annually without continuing the depletion of the growing stock, assuming that all sound trees will be cut at some time. Actually the volume available is somewhat less than the net growth, because some stands, as well as trees of the less desirable species, will probably never be cut. Moreover, some of the trees should be retained to build up the growing stock that is below a desirable level in most stands.

#### *Net Growth Per Acre*

The average net growth per acre in 1936 by condition class and regional unit is summarized in table

25. For the State, saw-timber stands in all condition classes averaged 131 board feet per acre, 71 percent of which was pine and 29 percent hardwoods. The average was 149 board feet on the northern Coastal Plain, 107 feet on the southern Coastal Plain, and 129 feet on the piedmont. For sawlog-size trees, second growth averaged 200 board feet per acre for all species, partly cut old-growth 118 feet and uncut old-growth 163 feet.

These figures indicate the growth that may be expected under the existing type of forest management and as long as significant changes do not occur in density. Management practices which lead to better stocking and also reduce mortality will, of course, result in greater increments per acre.

#### *Commodity Drain*

Commodity drain comprises the volume of wood cut from growing stock, i. e., from sound trees 5 inches d. b. h. and larger. It does not include material cut from dead and cull trees and from the tops of hardwoods and cypress, or the wood imported from adjoining States for processing in South Carolina.

After the Forest Survey's inventory of 1936, annual records were maintained in order to keep the data up to date. From these records table 26, showing the actual drain on South Carolina's forests in 1936, 1938, and 1940, and Appendix table 36, indicating the average annual commodity drain for the 5-year period 1936-40, have been prepared. The drain on the sawlog material is expressed in board feet and on all sound trees 5 inches d. b. h. and larger, excluding bark, in cubic feet.

#### *Drain on Sawlog Material*

The average drain on trees of sawlog size during the 5-year period 1936-40 was 1.3 billion board feet a year. The drain was distributed as follows:

	<i>Percent</i>
Lumber.....	58
Fuel wood.....	19
Pulpwood.....	8
Veneer.....	7
Hewn cross ties, poles, piles and miscellaneous.....	8

Total..... 100

Fifty-two percent of the drain was on forests in the northern Coastal Plain, 26 percent in the southern Coastal Plain, and 22 percent in the piedmont. Pines supplied two-thirds of the sawlog drain (892 million board feet a year), principally for lumber, fuel wood, and pulpwood; hardwoods and cypress

TABLE 25.—Average net growth per acre in South Carolina, by condition class and region, 1936

## SAW-TIMBER TREES

Survey unit	Sawlog size			Under-sawlog size	All conditions		
	Old growth, uncut	Old growth, partly cut	Second growth		All species	Pines	Hardwoods
	Board feet	Board feet	Board feet		Board feet	Percent	Percent
Southern Coastal Plain.....	167	87	164	37	107	60	40
Northern Coastal Plain.....	179	135	228	58	149	71	29
Piedmont.....	115	114	196	74	129	79	21
State:							
All species.....	163	118	200	58	131	71	29
	Percent	Percent	Percent	Percent	Percent		
Pines.....	23	32	77	86	71		
Hardwoods.....	77	68	23	14	29		

## ALL SOUND TREES

Survey unit	Cubic feet	Cubic feet	Cubic feet	Cubic feet	Cubic feet	Pines	Hardwoods
	Percent	Percent	Percent	Percent	Percent		
	Southern Coastal Plain.....	31.5	23.6	35.3	15.1		
Northern Coastal Plain.....	25.7	28.1	44.2	19.8	31.6	66	34
Piedmont.....	18.3	26.9	50.3	37.6	41.6	72	28
State:							
All species.....	26.1	26.7	42.8	24.7	32.8	65	35
	Percent	Percent	Percent	Percent	Percent		
Pines.....	21	28	69	73	65		
Hardwoods.....	79	72	31	27	35		

averaged 418 million board feet, nearly half of which was for lumber, a fifth for fuel wood, a fifth for veneer, and the remainder for pulpwood and other products.

Comparing the State-wide drain on sawlog-size material (table 26), the volume dropped slightly below the 1936 level in 1938 but rose appreciably in 1940. Presumably, the war imposed greater drains in succeeding years. The lumber drain alone totaled 787 million board feet in 1936, 624 million board feet in 1938, and 875 million in 1940. A reclassification of veneer products, which now assigns sawn crating produced at veneer plants to lumber, has caused an apparent drop in veneer consumption; war demands for plywood and crating material, however, probably increased production materially.

*Drain on Sound Trees*

The annual drain on all sound trees 5 inches d. b. h. and larger averaged 307 million cubic feet during the 5-year period (table 27), equivalent to from 3 to 3½ million cords annually, including bark. Lumber production took 45 percent (pines 35, hardwoods 10 percent) and fuel wood 33 percent (more than half pine). The fuel wood drain was particularly

TABLE 26.—Commodity drain from South Carolina forests in 1936, 1938, and 1940

Commodity and year	Sawlog material			All material		
	Pines	Hardwoods	All species	Pines	Hardwoods	All species
	Million board feet	Million board feet	Million board feet	Million cubic feet	Million cubic feet	Million cubic feet
Lumber:						
1936.....	601.4	185.9	787.3	116.04	29.04	145.08
1938.....	442.7	181.2	623.9	85.14	28.52	113.66
1940.....	630.7	244.2	874.9	123.04	38.58	161.62
Veneer:						
1936.....	14.3	85.4	99.7	2.59	13.40	15.99
1938.....	9.7	89.0	98.7	1.78	14.10	15.88
1940.....	7.1	80.4	87.5	1.33	12.80	14.13
Pulpwood:						
1936.....	5.5	1.0	6.5	2.51	.83	3.34
1938.....	101.1	2.6	103.7	25.72	1.40	27.12
1940.....	178.6	8.3	186.9	42.95	4.34	47.29
Fuel wood:						
1936.....	151.7	93.6	245.3	57.26	37.39	94.65
1938.....	152.1	86.1	238.2	57.70	41.18	98.88
1940.....	164.8	88.9	253.7	61.51	42.36	103.87
Others:						
1936.....	66.7	37.7	104.4	16.51	7.76	24.27
1938.....	67.8	41.5	109.3	16.43	7.81	24.24
1940.....	58.6	36.2	94.8	14.67	6.68	21.35
Total:						
1936.....	839.6	403.6	1,243.2	194.91	88.42	283.33
1938.....	773.4	400.4	1,173.8	186.77	93.01	279.78
1940.....	1,039.8	458.0	1,497.8	243.50	104.76	348.26

heavy on the northern Coastal Plain and the piedmont because of the large number of farms in these regions; on the piedmont, it exceeded the aggregate drain of all other products.

Of the pine drain in the State, 51 percent was chargeable to lumber, 28 percent to fuel wood; of the hardwood drain, 33 percent was for lumber manufacturing, 43 percent for fuel wood, and 14 percent for veneer logs and bolts.

As noted before, the influence of the new pulp mills, as well as the growing market for kraft paper, is reflected in the rapid increase in the pulpwood cut. For example, pulpwood accounted for only 1 percent of the total cubic-foot drain in the State in 1936, but approximately 14 percent in 1940, and an even larger percent on the Coastal Plain.

TABLE 27.—Average annual commodity drain,<sup>1</sup> all materials, in the 5-year period 1936-40

Survey unit and commodity	Pines	Hard-woods	All species
	Million cubic feet	Million cubic feet	Million cubic feet
<b>State:</b>			
Lumber.....	106.95	31.56	138.51
Veneer.....	1.81	13.71	15.52
Pulpwood.....	26.94	1.92	28.86
Fuel wood.....	59.31	41.28	100.59
Other products.....	16.25	7.22	23.47
<b>Total.....</b>	<b>211.26</b>	<b>95.69</b>	<b>306.95</b>
<b>Southern Coastal Plain:</b>			
Lumber.....	29.43	8.65	38.08
Veneer.....	.37	2.88	3.25
Pulpwood.....	6.84	.02	6.86
Fuel wood.....	6.38	6.10	12.48
Other products.....	5.45	1.72	7.17
<b>Total.....</b>	<b>48.47</b>	<b>19.37</b>	<b>67.84</b>
<b>Northern Coastal Plain:</b>			
Lumber.....	46.55	21.10	67.65
Veneer.....	1.39	10.17	11.56
Pulpwood.....	17.64	.72	18.36
Fuel wood.....	26.10	16.93	43.03
Other products.....	7.49	3.90	11.39
<b>Total.....</b>	<b>99.17</b>	<b>52.82</b>	<b>151.99</b>
<b>Piedmont:</b>			
Lumber.....	30.97	1.81	32.78
Veneer.....	.05	.66	.71
Pulpwood.....	2.46	1.18	3.64
Fuel wood.....	26.83	18.25	45.08
Other products.....	3.31	1.60	4.91
<b>Total.....</b>	<b>63.62</b>	<b>23.50</b>	<b>87.12</b>

<sup>1</sup> From all sound trees 5 inches d. b. h. and larger, inside bark.

Impounded water of the Santee-Cooper power and navigation project has eliminated about 120,000 acres of forest in portions of Berkeley, Calhoun,

Clarendon, Orangeburg, and Sumter Counties. However, approximately 90 percent of the old-growth bottom-land hardwoods, estimated at 90 million board feet, and second-growth pine, estimated at 150 million feet, were salvaged before the reservoirs were flooded. Possibly as much as 75 million feet, principally second-growth bottom-land hardwoods, were not utilized because of inaccessibility, the low volume of the stands, and lack of markets. About 680,000 cords of under-sawlog-size material and saw-timber were not salvaged, an amount equal to a half-year's supply of fuel wood for the State. Because the water was impounded after 1940, the last year for which complete commodity drain data are available, these losses have not been included in the tabulations in this report. Lumber and pulpwood produced from the area in 1940, however, have been included as items of drain.

### Commodity Drain in Relation to Growing Stock

South Carolina's wood-using industries can be supplied indefinitely from the State's forests at the current level of output only if the net growth continues to equal the commodity drain. Since demands for wood products do not remain constant, but are likely to expand from time to time (as during the war), an accumulation of growth surpluses over drain is desirable. Obviously, if mortality and commodity drain combined exceed the gross growth, year after year, the growing stock will eventually be exhausted.

