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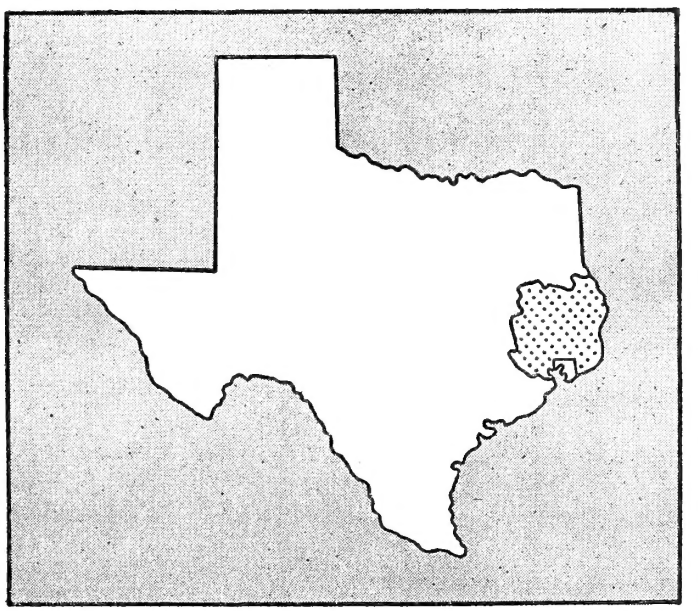
FOREST RESOURCES of Southeastern Texas



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Forest Resources of Southeastern Texas

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SOUTHERN FOREST EXPERIMENT STATION

FOREST SERVICE

Computations in charge of

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The Forest Survey

EFFECTIVE rehabilitation and constructive management of this country's forest resource require not only protection against neglect and destruction but, with equal urgency, provision for permanent and wise use of that resource. Wisdom in forest land use planning must rest on a long-time economy backed up by reliable facts as to supply and requirements for wood and other forest products, production and consumption, drain and growth, and the location, area, and condition of existing and prospective forest lands. This requirement for dependable and comprehensive technical information is now being translated into action through the provisions of the McSweeney-McNary Forest Research Act of May 22, 1928, authorizing a Nation-wide forest survey.

The Forest Survey, as constituted under that act, is obtaining essential field information and, through interpretation thereof, is aiding in the formulation of guiding principles and policies fundamental to a system of planned management and land use for each forest region and for the Nation.

The fivefold purpose of the Forest Survey is: (1) To make a field inventory of the present supply of timber and other forest products; (2) to ascertain the rate at which this supply is being increased through growth; (3) to determine the rate at which it is being diminished through industrial and domestic uses, windfall, fire, disease, and other causes; (4) to determine the present consumption and the probable future trend in requirements for timber and other forest products; and (5) to interpret and correlate these findings with existing and anticipated economic conditions, as an aid in the formulation of both private and public policies for the effective and rational use of land suitable for forest production.

It is planned to publish the results of this investigation as they become available. These publications apply to large areas and should not be interpreted as portraying correctly the forest situation for small sections, the condition of which may be either better or poorer than the average for the entire unit. They supply the general framework upon which to base intensive studies of critical situations.

The investigation is conducted in the various forest regions by the forest experiment stations of the Forest Service and in the South by the Southern Forest Experiment Station with headquarters in New Orleans, La.

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Introduction and Explanation of Terms Used

THE survey in southeastern Texas was conducted during the fall and early winter of 1934–35. Seven crews of three men each, directed by a supervisor, carried on the field work of the forest inventory. Parallel lines 10 miles apart were run approximately east and west across the unit. At ⅛-mile intervals, arbitrarily determined by measurement along each of the lines, 12,528 quarter-acre sample plots were established. On forest plots, of which there were 8,459, the fieldmen recorded forest type, forest condition, fire damage, density and distribution of reproduction, and site quality. They also tallied the trees by species and diameter class and made increment borings to determine age and growth of the timber during the last 10 years. These data furnished the basis for the statistics of area, volume, and growth presented in this report.

Data on forest industries and timber drain for the calendar year of 1935 were obtained from a canvass of the wood-using plants and local wood consumers, supplemented by the lumber-production statistics compiled by the Lumber Code Authority for the National Recovery Administration. Present consumption and probable future trends in national requirements for timber and other forest products are being studied on a Nation-wide basis and will be treated in a separate report.