The influence of growth, mortality, and commodity drain upon the growing stock of the State for the 5-year period (1936-40) is illustrated in table 28. The aggregate increase of about 710 million board feet of pine—142 million per year—is the quantity available for building up the growing stock and for industrial expansion. Because there is a deficit in hardwoods for the State as a whole, any expansion based upon growth increment will have to be limited to pine.

The results are somewhat different if calculations are based upon the cubic volume of sound trees 5 inches d. b. h. and larger, also shown in table 28. Expressed in this measure, the annual increment of pine growing stock for the State as a whole is somewhat less than in the board-foot measure, because the drain on under-sawlog-size trees for pulpwood and other small-tree uses is included. For the hardwoods, too, the situation is much better; instead of a deficit there is an increase in growing stock of 134

million cubic feet for the 5 years, or about 27 million cubic feet (roughly 335,000 cords) per year. This indicates an active growth of young hardwood stands of less than saw-timber size (5 to 13 inches d. b. h.).

TABLE 28.—*Influence of growth, mortality, and commodity drain upon the growing stock in South Carolina during the 5-year period 1936-40*

SAWLOG-SIZE TREES <sup>1</sup>			
Item	Pines	Hardwoods	All species
	<i>Million board feet</i>	<i>Million board feet</i>	<i>Million board feet</i>
Growing stock, Jan. 1, 1936.....	18,430.0	11,687.1	30,117.1
Gross growth, 1936-40.....	6,127.1	2,610.7	8,737.8
Mortality, 1936-40.....	-957.5	-593.4	-1,550.9
Net growth, 1936-40.....	5,169.6	2,017.3	7,186.9
Commodity drain, 1936-40.....	-4,459.5	-2,089.7	-6,549.2
Net change.....	710.1	-72.4	637.7
Growing stock, Dec. 31, 1940.....	19,140.1	11,614.7	30,754.8
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Change in 5 years.....	+3.9	-0.6	+2.1
Average change per year.....	+ .8	- .1	+ .4

ALL TREES <sup>2</sup>			
	<i>Million cubic feet</i>	<i>Million cubic feet</i>	<i>Million cubic feet</i>
Growing stock, Jan. 1, 1936.....	4,796.68	3,824.28	8,620.96
Gross growth, 1936-40.....	1,466.64	858.58	2,325.22
Mortality, 1936-40.....	-276.81	-246.08	-522.89
Net growth, 1936-40.....	1,189.83	612.50	1,802.33
Commodity drain, 1936-40.....	-1,056.29	-478.46	-1,534.75
Net change.....	133.54	134.04	267.58
Growing stock, Dec. 31, 1940.....	4,930.22	3,958.32	8,888.54
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Change in 5 years.....	+2.8	+3.5	+3.1
Average change per year.....	+ .6	+ .7	+ .6

<sup>1</sup> International  $\frac{1}{4}$ -inch rule.

<sup>2</sup> Sound trees 5 inches d. b. h. and larger, inside bark.

While the relation of growth and drain to the growing stock for the State is important, comparable information for smaller areas is needed. Unfortunately the computations do not permit of comparisons for regions smaller than the survey units. For the units the relation of average increment in board feet to commodity drain is illustrated in figure 44 for

the years 1936-40; and the average growth surpluses and deficits for the same period are shown in tables 27, and 29, and 35, 36, 37, and 38.

It is evident that the piedmont has the largest growth surplus of saw timber, both pine and hardwood. The State-wide deficit of hardwood saw timber is due to a sizeable deficit on the northern Coastal Plain; on the southern Coastal Plain and the piedmont there are actual surpluses. The piedmont leads in growth surpluses of pines 5 inches d. b. h. and larger, while the northern Coastal Plain shows deficits in both pine and hardwoods of this class (table 29). In general, the relation of growth to drain is most favorable on the piedmont and least favorable on the northern Coastal Plain.

TABLE 29.—*Average annual net growth and commodity drain, by regions, during the 5-year period 1936-40*

SAWLOG-SIZE TREES <sup>1</sup>						
Region	Pines			Hardwoods		
	Net growth	Commodity drain	Growth surplus or deficit	Net growth	Commodity drain	Growth surplus or deficit
	<i>Million bd. ft.</i>	<i>Million bd. ft.</i>	<i>Million bd. ft.</i>	<i>Million bd. ft.</i>	<i>Million bd. ft.</i>	<i>Million bd. ft.</i>
Southern Coastal Plain.....	243.6	230.3	13.3	150.2	109.0	21.2
Northern Coastal Plain.....	467.2	434.4	32.8	187.3	249.1	-61.8
Piedmont.....	323.1	227.2	95.9	86.0	59.9	26.1
All regions.....	1,033.9	891.9	142.0	403.5	418.0	-14.5

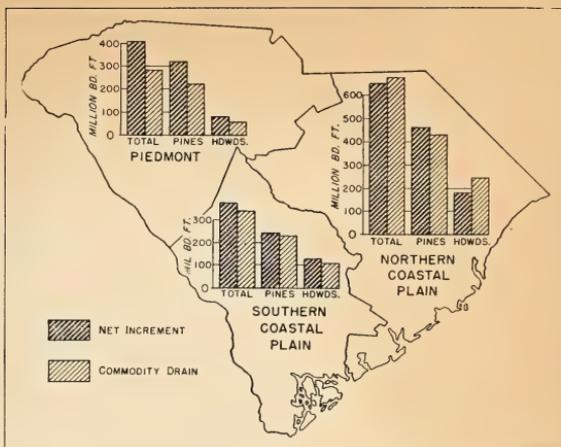
ALL TREES <sup>2</sup>						
	<i>Million cubic feet</i>					
Southern Coastal Plain.....	51.42	48.47	2.95	39.54	19.37	20.17
Northern Coastal Plain.....	91.17	99.17	-8.00	47.46	52.82	-5.36
Piedmont.....	95.38	63.62	31.76	35.50	23.50	12.00
All regions.....	237.97	211.26	26.71	122.50	95.69	26.81

<sup>1</sup> International  $\frac{1}{4}$ -inch rule.

<sup>2</sup> Sound trees 5 inches d. b. h. and larger, inside bark.

An ample yearly excess of growth over drain will increase the density of timber stands, allowing more timber of better quality to mature. The need for this is greatest on the piedmont because here the timber is generally of lower quality than that on the Coastal Plain. In fact, any significant expansion of

FIGURE 44.—Average net increment and commodity drain for the 5-year period 1936-40 in board feet, International  $\frac{1}{4}$ -inch rule, by species groups and survey units.



wood-using industries on the piedmont must take into account supplies that often contain considerable low-quality material.

The effect of commodity drain upon species composition as well as the size and quality of standing timber cannot be ascertained except through inves-

tigations over a period of years. Observations at present lead to the conclusion that in South Carolina as a whole, large, high-quality trees are being cut faster than they are replaced by growth, and that the volume of cull trees, particularly hardwoods, is increasing proportionately.

# Measures For Increasing Forest Production

THE forest is one of the few natural resources that can be managed so that it will meet anticipated future demands and furnish a steady supply of timber and related products indefinitely. The development and, in fact, the very life of wood-using industries and allied communities depend upon control of the forest growing stock. They cannot survive if the annual drain constantly exceeds the annual growth. Since the welfare of South Carolina will be advanced by permanent forest industries and stable forest employment, accumulation and maintenance of ample growing stock is a matter of State and Federal as well as private interest.

As yet, relatively little control of forest growth has been attempted. Many wood-using industries gage their output by the volume of accessible timber available in size, quality, and quantity for present needs, without much thought of replenishment by growth. In some localities overcutting is so exhausting accessible stands that the dependent plants will either have to limit their operations materially or shut down within a few years, involving a serious curtailment of South Carolina's wood production and of woods and mill employment. This condition is found in a number of localities in all three survey units, although our data do not show how severe overcutting is locally. Woodlands on many farms have also been overcut and their value lowered and reproduction delayed for a long time.

## *Building up Growth Capacity*

The growth capacity of the forest can be built up to provide for future needs by extending the productive forest area and increasing fire protection. This is the goal of the State forestry agencies; it governs the administration of the small area of national forest in South Carolina, and should be the objective of all private woodland owners. A few commercial concerns dependent upon wood have adjusted, or are attempting to adjust, their output to the forest growth within their procurement zones, and some farmers are managing their woodlands so as to de-

rive permanent future supplies of better products. Such instances are exceptional, however. The State-wide goal of full forest productivity is far from attainment. There is no question as to its value in the State economy from the standpoint of permanent employment in woods and mill, maintenance of manufacturing output and watershed protection, but attainment is constantly hindered by the uncertainties of taxation, the large amount of capital required, and the tenacity of fixed ideas not in keeping with permanent forest management.

Perhaps these impediments can never be entirely overcome, but the measures necessary to derive the maximum benefits from the forest form a program worthy of unremitting effort. They include building up the growing stock: improving timber utilization and marketing; controlling fire, insects, and disease; solving complicated financial problems which may involve the advancement of public credit to timberland owners; devising more equitable taxation methods; extending public forest ownership; instituting public control of cutting practices on private land; and planting nonproductive farm land to forest.

## *The Main Objective*

Adequate growing stock is the first requirement for satisfactory forest production. The maintenance of ample stocks of growing timber assures not only the permanence of wood-product manufacture, but prosperous and taxable industries, continuous employment of a large number of people in woods and mills, and other benefits such as watershed protection and adequate hunting and other facilities for recreation.

The supply of forest products in South Carolina can be vastly increased, possibly doubled. This may be accomplished by accelerating growth and by restricting the cut to mature and overmature trees and to younger ones which are unthrifty and slow-growing; by leaving well-formed and rapidly growing younger trees for future cutting, even though

some may already have reached sawlog size; by cutting cull trees and thinning young stands to provide more space for better trees or for reproduction; by preventing fires; and by planting tree seedlings where natural reproduction is lacking.

Individual stands vary greatly in species composition, site, age, condition, and density; and forest properties differ as to the markets for products immediately available, or that can be made available, under management, for future utilization. We have seen that the average volume per acre of pine stands in South Carolina is considerably below the volume of the best stocked stands (table 9). Few stands are overstocked, and even the best do not generally represent the optimum stocking obtainable under intensive management with growth conditions as favorable as they are in South Carolina. Under such management the growing stock can be materially increased and stands developed which will yield several crops of pulpwood and small sawlogs while selected trees are maturing into high grade saw or veneer logs, poles, or piles (fig. 45).

The measures suggested for perpetuating and increasing the timber supply naturally introduce some additional costs in logging methods. These should be regarded not as financial sacrifices but as investments in deferred returns. There are, of course, practical obstacles to the application of even the most urgent measures of forest management. Some owners may have financial or manufacturing obliga-

tions that make it impossible to incur the expense of improvements. Also, accentuated demands, like those imposed by war needs, and unanticipated losses from fire, insects, or disease, may reduce the volume of growing stock. The danger of such depletion, however, with its consequent injury to industrial output and employment may be lessened by public assistance in advancing credits to operators, increasing public cooperation in fire prevention and control, and related benefits. In return, the public may require timberland owners to adhere to reasonable cutting practices, protect young trees from logging damage, and take other constructive steps to build up the forest growing stock so that volume and quality will be increased.

### *Better Utilization of Forest Products*

Better utilization of raw materials will increase the yield from the forest and thus will reduce the drain on the growing stock to meet a given demand. For example, waste may be curtailed by various improvements in manufacture, and better utilization of forest materials may be attained by a closer integration of all the wood-using industries as well as by more efficient use of the portable sawmill.

### *Expanding the Production of Small Commodities*

Many small finished products like handles, brush backs, toys, woodenware, dowels, and novelties can be manufactured from cuttings of specified shapes

FIGURE 45.—*Selective cutting in a 36-year-old loblolly pine stand. This stand originally had 36 cords per acre, including sawlog trees containing 3,200 board feet. Half the board-foot volume was cut; the remainder, in carefully selected trees, was left for future growth.*



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and sizes sawn to order from low-grade lumber, edgings, slabs, etc. Hardwoods like elms, hickories, scarlet oak, water oak, and willow oak not in great demand for lumber or other customary commodities may be well suited for these small products, thus providing an outlet for some of the less desirable species now commonly left in the woods, where they lower the intrinsic and growth value of the stand. The demand for small products, however, is limited and plants for their manufacture relatively scarce, but the opportunity to save waste material and improve growing conditions suggests the desirability of thoroughly investigating market possibilities.

#### *Mill and Woods Refuse for Pulp*

The pulp mills of South Carolina could utilize the large quantities of pine refuse that are now left in the woods or burned as fuel at the sawmills. Also, large quantities of the hardwood logging and milling refuse, although used to a limited extent at present, are available for this purpose (fig. 46).

#### *Integration of Wood-Using Industries*

The products of the forest can be utilized more efficiently by the closer integration of sawmills with pulp, planing, veneer, turning, and other wood-using plants. For example, local industries manufacturing different wood products but so coordinated that all can obtain their supplies from the same forest area, or from each other in the form of discarded material, have great economic advantages over independent plants remote from each other. Transportation costs are thus reduced, and the opportunity is presented of sorting out the refuse materials in woods and mill to meet the particular needs of each plant. More complete utilization of raw mate-

rials promotes good forest management by permitting control over cull trees and the less desirable species. Such integration of the forest industries would also promote efficiency in administration and marketing, and, if based upon a well-guarded growing stock, would assure the permanence of employment, pay rolls, and income.

#### *Better Use of Portable Sawmills*

Small portable mills are so numerous in South Carolina that they produce almost three-fourths of the State's lumber. If used for stand betterment they can be of the highest value in providing for future timber production as well as contribute to the lumber supply. Since portable mills can be set up for small cuts in any locality, they may be supplied by timber removed in selective cutting. Frequently, stands with a large proportion of low-grade trees can be logged profitably only by portable mills.

Unfortunately, few of these small mills operate in such a manner as to leave a reserve of thrifty growing timber. The common practice is to cut all merchantable trees, including young and promising trees that have barely reached the smallest sawlog size and contain only narrow, low-grade lumber. Generally, after a stand has been logged by portable mills only worthless large trees are left standing, together with those slender, "plume-topped," under-sawlog-size trees that are subject to heavy mortality from exposure. A study by the Appalachian Forest Experiment Station in loblolly pine stands in North and South Carolina (1) showed that abrupt changes in the stand caused by heavy cutting "serve . . . to cause the death of an alarmingly high proportion of the smaller reserved trees." Portable mills are not only responsible for this damage, but their number and mobility increase the aggregate destruction.

#### *Public Participation in Forest-Land Management*

We have seen in previous sections how important the forest industries are to the economy of South Carolina. The people of the State therefore have a great deal to gain from good forest management, which would assure a permanent taxable resource as well as substantial employment of labor. In the long run, the State as a whole as well as the individuals dependent upon wood-using industries will profit from any public measures that aid in the development and perpetuation of the forest growing stock.



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FIGURE 46.—Slabs and edgings can provide raw material for the pulp mill, where transportation is practicable.

Public assistance is needed in controlling fires, insects, and disease, in promoting better management of stands, providing trees for planting, in research on forest problems, and in the solution of economic problems over which the individual owner or operator has little or no control. Some of the costs of this assistance must be borne by the Federal, State, and perhaps the county governments.

To assure adequate returns from this expenditure and protect the interests of local people, the public is entitled to require of timberland owners and operators compliance with the principles of forest practice directed toward building up the growing stock and increasing forest productivity. Numerous measures for the cooperation of the Federal Government and the States on behalf of better forest management have been advanced and some put into practice. The report on Forest Lands of the United States by the Joint Committee on Forestry of the 77th Congress (15) outlines a constructive program which the State of South Carolina might adopt. Its enactment into law and accomplishment on the ground would do more than anything else to establish timber production on a high and permanent level. Important features of this program are discussed below.

#### *Extension of Forest-Fire Control*

The degree to which forest fires are controlled in South Carolina will, among other things, determine the ability of the State to produce the amount of wood needed in the future without dangerously depleting its forest capital. Unquestionably, much of the understocking and, on many areas, complete absence of reproduction, are directly chargeable to uncontrolled fires. Even the casual observer is impressed by the rapidity with which cut-over forests—particularly pine—reestablish themselves where there are adequate seed sources and the trees are protected from fire during critical stages of growth. It is evident that an expanded program of forest-fire control would be an effective means of bettering forest conditions.

It was estimated in 1938 by State and Federal protective agencies that adequate protection of State and private forest lands from fires would require annual appropriations of \$627,000. In the calendar year 1942, however, the expenditure for this purpose in South Carolina was only \$277,901, of which \$194,641 was allotted by the State and counties, \$50,996 contributed by the Federal Government

under the Clarke-McNary law, and \$32,264 supplied by private sources.

According to the report of the State Commission of Forestry (5) for the fiscal year 1942, 23 of South Carolina's 46 counties and 4 private associations had formed forest protective organizations to cooperate with landowners in the prevention and suppression of fires on their properties. The area thus protected covered 6,971,936 acres. In addition, 148,910 acres in other counties were given extensive protection by means of detection units. National-forest land under protection amounted to 558,384 acres, and State forest land not in protective associations to 85,000 acres, bringing the total forest area which was under at least extensive protection to 7.7 million acres, or 72 percent of South Carolina's productive forest land. During the period covered by the report approximately 4,500 fires were reported for the area under extensive protection. These burned about 118,000 acres. The Forest Service estimates that during the calendar year 1942, 7,500 fires burned more than a million acres of unprotected forest in the State.

In trying to eliminate uncontrolled fires, forestry agencies do not contemplate a policy of complete fire exclusion. There is growing evidence that prescribed burning can be of great value if properly done in certain kinds of stands. In some types of forests, heavy accumulations of litter which would burn with disastrous intensity if ignited during periods of high hazard, can by proper burning be reduced with comparatively little damage to forest growth. Grazing in some longleaf and slash pine forests seems to improve if the range is burned every 2 or 3 years under the right conditions. Fire can also be a valuable tool to the forester in promoting the dominance of pine in stands that are threatened by the invasion of less desirable hardwoods. However, much remains to be learned about prescribed burning; even in the hands of the most skilled and experienced men, fires sometimes do more harm than good.

#### *Controlling Diseases and Insects*

Forest diseases and insects cause a great deal of loss annually to standing and cut timber. Except for the chestnut blight which has killed most of the chestnut in the mountain regions, there are no important epidemic diseases of forest trees in South Carolina, but considerable loss of sound wood is caused by rots which enter trees through fire wounds at the base, or through broken branch stubs or

wounds in the top. The little-leaf disease, serious in shortleaf and to a less extent loblolly pine, causes the gradual decline of stands 20 or more years of age in certain areas of the piedmont and results in premature death. Where little-leaf disease is serious some adjustment is forest management, such as shorter rotations, is required, since mortality rates become very high before the timber reaches sawlog-size.

The southern pine beetle (*Dendroctonus frontalis*) kills some pine every year, and in dry seasons following mild winters this insect may become epidemic and do great damage. The southern pine sawyer (*Monochamus titillator*) attacks weakened or recently killed pines; infested trees or logs left in the woods for more than 3 weeks in the summer may be rendered worthless. Various other insects damage the sapwood or heartwood of living or dead pines and hardwoods, and some cause serious losses to finished products. The Lyctus powder-post beetles are particularly destructive of the seasoned sapwood of oak, ash, and hickory in such finished forms as lumber, handles, furniture, vehicle stock, woodwork, shunt poles, and picker sticks.

Because of the large losses from insects and diseases, investigations leading to their control are especially worthy of public support. Such investigations are now being conducted by the Appalachian Forest Experiment Station in the group of States in the Station's territory, but the field is so large that additional means should be provided. A trained forest pathologist and a specialist in forest entomology should be attached to the State Commission of Forestry to conduct the necessary studies within South Carolina, working in cooperation with Federal and State specialists in related activities. This would permit better application of research results in pest control. A minimum of \$10,000 per year would be needed to finance this work.

#### *Technical Assistance to Timberland Owners*

There is great need for technical assistance to farmers and other landowners in the management of their timberlands. Owners frequently require advice on proper selection of trees to be cut or left for growth, and in preparing, grading, and marketing forest products, in order to insure success in the management of their properties.