The following definitions of technical and unusual terms used in this report are given to facilitate a thorough comprehension of the forest situation discussed.

Land-Use Classes

Productive forest area.—Forest area having qualities essential for the growth of commercial timber.

Nonproductive forest area.—Forest area lacking the qualities essential for the growth of commercial timber.

Cultivated agricultural land.—Land used for production of farm or orchard crops or evidently so used during the last 2 years. This includes new cropland, i. e., land converted from forest to cropland within 5 years prior to survey.

Idle agricultural land.—Cultivated land that has been idle for 2 years or more but has not reached the abandoned stage.

Abandoned agricultural land.—Land once cultivated but showing distinct evidence of having been abandoned for agricultural crop production; no attempt has been made to maintain it as improved pasture.

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

Other areas.—Areas included within the corporate limits and suburban or industrial sections of cities and communities; power, rail, and highway rights-of-way; marsh; nonmeandered waterways; and prairie not used for pasture.

Forest Types

Bottom land and swamp hardwood.—Mixed stands of oak, gum, ash, magnolia, maple, and other hardwoods characteristic of the larger stream bottoms and swamps. The hardwoods comprise at least 75 percent of the saw-timber volume in sawlog-size stands or 75 percent of the dominant and codominant stems in under-sawlog-size stands.

Cypress-tupelo.—Cypress or tupelo constituting at least 50 percent of the saw-timber volume or 50 percent of the dominant and codominant stems in under-sawlog-size stands.

Scrub hardwood.—Stands predominantly scrub oak or other hardwoods, stunted and of poor form, that have come in after fire or cutting, or that occupy areas with adverse soil and climatic conditions.

Upland hardwood.—Mixed oak, gum, and other hardwoods of good quality and form, characteristic of the uplands, constituting at least 75 percent of the saw-timber volume in sawlog-size stands or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands.

Longleaf.—Longleaf constituting at least 75 percent of the saw-timber volume in sawlog-size stands, or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands. Scrub oak areas that show promise of coming back to longleaf pine are included in this type.

Longleaf-hardwoods.—Wherein neither pines nor hardwoods alone make up 75 percent of the saw-timber volume in sawlog-size stands or 75 percent of the dominant and codominant stems in under-sawlog-size stands, but at least 25 percent of the stand is longleaf pine in either case.

Longleaf-loblolly.—At least 75 percent of the saw-timber volume in sawlog-size stands or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands is in longleaf and loblolly pine, but less than 75 percent of the stand is composed of either species alone.

Longleaf-shortleaf.—At least 75 percent of the saw-timber volume in sawlog-size stands, or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands is in longleaf and shortleaf pine, but less than 75 percent of the stand is composed of either species alone.

Loblolly.—Loblolly pine constituting at least 75 percent of the saw-timber volume, or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands.

Loblolly-hardwoods.—Wherein neither loblolly nor hardwoods alone makes up 75 percent of the saw-timber volume of sawlog-size stands or 75 percent of the dominant and codominant stems in under-sawlog-size stands, but at least 25 percent of the stand is loblolly in either case.

Shortleaf.—Shortleaf pine constituting at least 75 percent of the saw-timber volume in sawlog-size stands or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands.

Shortleaf-hardwoods.—Wherein neither shortleaf nor hardwoods alone makes up 75 percent of the saw-timber volume of sawlog-size stands or 75 percent of the dominant and codominant stems in under-sawlog-size stands, but at least 25 percent of the stand is shortleaf in either case.

Shortleaf-loblolly.—At least 75 percent of the saw-timber volume in sawlog-size stands or at least 75 percent of the dominant and codominant stems in under-sawlog-size stands is in shortleaf and loblolly pine, but less than 75 percent of the stand is made up of either species alone.

Topographic Situations

Flatwoods.—Areas having low, flat topography and resultant poor drainage, generally with sandy soils, and usually supporting a stand of mixed pines.

Rolling uplands.—Areas of rolling or hilly topography that are well drained and usually have light soils.

Swamps, bays, ponds, and branch heads.—Low, wet, poorly drained areas, frequently under water and supporting mixed stands of hardwoods, cypress, and some pine.

River bottoms.—Alluvial land subject to inundation, bordering rivers and their tributaries. Stands of mixed hardwoods with some cypress and pine in scattered groups characterize these sites.

Forest Conditions

Old-growth uncut.—Old-growth stands from which less than 10 percent of the volume has been cut.