Several cooperative endeavors have been started for the purpose of furnishing such assistance. Since 1941 timber-marking service has been available from the South Carolina Forest Service, part of the cost

being borne by that agency and part by the landowner. In 1938 the United States Forest Service and the South Carolina Commission of Forestry entered into an agreement which provided for the assignment of a forest-management specialist to work with the commission on a cooperative basis. In 1940 a project sponsored by the State extension service, the State forest service, and the United States Soil Conservation Service was begun in Aiken County for the purpose of increasing the productivity of farm woodlands.

These programs, however, are hampered by lack of funds and personnel and are far from meeting the needs of forest landowners throughout the State. A material increase in funds would help immeasurably in establishing higher levels of timberland values, thus benefiting both the individual and the State.

#### *Provision of More Tree Planting Stock*

Forest planting has certain advantages over natural reproduction. The species and spacing are subject to control, and areas can be restocked immediately without waiting for naturally sown tree seedlings to become established. Planting is the only means for stocking old fields, cut-over areas, and burns that are far from seed trees.

During the past decade, the South Carolina Commission of Forestry has supplied increasing quantities of seedlings from its nurseries; in the fiscal year 1940-41 nearly 14½ million were distributed, about two-thirds going to farmers and less than a tenth to industrial and other nonfarm private landowners (4).

Federal cooperation with the States in raising and distributing forest tree seedlings is authorized under the Clarke-McNary Act and the Cooperative Farm Forestry Act, but these permit the distribution of planting stock only to farmers. To extend Federal cooperation to industrial and other nonfarm timberland owners, and to increase the distribution for farm use, would require amendment of one or both of these acts. Without such amendment, the cost of reforestation expansion is a State responsibility, and State allotments to meet the growing needs should be provided.

#### *Equitable Forest Taxation*

Property taxes in South Carolina fall on the maturing forest crop more heavily than on any other soil crop. The taxation of forests and forest lands shares the inequities of taxation affecting other

classes of land from which it cannot easily be separated. General tax rates vary widely among the counties, and the range is even greater between tax districts within a county. That the relation of assessed to appraised value varies even more was revealed by a study of several years' taxes on approximately 75,000 acres of forest land in small tracts scattered through 7 South Carolina counties. The average county tax here ranged from 7 to 17 cents per acre, and the assessed valuations averaged about half the appraised and sales value. On some forest land the taxes are excessive and no distinction is made in the appraisal between forest and other land, nor is it customary to distinguish between land and standing timber. Cut-over and reproducing areas are commonly assessed at a higher proportion of the market value than are timbered areas, and there is a particularly unjust tendency to assess small holdings at a higher level than large holdings.

Improvements in forest taxation methods could be effected by adopting the suggestions made by the Forest Taxation Inquiry of the United States Forest Service (2). Particularly helpful would be a separate classification, for assessment purposes, of forest land and standing timber, with an adjustment of the rate on the latter to take care of the long-time investment involved. State action to bring about more accurate and consistent assessments would be a constructive step in the direction of better forest management. It would eliminate discrimination against individual owners, do away with the uncertainty as to future taxes on individual properties, and at the same time provide a more stable tax revenue.

#### *Establishing A Forest Credit System*

Financial obligations and difficulties of various kinds now prevent some timber owners and operators from adopting forestry methods which will perpetuate their supplies. Since the accumulation and improvement of adequate growing stock is of concern to the State as a whole, as well as to individuals, safeguarded financial assistance by the State becomes practicable and desirable.

A forest credit system could be used for many purposes. It would tend to make forest investments more liquid without liquidating the forest itself and the sacrifice of immature or economically unripe timber could be prevented. The credit might be used to pay carrying costs or to consolidate timber holdings. Some operators might use it to refinance unduly burdensome loans, others to install

needed improvements and facilities. State credit might greatly aid groups of small owners desiring to form cooperative associations for the management of their forests and the processing and marketing of their forest products. In these ways, and with the necessary guarantees as to proper forest management, State credit would help directly in bringing about sustained-yield production.

The report of the Joint Committee on Forestry of the 77th Congress recommended the establishment of a credit system whereby long-term loans at low interest rates would be made to private forest and naval stores operators through such agencies as the Reconstruction Finance Corporation or the Farm Credit Administration. The loans would be adjusted to the long-term nature of forestry and naval stores operations, and would be conditioned upon good forest practice and sound investment. Provisions for a forest credit system are contained in at least one bill placed before the 78th Congress.

#### *Public Regulation of Forest Practices*

While advocating additional public assistance for private forest landowners, and recognizing the noteworthy spread of commercial forestry in recent years, the Forest Service is convinced that, in addition, public regulation of forest practices on these lands is essential in order to keep them reasonably productive. It believes that a floor of standards for such practices should be established by Federal legislation. To assure Nation-wide application of these standards and, as far as possible, prevent inequitable interstate competition in the production and marketing of forest products, the Secretary of Agriculture should be authorized to take direct action in any State where suitable legislation is not enacted and enforced.

The public is entitled to require compliance with reasonable standards of forest practice, for several reasons. First, adequate and well-distributed growing stock, or forest capital, must be maintained to produce needed timber crops. Second, the public's investment in fire protection and other cooperative activities benefiting private owners must be protected. Third, it is necessary to maintain the forest-land tax base in order to protect watersheds and to provide regular employment and satisfactory living standards for forest industry workers. Finally, small and large operators who wish to practice good forest management must be protected from loss of markets and the general maladjustments brought on

by short-sighted owners who permit destructive cutting on their properties.

Under the plan suggested above, South Carolina (as well as other States) would have ample opportunity to administer forest regulation within its borders in a manner most acceptable to it, provided only that its practices conform, as a minimum, to the Federal standards. Within the framework of these standards, specific rules of practice could be developed for as many local administrative areas as might be needed. In handling the job the State would also have access to financial aid from the Federal Government. This program should be given priority by South Carolina because of the urgent need for bringing the forest land into full productivity, not only to promote local welfare and prosperity, but as a direct means of discharging the State's responsibility in the national picture.

#### *Federal Standards of Forest Management*

The Federal standards should protect forest lands against fire, insects, and disease and prevent their improper exploitation. This may be accomplished by: (1) Requiring adequate restocking after cutting; (2) prohibiting premature or wasteful cutting in young stands; (3) providing for a reserve of growing stock of desirable trees to keep the lands reasonably productive; (4) preventing avoidable damage to uncut trees, young growth, and watersheds; (5) regulating grazing to prevent damage to tree growth, and (6) prohibiting clear cutting except where it is silviculturally necessary or the land is to be put to some other suitable use.

Most operators will find it good business to go beyond these standards. And it should be noted that the regulation proposed does not involve any interference with ordinary business practices. It does not dictate the details of cutting or personnel management, or impose a load of reporting and accounting. It deals only with the prevention of forest destruction and deterioration and with keeping forest lands reasonably productive.

#### *Public Forests for South Carolina*

The benefits of public ownership and operation of forest lands warrant at least a moderate extension of this form of ownership in South Carolina. Further acquisition of national-forest land is needed, particularly within the national-forest boundaries, to consolidate the present holdings. The advantages of public ownership include continuity of tenure

and availability of trained personnel for administration and protection; combined, these carry assurance of uninterrupted management in accordance with long-term plans. Public forests, also, are more readily devoted than private forests to other functions than timber production, such as watershed protection, recreation, and wildlife management. They constitute demonstration areas where good methods of management may be exhibited or promising innovations tried out.

A strong incentive for the establishment of small public forests is the possibility of devoting to permanent forest the lands in so-called "problem areas" which have repeatedly reverted to the county because of tax delinquency. The present laws in South Carolina provide for the transfer of unsold tax delinquent land to the County Forfeited Land Commission, thus enabling a county to place such land in county forests, wherever forest management is practicable, and convert submarginal areas from liabilities into productive assets. The Aiken County Forest is an example of this procedure. However, since only a small amount of tax delinquent land is in blocks sufficiently large for efficient forestry operations, such developments are limited.

#### *Forest Research*

Most of the remedial measures that have been suggested involve the use of technical methods of forest management or forest product utilization, or both. These methods are based upon knowledge acquired partly by experience and partly by research. Systematic forest research is the most dependable way of acquiring the needed information. The principal agencies now working on problems of forest management, reforestation, forest surveys, forest economics, etc., pertinent to South Carolina are the Appalachian and the Southern Forest Experiment Stations of the United States Forest Service, with headquarters at Asheville, N. C., and New Orleans, La., respectively. Research in the utilization of forest products, which of course is beneficial to the wood-using industries and to the public at large, is being conducted by the Forest Products Laboratory at Madison, Wis.

#### *Information Service*

A far greater effort than is possible under current extension services is needed to develop among the people of South Carolina a keener appreciation of

the many advantages which they could derive from good forest management. The dissemination of information is a major activity of the State forestry agencies, but the personnel available is far from adequate to carry on the demonstrations, lectures,

and other programs in the outlying parts of the State, where it is most needed. A large increase of funds for these services is one of the important requirements among public measures that should be adopted in the cause of better forest management.

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# Appendix

## Survey Methods

THE forest land areas, volume of standing timber, and available forest products were computed by measurements and observations on 24,218  $\frac{1}{4}$ -acre sample plots established at intervals of  $\frac{1}{2}$  mile along parallel lines spaced 10 miles apart across the State. The records obtained form the basis for estimating the areas devoted to the various kinds of land use as well as to the volume of forest products.

To facilitate analysis and use of the data, the State was divided into three survey units, the southern Coastal Plain, excluding the coastal islands of Beaufort County (not included in this report) which comprise an estimated 91,200 acres, the northern Coastal Plain, and the Piedmont Plateau. The figures apply to the whole of each unit and may be considered reasonably accurate, as of the dates shown on the tables and charts, for these units or for areas which approach them in size, but obviously not for smaller tracts.

## Increment

Measurements for growth calculations were obtained on the inventory sample plots by increment borings made in a mechanically selected sample of all trees over 3 inches d. b. h. In general, the calculation of growth consisted of determining the volume of small trees that grew to merchantable size during the period covered by the survey and of increasing the sample tree diameters by the measured diameter growth of the past decade. The difference between the present and projected volumes of the sample trees was then expressed as a percentage increase and applied directly to the inventory volume. By this method the growth was computed for the years 1936-40.