Old-growth partly cut.—Old-growth stands from which 10 percent or more of the volume has been cut, but in which the remaining old-growth saw timber contains at least 1,000 board feet per acre of hardwood, or 600 board feet of pine or pine and hardwood mixed.

Second-growth sawlog-size uncut.—Second-growth stands rom which less than 10 percent of the sawlog-size trees have been cut, and in which the remaining saw timber contains at least 600 board feet per acre.

Second-growth sawlog-size partly cut.—Second-growth stands from which 10 percent or more of the sawlog-size trees have been cut, but in which the remaining saw timber contains at least 400 board feet per acre.

Second-growth under-sawlog-size uncut.—Second-growth stands composed predominantly of under-sawlog-size trees, less than 10 percent of which have been cut. The saw timber present contains less than 600 board feet per acre.

Second-growth under-sawlog-size partly cut.—Second-growth stands composed predominantly of under-sawlog-size trees, at least 10 percent of which have been cut. The saw timber present contains less than 600 board feet per acre.

Reproduction.—Areas insufficiently stocked to classify as second-growth, but bearing per acre more than 80 seedlings less than 1 inch d. b. h.

Clear-cut.—Cut-over areas in which an insufficient quantity of young growth has come in to classify them either as second growth or as reproduction.

Pine Tree Grades

Smooth tree.—A tree with at least 20 feet of clear length, and with at least 50 percent of the total merchantable length clear. The clear length must be at least 80 percent free from knots or limbs.

Limby tree.—A tree with at least 12 feet of clear length, and the clear length must be at least 80 percent free from knots or limbs.

Rough tree.—A tree too rough to be put in either of the previous classes.

Hardwood Log Grades

Grade 1.—Logs of the size and quality suitable for industrial lumber. They must be at least 50 percent sound, with a minimum top diameter of 14 inches and a minimum length of 12 feet. They should yield at least 30 percent of No. 1 Common lumber. Defects must be located so that at least 60 percent of the surface is clear.

Grade 2.—Logs of the size and quality suitable for cooperage and small-dimension use, with a minimum top diameter of 10 inches and a minimum length of 10 feet. They must be at least 50 percent sound and should yield at least 30 percent of No. 1 Common lumber, but may have sweep that would disqualify them for grade 1 logs. Sixty percent of the surface must be clear.

Grade 3.—Logs of size and quality suitable only for ties, headings, crates, boxes, and rough structural material, with a minimum top diameter of 10 inches and a mini-

mum length of 8 feet. The surface does not need to be clear, but at least 50 percent of the volume must be sound.

Tree Classification

Good sawlog-size tree.—A pine or cypress tree at least 9 inches d. b. h., or hardwood tree at least 13 inches d. b. h., which will produce one sound butt log at least 12 feet long, or which contains at least 50 percent of its gross volume in sound material in case this butt log is a cull.

Good under-sawlog-size tree.—Any tree between 1 inch and the minimum merchantable diameter at breast height, with not more than 25 percent rot and a reasonably straight stem.

Sound cull tree.—A tree which, because of form, crook, extreme limbiness, or other sound defect, is not and never will become suitable for saw timber.

Rotten cull tree.—A sawlog-size tree that is over 50 percent defective, or an under-sawlog-size tree that is more than 25 percent defective.

Log Rules

Doyle log rule.—Using as the formula for a 16-foot log: $V=(D-4)^2$.

Scribner log rule.—Using as the formula for a 16-foot log with allowance, for a ¼-inch saw kerf: $V=0.79D^2-2D-4$.

International log rule.—Using as the formula for a 16-foot, log, with allowances for a ¼-inch saw kerf and $\frac{1}{16}$-inch shrinkage: $V=0.0796D^2-1.375D-1.23$.

Diameters

D. b. h. (diameter at breast height).—Diameter, outside of bark, 4½ feet from the ground.

Two-inch diameter classes.—Including diameters 1.0 inch below and 0.9 above the stated midpoint, e. g., trees 5.0 to 6.9 inches d. b. h. are placed in the 6-inch class; corresponding limits apply to the other diameter classes.

Summary of Findings

Description of the Survey Unit

THE total land area of the unit is 9,893,800 acres, of which 67 percent is forest and 33 percent agricultural. Nine percent of the agricultural land is idle or abandoned (table 1).

Lands in tax default for 3 or more years ranged in different counties from 3 to 33 percent of the county area.

The total population of the unit in 1930 was 740,000, an increase of 200 percent since 1900. Of this, 60 percent was urban.

Of the forest area 58 percent is on the rolling uplands, 20 percent in the flatwoods, and 22 percent in swamps and river bottoms (table 2).

The shortleaf-loblolly-hardwood type group is present on 60 percent of the forest area; the hardwood types, on 26 percent; and the longleaf type group, on only 14 percent (table 2).

Of the net cubic volume in the shortleaf-loblolly-hardwood type group, 73 percent is shortleaf and loblolly pine.

Of the forest area of the unit, 16 percent is in the old-growth condition; 81 percent, second growth; and 3 percent, clear-cut (table 4).

The shortleaf-loblolly-hardwood type group has 93 percent of its area in second growth, while 65 percent of the longleaf type-group area is in this condition. There is more old growth (39 percent) in the hardwood than in any of the other type-group areas.

Volume Estimates

The total board-foot volume by the International ¼-inch rule, which closely approximates green lumber tally, is 19 billion feet. By the Doyle rule, which is used in the following estimates, the total volume is 12 billion board feet (table 6).

Loblolly pine, the most prevalent single species, makes up 37 percent of the total board-foot volume in the unit, or about 4½ billion board feet.

Sixty-one percent of the total board-foot volume is in second-growth sawlog-size stands. Old-growth stands, all species combined, contain 37 percent of the board-foot volume, or 4½ billion feet.

Reduced to cords, the total sound volume, with bark, of all species 5.0 inches d. b. h. and larger, including upper stems and limbs of both saw-timber and cull trees, is 98 million cords, of which about 54 million is in material not suited for saw timber. This nonsaw-timber material is 32 percent pine and 68 percent hardwood.

The total cubic-foot volume of sound material in the unit is almost 7 billion cubic feet, of which 50 percent is pine and 50 percent hardwood. The volume of sound material in sound trees is slightly over 6 billion cubic feet, while the sound volume in the usable parts of cull trees (both sound and rotten culls) is about 655 million cubic feet (table 10).

Forest Increment and Drain

The increment on the saw-timber growing stock during 1935 amounted to 1,268 million board feet (International ¼-inch rule), a volume increase of approximately 6.5 percent. Since saw-timber material that was harvested totaled 814 million board feet, the stand actually increased only 454 million feet. Eighty-six percent of the saw-timber increment occurred on saw-timber stands stocked with a minimum volume of 400 board feet and averaging 4,220 board feet per acre. A large proportion of these stands had a minimum volume of 600 board feet per acre, with an average volume of 4,610 feet. Under prevailing conditions such

stands are utilizable for their crops of saw-timber, poles, cross ties, and pulpwood. The increase in sound material on all trees 5 inches d. b. h. and larger, including the annual cut, was 303 million cubic feet.

In 1935 there were 175 active sawmills in the unit, 72 percent of which were cutting pine only. The total lumber production was 644 million board feet, more than half of which came from old-growth stands. Sixty-five percent of the lumber produced was sold within the State boundaries. The production of cross ties, veneer, cooperage stock, and poles are the other important primary wood-using industries. Fuel-wood production was a large factor in wood use. Forest industries furnished in the unit during 1935 over 3 million man-days of labor, equivalent to over 13,000 man-years if 250 days are considered a full year. More than half of this labor was consumed by the lumber industry.

The drain from saw timber trees amounted to 814 million board feet in 1935; the total drain from material of all sizes aggregated 150 million cubic feet.

During 1935 there was a net increase of 454 million board feet in the growing stock, representing the surplus of increment left after commodity drain, i. e., the volume of timber cut from the forests of the unit for commercial and domestic use, had been deducted. Commodity drain was over three times the net increment in the old-growth pine, while in the second-growth sawlog-size pine the drain was about 40 percent of the growth. This means that future supplies of saw timber must soon come entirely from the lower-quality second-growth stands. In the hardwoods a somewhat similar relation existed between increment and drain, with the result that the less valuable second growth will be the inevitable source of hardwood saw timber in the not-far-distant future. The cubic-foot increment of all sound trees, both saw timber, and nonsaw timber, exceeded the commodity drain by 153 million cubic feet.