## Forest Industries and Commodity Drain

Data on forest industries and estimates of commodity drain for 1936-40 are based upon canvasses of sawmills, other primary wood-using plants, and domestic wood consumers. A representative number of domestic consumers were canvassed to determine the quantity of wood consumed directly as fuel, fence posts, and for miscellaneous uses.

## Definition of Terms

The technical and uncommon terms used in this report, as well as certain common terms given special meaning, are defined as follows:

### Land Use Classes

*Productive forest land.*—Forest land having qualities necessary for the growth of merchantable saw-timber stands. Land without these qualities is defined as *nonproductive*.

*Cropland, old and new.*—Land used for production of farm or orchard crops, or so used evidently during the past 5 years.

*Abandoned cropland.*—Land formerly cultivated but definitely abandoned for agricultural crop production.

*Pasture.*—Cleared or open land under fence, used primarily for grazing.

*Other nonforest land.*—Land included within the corporate limits and suburban or industrial sections of cities and communities; power, rail, and highway rights-of-way; marsh, open prairie, and nonmeandered waterways.

## Species Groups

*Softwoods and Hardwoods.*—For enumeration of species in each of these groups see below, list of Principal Forest Trees of South Carolina. Softwoods are generally referred to in this report as "pines" because of the predominance of pines in the softwood group.

## Major Forest Types

*Loblolly pine type.*—Stands in which pines, loblolly predominating, form at least 25 percent of the dominant and codominant trees. Includes areas on which pond pine predominates (the pond pine type).

*Shortleaf pine types.*—Stands in which pines, shortleaf predominating, form at least 25 percent of the dominant and codominant trees. Includes areas, principally on the western piedmont, on which Virginia pine predominates (the Virginia pine type).

*Longleaf pine type.*—Stands in which pines, longleaf predominating, form at least 25 percent of the dominant and codominant trees. Includes areas on the southern Coastal Plain on which slash pine predominates (the slash pine type).

*Bottom-land hardwood type.*—Stands in which hardwoods, cypress, or mixed hardwoods and cypress form at least 75 percent of the dominant and codominant trees. The hardwoods are chiefly blackgum and sweetgum, associated with tupelo, oaks, and other bottom-land and swamp species.

*Upland hardwood type.*—Stands in which hardwoods characteristic of mountain and upland sites form at least 75 percent of the dominant and codominant trees. The hardwoods are of many species, notably oaks, hickories, and yellow-poplar. There are intermixtures of softwoods characteristic of the different parts of the State.

## Diameter Classification

*D. b. h.*—Diameter at breast height, outside of bark,  $4\frac{1}{2}$  feet above ground level.

*Diameter class.*—All trees were recorded in 2-inch diameter classes, including diameters 1 inch below and 0.9 inch above the stated midpoint: e. g., trees 7 to 8.9 inches in diameter were placed in the 8-inch class.

## Tree Classes

*Sound sawlog-size tree.*—A softwood tree at least 9 inches d. b. h. or a hardwood tree at least 13 inches d. b. h. with not less than one sound log 12 feet long, or with 50 percent of the gross volume of the tree sound saw timber.

*Sound under-sawlog-size tree.*—A tree over 1 inch d. b. h. and less than sawlog-size with a reasonably straight, sound stem.

*Cull tree.*—A tree that fails to qualify as a sound sawlog or under-sawlog-size tree because of rot, poor form, limbiness, or other defect.

*Pole tree.*—A pine tree that will produce a pole conforming to specifications of the American Standards Association.

## Forest Conditions

*Old growth.*—Stands composed of trees having the characteristics of the original mature timber of the region, containing at least 1 M board feet per acre of merchantable species in hardwood types and 600 board feet per acre in pine types. Stands are classed as *uncut* if less than 10 percent of the original volume has been cut, and as *partly cut* if more than 10 percent has been removed; the minimum volume per acre is the same in both cases.

*Second-growth sawlog-size.*—Stands of second growth having at least 600 board feet per acre in trees of sawlog-size. Stands are classed as *uncut* if less than 10 percent of the sawlog-size trees has been removed and as *partly cut* if 10 percent or more of the sawlog-size trees has been cut; the minimum volume per acre is the same in both cases.

*Second-growth sawlog-size partly cut.*—Stands of second growth from which 10 percent or more of the sawlog-size trees have been removed but with the remaining stand containing 600 or more board feet per acre.

*Second-growth under-sawlog-size.*—Young second-growth stands with less than 600 board feet per acre in trees of sawlog-size and with the remainder of the trees below sawlog-size, but averaging over 1 inch d. b. h.

*Reproduction.*—Stands too young to classify as second growth, having at least 80 well-distributed seedlings per acre of commercial species, averaging less than 1 inch d. b. h.

*Clear-cut.*—Cut-over areas with insufficient young growth to qualify either as second growth or as reproduction.

## Volume Estimates

*Board-foot volume.*—Includes only the saw-timber portion of sawlog-size trees. Top diameters vary with the limits of usable material. Deductions are made for woods cull and for loss in sawing at the mill. The volumes were computed by the International  $\frac{1}{4}$ -inch log rule, derived from the following formula:  $V = (0.22D^2 - 0.71D) 0.905$  for 4-foot section. Taper allowance:  $\frac{1}{2}$ -inch per 4 linear feet.

*Cordwood volume.*—Volume in standard cords, including bark, embraces the following:

1. The sawlog portion of sawlog-size trees.

2. The upper stems of sawlog-size softwoods and the upper stems and limbs of sawlog-size hardwoods. The minimum diameter is 4 inches outside bark.

3. The full stems of sound under-sawlog-size trees at least 5 inches d. b. h. to a variable top diameter of not less than 4 inches outside bark.

4. The estimated sound material in cull trees.

Deductions for cull include only the volume in defects which cause the material to be unsuited for cordwood. Sweep and slight crook are not regarded as defects.

The cordwood estimates are in terms of the *standard cord* of 128 stacked cubic feet, measuring 8 feet long and 4 feet high, and made up of round or split wood bolts 4 feet long. The wood and bark contents of the standard cord are 90 cubic feet for softwoods, 80 for hardwoods.

*Cubic-foot volume.*—The volume in cubic feet of solid wood, derived from the same material as the cordwood volume excepting the bark.

## Forest Growth and Commodity Drain

*Growing stock.*—The sum of the volumes of all sound trees in a stand, type, or region, expressed in board feet of sawlog-size timber or in cords or cubic feet of trees 5 inches d. b. h. and larger; dead and cull trees and tops of hardwoods are not included.

*Board-foot growth.*—The net growth of the sawlog portions of sawlog-size trees, plus the volume in sound trees that have grown from the under-sawlog to the sawlog-size class.

*Cubic-foot growth.*—The net growth of the sound stem wood, inside bark and excluding limbs, in trees 5 inches d. b. h. and larger (but including only the sawlog portions of sawlog-size hardwoods) plus the inside-bark volume in sound trees that have reached 5 inches d. b. h. during the growth period considered.

*Net growth.*—The gross, or total, growth of the forest minus mortality losses.

*Mortality.*—The volume lost from the growing stock through death of trees from such causes as fire, lightning, tree competition, old age, disease, insects, drought, and wind. Fire is the chief man-caused source of mortality.

*Commodity Drain.*—The sound-tree growing-stock material utilized plus the sound usable material left in felled trees.

*Board-foot drain.*—Commodity drain of saw-timber material.

*Cordwood drain.*—The total drain (including the felled trees left in the woods) from (a) saw-timber material, (b) upper stems of sawlog-size softwoods, and (c) small trees ranging from 5 inches to sawlog-size, cut from the sound-tree growing stock.

*Cubic-foot drain.*—Identical with cordwood drain except that bark volumes are omitted.

## Principal Forest Trees of South Carolina

### SOFTWOODS

Lumber or trade name	Recognized common name	Botanical name
Cedar, red. . . . .	Eastern redcedar . . . . .	<i>Juniperus virginiana</i>
Cedar, white. . . . .	Atlantic white-cedar ("southern white cedar"). . . . .	<i>Chamaecyparis thuyoides</i>
Cypress. . . . .	{ Baldcypress ("southern cypress") . . . . . Pondcypress . . . . .	<i>Taxodium distichum</i> <i>T. ascendens</i>
Hemlock . . . . .	Eastern hemlock . . . . .	<i>Tsuga canadensis</i>

## SOFTWOODS—continued

Lumber or trade name	Recognized common name	Botanical name
Pine, southern yellow . . . . .	Loblolly pine . . . . .	<i>Pinus taeda</i>
	Longleaf pine . . . . .	<i>P. palustris</i>
	Pitch pine . . . . .	<i>P. rigida</i>
	Pond pine . . . . .	<i>P. rigida</i> var. <i>serotina</i>
	Shortleaf pine . . . . .	<i>P. echinata</i>
	Slash pine . . . . .	<i>P. caribaea</i>
Pine, white . . . . .	Virginia pine . . . . .	<i>P. virginiana</i>
	Eastern white pine . . . . .	<i>P. strobus</i>