Special Resources

Pulpwood.—In the survey unit there are in species suitable for pulping nearly 65 million cords of material, 69 percent of which is pine and 31 percent pulping hardwoods. Twenty-one million cords of this total are in saw-timber material from trees at least 13 inches in diameter; 35 million cords in trees under 13 inches; slightly over 5 million cords in upper stems and limbs of the larger trees; and 3 million cords in sound and rotten cull trees over 5 inches in diameter. Part of the material in the last two items is available for pulpwood and fuel wood. Increment in second-growth pine types of sawlog-size stands approximates 0.9 cord per acre per year.

Poles and piles.—There are 35 million pine trees (the volume of which is included also in the cordwood and saw timber estimates) suitable for poles and piles. Seventy percent of these are in the 20- and 25-foot lengths. About 20 percent of the pine trees 7 to 19 inches in diameter were found suitable for poles or piles (table 21).

Gum naval stores.—Only two tracts, totaling 350,000 acres, are suitable for naval stores operations. They could maintain an operation of 50 to 60 crops by progressive working over a period of several years.

Wood naval stores.—Suitable supplies of merchantable longleaf stumps are found on 612,400 acres. Available volume amounts to 1,938,000 tons, equivalent to 78,000 tons annually for 25 years. In addition, there are 1,726,000 tons of well-seasoned stumps intermixed with standing timber, and probably about 700,000 tons of stump wood in old-growth trees now standing.

Description of the Unit

THE AREA covered by this report consists of 17 counties in southeastern Texas. It is in the southeastern corner of the broad region known as the east Texas plains and forms the south half of the east Texas pine timber belt. Houston, Beaumont, and Port Arthur, the largest cities in the unit, are in the southern tier of counties; while Lufkin and Crockett are among the important centers of activity in the northern part of the unit.

Physical Conditions

TOPOGRAPHY

Topographically, the land surface can be divided into two distinct areas: the coastal prairies and the rolling plains. The coastal prairies within the unit form a belt about 40 miles wide that parallels the Gulf of Mexico. Treeless, except along the watercourses, they are level and poorly drained. The heavily timbered rolling plains rise gradually from these prairies, becoming more broken with increasing distance from the coast. Elevations of 200 to 400 feet are attained in the most northern counties.

SOILS

The soils of the unit are in two broadly defined groups: the dark-colored prairie soils, confined to the coastal prairie section; and the grayish-brown upland soils, which characterize about 65 percent of the unit.

The prairie soils are for the most part poorly drained heavy clay of the Lake Charles series, with a dense clay subsoil. Along the northern edge of the coastal prairie adjacent to the timbered areas, the surface soils have a sandy texture and rest directly upon an impervious clay subsoil.

The light-colored upland soils, upon which the important timber stands occur, were developed primarily from sands and sandy clays. Deep, sandy subsoil prevails in a belt about 40 miles wide, extending about halfway across the unit just north of the coastal prairies. The Segno soil series is the most important in this area, but Ruston, Caddo, and Kalmia soils also occur. In the northern and western parts of the unit, where the Susquehanna and Lufkin soils are most important, the sandy loam surface soils are underlain with a dense, heavy, almost impervious subsoil.

A local variation from the grayish-brown upland soils is formed by the Nacogdoches soils of the "redlands" belt in Sabine and San Augustine Counties. These rather heavy, red to reddish-brown soils have a crumbly, permeable clay subsoil, and with the rich land in the river bottoms, represent the most fertile soils in the unit.

DRAINAGE

The rolling uplands are well drained by the Sabine, Angelina, Neches, Trinity, and San Jacinto Rivers, which with their tributaries flow in a southeasterly direction into the Gulf of Mexico. During the spring months, or after extremely heavy rains, these rivers overflow their banks, but they seldom cause heavy damage. In the coastal prairies drainage is poor, and it is only by means of combined drainage and irrigation projects that much of the land is made available for agricultural crops.

CLIMATE

This portion of Texas has a relatively humid climate. Rainfall decreases westward from over 50 inches a year along the Sabine River to 40 inches annually in the western part of the unit. Along the coast the heaviest rainfall is in the

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winter months and during July and August. Farther north the heaviest rainfall occurs during the winter and in April and May; here August is the driest month of the year. There is no part of the unit that receives less than 2 inches of rainfall per month. The mean temperature during the winter months is between 50° and 60° F., while the mean during the summer months is about 80°. Variations in temperature are greatest in the uplands. Sudden changes in temperature occur during the winter in connection with cold waves that sweep across the unit at irregular intervals. The average date of the first killing frost is about December 1, while the last in the spring is about March 1.