## HARDWOODS

Ash, white . . . . .	Carolina ash . . . . .	<i>Fraxinus caroliniana</i>
	Pumpkin ash . . . . .	<i>F. tomentosa</i>
	Red ash (and varieties) . . . . .	<i>F. pennsylvanica</i>
	White ash . . . . .	<i>F. americana</i>
Basswood . . . . .	American basswood (related species)	<i>Tilia americana</i>
Beech . . . . .	American beech . . . . .	<i>Fagus grandifolia</i>
	River birch . . . . .	<i>Betula nigra</i>
Birch . . . . .	Sweet birch . . . . .	<i>B. lenta</i>
	Yellow birch . . . . .	<i>B. lutea</i>
	Yellow buckeye . . . . .	<i>Aesculus octandra</i>
Butternut . . . . .	Butternut . . . . .	<i>Juglans cinerea</i>
Cherry . . . . .	Black cherry . . . . .	<i>Prunus serotina</i>
Chestnut . . . . .	American chestnut . . . . .	<i>Castanea dentata</i>
Cottonwood . . . . .	Eastern cottonwood . . . . .	<i>Populus deltoides</i>
	Swamp cottonwood . . . . .	<i>P. heterophylla</i>
Dogwood . . . . .	Flowering dogwood . . . . .	<i>Cornus florida</i>
Elm, soft . . . . .	American elm . . . . .	<i>Ulmus americana</i>
	Winged elm . . . . .	<i>U. alata</i>
Gum, black . . . . .	Black tupelo (blackgum) . . . . .	<i>Nyssa sylvatica</i>
	Swamp tupelo (blackgum) . . . . .	<i>N. sylvatica</i> rom. <i>biflora</i>
Gum, red . . . . .	Sweetgum . . . . .	<i>Liquidambar styraciflua</i>
Hackberry . . . . .	Hackberry . . . . .	<i>Celtis occidentalis</i>
Hickory, bitternut . . . . .	Bitternut hickory . . . . .	<i>Carya cordiformis</i>
Hickory, Carolina . . . . .	Carolina hickory . . . . .	<i>C. caroliniae-septentrionalis</i>
Hickory, mockernut . . . . .	Mockernut hickory . . . . .	<i>C. tomentosa</i> ( <i>Hicoria alba</i> )
Hickory, pignut . . . . .	Pignut hickory . . . . .	<i>C. glabra</i>
Hickory, red . . . . .	Red hickory . . . . .	<i>C. ovalis</i>
Hickory, shagbark . . . . .	Shagbark hickory . . . . .	<i>C. ovata</i>
Holly . . . . .	American holly . . . . .	<i>Ilex opaca</i>
Honeylocust . . . . .	Honeylocust . . . . .	<i>Gleditsia triacanthos</i>
Locust . . . . .	Black locust . . . . .	<i>Robinia pseudoacacia</i>
Magnolia . . . . .	Cucumber tree . . . . .	<i>Magnolia acuminata</i>
	Southern magnolia . . . . .	<i>M. grandiflora</i>
Maple, hard . . . . .	Sugar maple . . . . .	<i>Acer saccharophorum</i> ( <i>A. saccharum</i> )
Maple, soft . . . . .	Red maple . . . . .	<i>A. rubrum</i>
	Silver maple . . . . .	<i>A. saccharinum</i>
Oak, red . . . . .	Black oak . . . . .	<i>Quercus velutina</i>
	Cherrybark oak . . . . .	<i>Q. falcata</i> rom. <i>leucophylla</i>
	Northern red oak . . . . .	<i>Q. borealis</i>
	Scarlet oak . . . . .	<i>Q. coccinea</i>
	Southern red oak . . . . .	<i>Q. falcata</i>
	Swamp red oak . . . . .	<i>Q. falcata</i> rom. <i>pagodaefolia</i>
	Water oak . . . . .	<i>Q. nigra</i>
	Willow oak . . . . .	<i>Q. phellos</i>
Oak, white . . . . .	Chestnut oak . . . . .	<i>Q. montana</i>
	Live oak . . . . .	<i>Q. virginiana</i>
	Overcup oak . . . . .	<i>Q. lyrata</i>
	Post oak . . . . .	<i>Q. stellata</i>
	Swamp chestnut oak . . . . .	<i>Q. prinus</i>
	White oak . . . . .	<i>Q. alba</i>
Persimmon . . . . .	Common persimmon . . . . .	<i>Diospyros virginiana</i>
Sycamore . . . . .	American sycamore . . . . .	<i>Platanus occidentalis</i>
Tupelo (black gum) . . . . .	Water tupelo . . . . .	<i>Nyssa aquatica</i>
Walnut . . . . .	Black walnut . . . . .	<i>Juglans nigra</i>
Yellow-poplar . . . . .	Yellow-poplar . . . . .	<i>Liriodendron tulipifera</i>

## Supplementary Tables

The following tables present additional data for appraising the general forest situation in the State:

TABLE 30.—Distribution of land areas of the three survey units classified by use, 1936

Land Use	Southern Coastal Plain <sup>1</sup>		Northern Coastal Plain		Piedmont		State	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
<b>Forest:</b>								
Productive.....	2,993,000	57.7	4,498,400	59.5	3,187,200	47.8	10,678,600	55.0
Nonproductive.....			9,600	1	15,900	.2	25,500	.1
Total forest.....	2,993,000	57.7	4,508,000	59.6	3,203,100	48.0	10,704,100	55.1
<b>Nonforest:</b>								
<b>Agriculture:</b>								
Old cropland.....	1,638,700	31.6	2,314,200	30.6	2,718,600	40.7	6,671,500	34.3
New cropland.....	6,400	.1	15,200	.2	35,800	.5	57,400	.3
Improved pasture.....	31,400	.6	68,200	.9	204,400	3.1	304,000	1.6
Total agriculture.....	1,676,500	32.3	2,397,600	31.7	2,958,800	44.3	7,032,900	36.2
<b>Abandoned cropland.....</b>	181,600	3.5	124,400	1.6	245,800	3.7	551,800	2.8
<b>Other nonforest:</b>								
Marsh.....	212,200	4.1	321,000	4.3			533,200	2.8
Water areas.....	32,200	.6	30,500	.4	41,400	.6	104,100	.5
Urban areas.....	48,200	.9	82,700	1.1	126,500	1.9	257,400	1.3
Roads, railroads, etc.....	43,200	.9	63,400	.8	84,300	1.3	190,900	1.0
Miscellaneous.....			38,500	.5	12,700	.2	51,200	.3
Total nonforest.....	2,193,900	42.3	3,058,100	40.4	3,469,500	52.0	8,721,500	44.9
<b>All uses.....</b>	5,186,900	100.0	7,566,100	100.0	6,672,600	100.0	19,425,600	100.0
	Percent		Percent		Percent			
	26.7		39.0		34.3			

<sup>1</sup> Excludes the coastal islands of Beaufort County with an estimated land area of 91,200 acres and forest area of 27,400 acres.

TABLE 31.—Net board-foot volume, three log rules, by species and survey units, 1936

Species	International $\frac{3}{4}$ -inch rule				Scribner rule				Doyle rule			
	Southern Coastal Plain	Northern Coastal Plain	Piedmont	State	Southern Coastal Plain	Northern Coastal Plain	Piedmont	State	Southern Coastal Plain	Northern Coastal Plain	Piedmont	State
<b>Pines:</b>												
Loblolly.....	3,703.3	6,322.4	1,253.3	11,279.0	3,255.9	5,494.0	1,059.8	9,809.7	2,452.2	3,934.1	701.4	7,087.7
Shortleaf.....	150.0	315.0	2,644.5	3,109.5	129.9	262.9	2,202.7	2,595.5	87.0	165.5	1,398.0	1,650.5
Longleaf.....	1,024.5	1,341.0	73.7	2,439.2	863.6	1,114.2	64.8	2,042.6	571.5	697.5	49.2	1,318.2
Slash.....	321.1			321.1	263.3			268.3	168.3			168.3
Virginia.....		168.8	168.8				140.	140.2				84.5
Other.....	564.4	545.7	96.5	1,206.6	488.6	467.0	88.2	1,043.8	327.5	316.2	76.6	720.3
Total.....	5,763.3	8,524.1	4,236.8	18,524.2	5,006.3	7,338.1	3,555.7	15,900.1	3,606.5	5,113.3	2,309.7	11,029.5
<b>Hardwoods:</b>												
Sweetgum.....	931.1	1,714.0	309.6	2,954.7	849.4	1,584.4	279.9	2,713.7	694.7	1,338.2	220.0	2,252.9
Tupelo <sup>2</sup> .....	993.7	1,503.7	28.1	2,525.5	853.4	1,383.6	23.9	2,260.9	674.6	1,097.9	18.5	1,791.0
Yellow-poplar.....	161.5	218.2	448.4	828.1	144.0	199.4	410.8	754.2	110.9	155.0	341.9	607.8
Red oaks.....	458.5	620.0	501.5	1,380.0	424.2	573.5	274.5	1,272.2	359.5	489.7	225.1	1,074.3
White oaks.....	170.2	397.9	289.0	857.1	156.9	372.1	263.3	792.3	130.8	329.1	216.2	676.1
Ash.....	97.2	282.5	(3)	379.7	89.5	258.8	(3)	348.3	71.2	206.6	(3)	277.8
Other <sup>4</sup> .....	343.2	665.2	350.9	1,359.3	310.4	598.3	318.8	1,227.5	242.2	474.6	247.9	964.7
Total.....	3,155.4	5,401.5	1,727.5	10,284.4	2,827.8	4,970.1	1,571.2	9,369.1	2,283.9	4,091.1	1,269.6	7,644.6
<b>Cypress.....</b>	490.8	896.8		1,387.6	410.6	800.2		1,210.8	270.3	590.3		860.6
All species.....	9,409.5	14,822.4	5,964.3	30,196.2	8,244.7	13,108.4	5,126.9	26,480.0	6,160.7	9,794.7	3,579.3	19,534.7

<sup>1</sup> Includes pond pine on the Coastal Plain, white pine and hemlock on the piedmont.

<sup>2</sup> Includes blackgum, water tupelo, and swamp tupelo on the Coastal Plain, blackgum on the piedmont.

<sup>3</sup> Ash included with "other" on the piedmont.

<sup>4</sup> Includes hickories and other hardwoods.

TABLE 32.—Average board-foot volume per acre in sawlog-size condition class, by forest type groups, 1936

Forest type group	Less than 2 M		2 M to 6 M		6 M to 10 M		10 M and over	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume
State:	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Pine.....	28.6	8.8	49.2	38.8	13.5	23.1	8.7	29.3
Hardwood.....	22.0	5.4	45.2	29.9	17.9	24.4	14.9	40.3
All types.....	26.7	7.6	48.1	35.8	14.7	23.6	10.5	33.0
Southern Coastal Plain:								
Pine.....	25.2	6.3	45.7	31.1	16.8	24.6	12.3	38.0
Hardwood.....	17.1	3.8	46.3	29.4	20.4	26.1	16.2	40.7
All types.....	22.9	5.6	45.9	30.5	17.8	25.1	13.4	38.8
Northern Coastal Plain:								
Pine.....	27.4	8.2	48.1	37.0	14.3	23.6	10.2	31.2
Hardwood.....	19.4	4.4	43.9	26.8	18.6	23.5	18.1	45.3
All types.....	24.6	6.6	46.6	32.7	15.8	23.6	13.0	37.1
Piedmont:								
Pine.....	33.7	13.6	54.1	54.6	9.1	19.8	3.1	12.0
Hardwood.....	37.3	14.5	47.7	47.1	11.8	25.3	3.2	13.1
All types.....	34.4	13.8	52.9	53.0	9.6	21.0	3.1	12.2

TABLE 33.—Net cordwood volume of sound trees, by tree-diameter class, 1936<sup>1</sup>

Survey unit and species group	6-8 inches	10-12 inches	14-18 inches	20+ inches	All classes
State:	1,000 cords	1,000 cords	1,000 cords	1,000 cords	1,000 cords
Pines.....	16,014.6	21,164.1	20,048.6	9,498.3	66,725.6
Hardwoods.....	12,185.9	15,221.4	14,765.1	11,049.5	53,221.9
Cypress.....	860.7	1,096.7	1,225.1	1,003.1	4,185.6
All species.....	29,061.2	37,482.2	36,038.8	21,550.9	124,133.1
Southern Coastal Plain:					
Pines.....	4,041.0	5,396.0	5,928.9	4,129.4	19,495.3
Hardwoods.....	4,247.9	5,160.4	4,659.2	3,177.6	17,245.1
Cypress.....	464.3	567.0	415.5	245.7	1,692.5
All species.....	8,753.2	11,123.4	11,003.6	7,552.7	38,432.9
Northern Coastal Plain:					
Pines.....	4,966.0	8,744.3	9,742.4	4,264.4	27,717.1
Hardwoods.....	5,029.3	7,125.9	7,479.7	6,115.2	25,750.1
Cypress.....	396.4	529.7	809.6	757.4	2,493.1
All species.....	10,391.7	16,399.9	18,031.7	11,137.0	55,960.3
Piedmont:					
Pines.....	7,007.6	7,023.8	4,377.3	1,104.5	19,513.2
Hardwoods.....	2,908.7	2,935.1	2,626.2	1,756.7	10,226.7
All species.....	9,916.3	9,958.9	7,003.5	2,861.2	29,739.9

<sup>1</sup> Includes tops and limbs of pines but not of hardwoods; excludes the volume of sound or rotten culls and scrub oak and other non-commercial species. Pine includes small quantities of hemlock, redcedar, and Atlantic white-cedar.

TABLE 34.—Distribution of pine poles by survey units, tree-diameter class and length, 1936

Survey unit and tree-diameter class (inches)	20 feet	25 feet	30 feet	35 feet	40 feet	45 feet+	All lengths	
State:	1,000 poles	Percent						
7.0 to 8.9.....	8,567	2,059	534				11,160	31.8
9.0 to 10.9.....	5,642	2,609	1,451	704	137		10,543	30.1
11.0 to 12.9.....	2,590	2,060	1,646	801	400	32	7,529	21.5
13.0 to 14.9.....	668	1,129	1,102	569	249	118	3,835	10.9
15.0 to 16.9.....	109	388	499	252	117	84	1,449	4.1
17.0 to 18.9.....	3	129	219	121	49	35	556	1.6
Total.....	17,579	8,374	5,451	2,447	952	269	35,072	100.0
Southern Coastal Plain:								
7.0 to 8.9.....	3,542	798	270				4,610	29.3
9.0 to 10.9.....	2,357	1,080	668	325	90		4,520	28.7
11.0 to 12.9.....	1,219	845	727	334	234		3,359	21.3
13.0 to 14.9.....	457	498	505	270	148	32	1,910	12.1
15.0 to 16.9.....	109	241	293	158	77	29	907	5.8
17.0 to 18.9.....	3	116	164	102	39	16	440	2.8
Total.....	7,687	3,578	2,627	1,189	588	77	15,746	100.0
Northern Coastal Plain:								
7.0 to 8.9.....	2,568	520	96				3,184	27.1
9.0 to 10.9.....	2,121	854	433	286			3,694	31.4
11.0 to 12.9.....	979	796	568	318	125	32	2,818	24.0
13.0 to 14.9.....	148	510	427	193	77	86	1,441	12.2
15.0 to 16.9.....		141	190	83	38	55	507	4.3
17.0 to 18.9.....		13	55	19	10	19	116	1.0
Total.....	5,816	2,834	1,769	899	250	192	11,760	100.0
Piedmont:								
7.0 to 8.9.....	2,457	741	168				3,366	44.4
9.0 to 10.9.....	1,164	675	350	93	47		2,329	30.8
11.0 to 12.9.....	392	419	351	149	41		1,352	17.9
13.0 to 14.9.....	63	121	170	106	24		484	6.4
15.0 to 16.9.....		6	16	11	2		35	.5
17.0 to 18.9.....								
Total.....	4,076	1,962	1,055	359	114		7,566	100.0
Summary:	Percent							
Southern Coastal Plain.....	48.8	22.7	16.7	7.6	3.7	.5	100.0	
Northern Coastal Plain.....	49.5	24.1	15.1	7.6	2.1	1.6	100.0	
Piedmont.....	53.9	26.0	13.9	4.7	1.5		100.0	
All regions.....	50.1	23.9	15.5	7.0	2.7	.8	100.0	

TABLE 35.—*Net growth by forest condition classes, 1936*

Survey unit and forest condition class	Sawlog-size trees			All trees <sup>1</sup>		
	Pines	Hardwoods	All species	Pines	Hardwoods	All species
State:						
Sawlog size:	<i>Million board feet</i>	<i>Million board feet</i>	<i>Million board feet</i>	<i>Million cubic feet</i>	<i>Million cubic feet</i>	<i>Million cubic feet</i>
Old growth:						
Uncut.....	25.5	86.6	112.1	3.81	11.99	15.80
Partly cut.....	34.9	71.3	106.2	7.43	17.20	24.63
Second growth.....	697.7	209.8	907.5	135.67	61.68	197.35
Under-sawlog size.....	217.9	36.9	254.8	78.49	29.08	107.57
All conditions.....	976.0	404.6	1,380.6	225.40	119.95	345.35
Southern Coastal Plain:						
Sawlog size:						
Old growth:						
Uncut.....	6.8	27.7	34.5	1.06	3.47	4.53
Partly cut.....	1.3	19.5	20.8	.95	5.21	6.16
Second growth.....	146.6	73.0	219.6	24.78	21.08	45.86
Under-sawlog size.....	38.0	7.6	45.6	12.64	6.74	19.38
All conditions.....	192.7	127.8	320.5	39.43	36.50	75.93
Northern Coastal Plain:						
Sawlog size:						
Old growth:						
Uncut.....	11.5	50.9	62.4	1.67	7.34	9.01
Partly cut.....	22.5	43.7	66.2	4.37	9.51	13.88
Second growth.....	344.1	85.6	429.7	61.18	23.22	84.40
Under-sawlog size.....	86.7	10.8	97.5	24.88	7.92	32.80
All conditions.....	464.8	191.0	655.8	92.10	47.99	140.09
Piedmont:						
Sawlog size:						
Old growth:						
Uncut.....	7.2	8.0	15.2	1.08	1.18	2.26
Partly cut.....	11.1	8.1	19.2	2.11	2.48	4.59
Second growth.....	207.0	51.2	258.2	49.71	17.38	67.09
Under-sawlog size.....	93.2	18.5	111.7	40.97	14.42	55.39
All conditions.....	318.5	85.8	404.3	93.87	35.46	129.33

<sup>1</sup> All sound trees 5 inches d. b. h. and larger, inside bark.

TABLE 36.—Average annual commodity drain of sawlog material during the 5-year period 1936-40

Survey unit and commodity	Pines	Hardwoods	All species
State:	<i>Million board feet</i>	<i>Million board feet</i>	<i>Million board feet</i>
Lumber.....	553.3	200.9	754.2
Veneer.....	9.8	86.6	96.4
Pulpwood.....	105.3	3.9	109.2
Fuel wood.....	157.1	88.9	246.0
Other products.....	66.4	37.6	104.0
Total.....	891.9	417.9	1,309.8
Southern Coastal Plain:			
Lumber.....	153.5	57.7	211.2
Veneer.....	2.0	19.3	21.3
Pulpwood.....	26.4	.1	26.5
Fuel wood.....	24.1	22.8	46.9
Other products.....	24.3	9.1	33.4
Total.....	230.3	109.0	339.3
Northern Coastal Plain:			
Lumber.....	255.0	132.7	387.7
Veneer.....	7.6	63.5	71.1
Pulpwood.....	71.3	2.5	73.8
Fuel wood.....	67.3	28.6	95.9
Other products.....	33.2	21.8	55.0
Total.....	434.4	249.1	683.5
Piedmont:			
Lumber.....	144.8	10.5	155.3
Veneer.....	.2	3.8	4.0
Pulpwood.....	7.6	1.3	8.9
Fuel wood.....	65.7	37.5	103.2
Other products.....	8.9	6.7	15.6
Total.....	227.2	59.8	287.0

TABLE 37.—Growing stock of sawlog-size trees as influenced by growth and commodity drain, by survey units, during the 5-year period 1936-40

## SOUTHERN COASTAL PLAIN

Item	Pines	Hardwoods	All species
	<i>Million board feet</i>	<i>Million board feet</i>	<i>Million board feet</i>
Growing stock, Jan. 1, 1936.....	5,816.5	3,664.1	9,480.6
Net growth, 1936-40.....	1,218.1	651.0	1,869.1
Commodity drain, 1936-40.....	1,151.6	545.0	1,696.6
Net change in growing stock.....	66.5	106.0	172.5
Growing stock, Dec. 31, 1940.....	5,883.0	3,770.1	9,653.1

## NORTHERN COASTAL PLAIN

Growing stock, Jan. 1, 1936.....	8,470.5	6,330.6	14,801.1
Net growth, 1936-40.....	2,335.7	936.5	3,272.2
Commodity drain, 1936-40.....	2,171.8	1,245.5	3,417.3
Net change in growing stock.....	163.9	-309.0	-145.1
Growing stock, Dec. 31, 1940.....	8,634.4	6,021.6	14,656.0

## PIEDMONT

Growing stock, Jan. 1, 1936.....	4,143.0	1,692.4	5,835.4
Net growth, 1936-40.....	1,615.8	429.8	2,045.6
Commodity drain, 1936-40.....	1,136.1	299.2	1,435.3
Net change in growing stock.....	479.7	130.6	610.3
Growing stock, Dec. 31, 1940.....	4,622.7	1,823.0	6,445.7
Average annual change in growing stock:	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Southern Coastal Plain.....	.2	.6	.4
Northern Coastal Plain.....	.4	-1.0	-.2
Piedmont.....	2.3	1.5	2.1

TABLE 38.—Growing stock of total stand as influenced by growth and commodity drain, by survey units, during the 5-year period, 1936-40<sup>1</sup>

## SOUTHERN COASTAL PLAIN

Item	Pines	Hardwoods	All species
Growing stock, Jan. 1, 1936.....	<i>Million cubic feet</i> 1,474.92	<i>Million cubic feet</i> 1,290.82	<i>Million cubic feet</i> 2,765.74
Net growth, 1936-40.....	257.07	197.69	454.76
Commodity drain, 1936-40.....	242.33	96.84	339.17
Net change in growing stock.....	14.74	100.85	115.59
Growing stock, Dec. 31, 1940.....	1,489.66	1,391.67	2,881.33

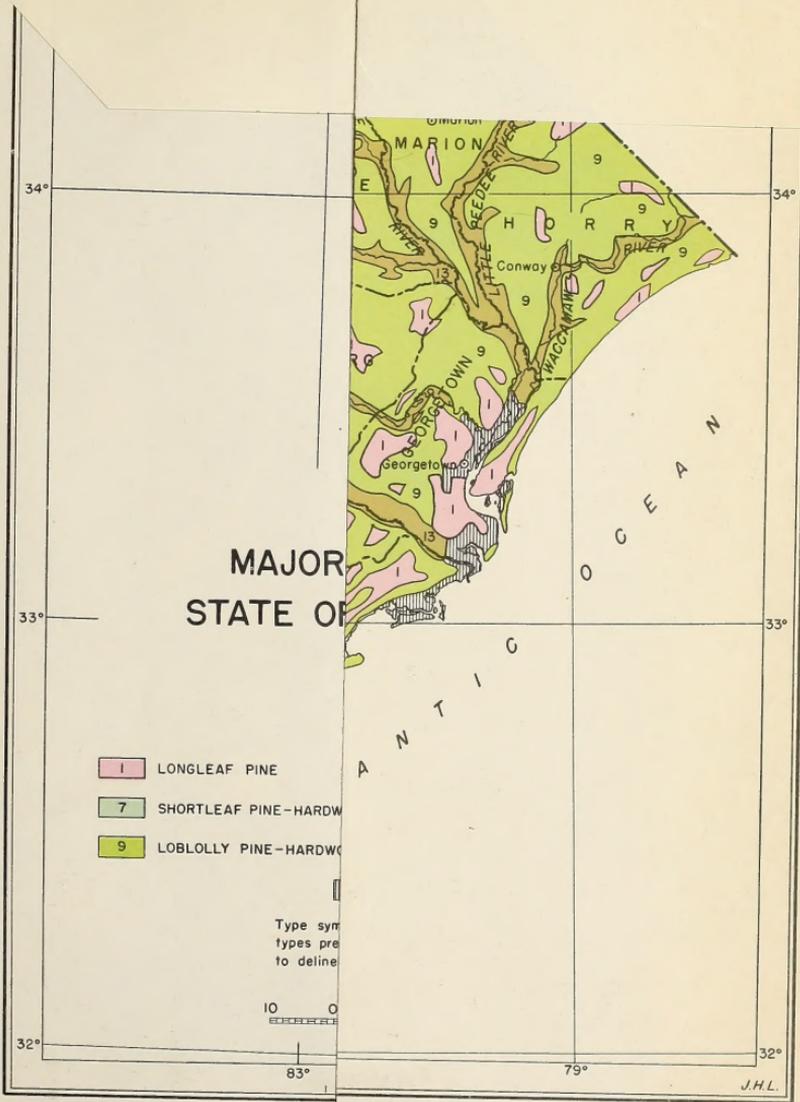
## NORTHERN COASTAL PLAIN

Growing stock, Jan. 1, 1936.....	1,977.63	1,886.53	3,864.16
Net growth, 1936-40.....	455.88	237.32	693.20
Commodity drain, 1936-40.....	495.88	264.11	759.99
Net change in growing stock.....	-40.00	-26.79	-66.79
Growing stock, Dec. 31, 1940.....	1,937.63	1,859.74	3,797.37

## PIEDMONT

Growing stock, Jan. 1, 1936.....	1,344.13	646.93	1,991.06
Net growth, 1936-40.....	476.88	177.49	654.37
Commodity drain, 1936-40.....	318.08	117.51	435.59
Net change in growing stock.....	158.80	59.98	218.78
Growing stock, Dec. 31, 1940.....	1,502.93	706.91	2,209.84
Average annual change in growing stock:	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Southern Coastal Plain.....	.2	1.6	.8
Northern Coastal Plain.....	-.4	-.3	-.3
Piedmont.....	2.4	1.9	2.2

<sup>1</sup> All sound trees 5 inches d. b. h. and larger, inside bark.



- 1 LONGLEAF PINE
- 7 SHORTLEAF PINE-HARDWOOD
- 9 LOBLOLLY PINE-HARDWOOD

Type symbols  
types present  
to delineate

10 0



# MAJOR FOREST TYPES STATE OF SOUTH CAROLINA 1940

## LEGEND

- |  |                          |    |                         |
|--|--------------------------|----|-------------------------|
| 1  | LONGLEAF PINE            | 22 | VIRGINIA PINE-HARDWOODS |
| 7  | SHORTLEAF PINE-HARDWOODS | 11 | MOUNTAIN HARDWOODS      |
| 9  | LOBLOLLY PINE-HARDWOODS  | 13 | BOTTOM-LAND HARDWOODS   |
|  MARSH OR BEACH |                          |    |                         |

Type symbols show areas where the major types predominate. No attempt has been made to delineate minor types or agricultural land.

SCALE IN MILES  
 10 0 10 20 30 40

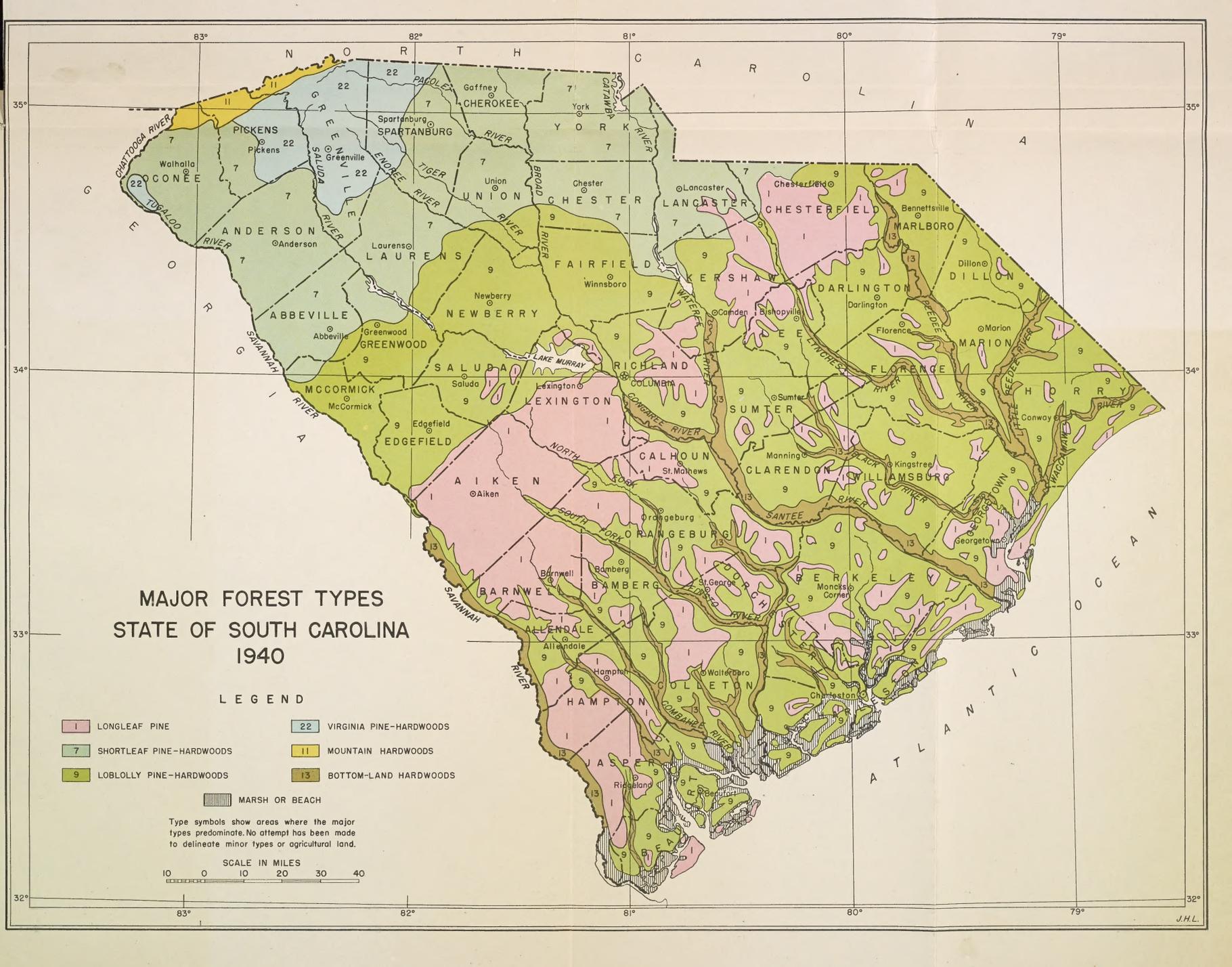


TABLE 38.—Growing stock of total stand as influenced by growth and commodity drain by counties

MAJOR FOREST TYPES  
IN NORTH CAROLINA  
1914

U. S. FOREST SERVICE  
BUREAU OF FOREST MANAGEMENT  
WASHINGTON, D. C.