EROSION

The terrain generally has such a gentle topography that run-off is gradual and advanced erosion is comparatively lacking. From systematic observations made on the 12,528 sample plots surveyed, it is estimated that marked erosion occurs on about 4 percent of the gross area.

Economic and Industrial Conditions

Active settlement of this unit began with the establishment of the Republic of Texas in 1836, when settlers began to drift in from other Southern States. The population growth was slow for many years, and it was only with the building of railroads and the establishment of the lumbering industry, in the latter part of the nineteenth century, that the population of southeast Texas materially increased. In 1901 oil was discovered at Beaumont, leading to an influx of people from every State in the Union; and since 1900 there has been an increase in the population of the unit of 200 percent.

PEOPLE AND COMMUNITIES

The total population of the unit, according to the 1930 census, is about 740,000 people, 290,000 of whom live in Houston, the largest city in the unit. Beaumont and Port Arthur are thriving industrial cities, each having slightly over 50,000 inhabitants. Outside of these three cities the population is chiefly rural with an average of 19 people per square mile. The county seat in each county is usually the largest town and the center of retail trade for the surrounding territory.

Seventy percent of the people in the unit are American-born whites. Negroes are more numerous here than in any other section of Texas, constituting 24 percent of the total population. Mexicans, foreign-born whites, and a few Indians make up the remaining 6 percent.

TRANSPORTATION AND SHIPPING

This unit is well supplied with railroad facilities. Four large railway systems—the Southern Pacific, Missouri Pacific, Santa Fe, Kansas City Southern, with several interconnecting lines—provide adequate means of transportation.

Deep-water seaport facilities are available at Houston, Beaumont, Port Arthur, and Galveston. The Intracoastal Canal connects Port Arthur and Galveston with New Orleans and other Gulf ports to the east. Continuation of this canal westward to Freeport and Corpus Christi, where sulphur and soda are found, is proposed.

Paved highways radiate from the larger cities to all parts of the unit with connecting improved secondary roads at frequent intervals. Many miles of woods roads recently constructed by the Civilian Conservation Corps open up forest areas hitherto inaccessible to motor vehicles. Excepting parts of the "Big Thicket" in Hardin County, few areas exist that are more than 5 miles from a road passable at all seasons.

Several thousand miles of pipe line within the unit, extending many additional miles to other States, facilitate the movement of crude oil and gas to consuming centers, particularly to Houston, Beaumont, and Port Arthur.

AGRICULTURE

According to the 1935 census, there are 3,180,000 acres of land in farms in over 35,000 ownerships. The farms average 90 acres, of which 33 acres are woods or woodland pasture. Since 1930 the area in farms had increased 18 percent, but the land available for crops had increased only 3.5 percent.

Large-scale farming methods prevail in the coastal counties of the unit. On the grasslands not suited to rice or other crops, great numbers of beef cattle are produced. Nearly 200,000 head were on the range in the early part of 1935. Rice is the chief cultivated farm crop, as it is well suited to the dark clay soils. Power machinery is used for planting and harvesting. Control of irrigation

and drainage water is secured through a system of canals and pumps. The average investment per rice farm is estimated to be $11,000 to $14,000. In addition to cattle and rice, small acreages of cotton, corn, and other forage crops are grown. Producers of dairy, poultry, and truck products find a ready market in the Houston and Beaumont areas.

The upland timbered counties make up a section of small, scattered farms. The chief crops are cotton, corn, and hay, but some truck crops also are produced; Livingston in Polk County being a shipping center for tomatoes. Cattle, horses, mules, and hogs are raised, although the number of the latter has decreased since 1930. Cash income from farm woodlands in Polk County amounted to $60 per farm during 1930. Broadly speaking, the upland soil is not well adapted to agriculture, most of the farms being on little more than a subsistence basis.

POWER

Fuel supplies consisting of petroleum, natural gas, and lignite are readily available. Oil fields in the unit produced 34 million barrels in 1935. The principal gas fields supplying southeast Texas are those in Harrison and Panola Counties, together with the Monroe field in Louisiana. Deposits of lignite, roughly estimated at 30 billion tons, are within short shipping distance of the unit. It is estimated that 95 percent of the electric power used in the State is generated from fuel in plants such as those at Houston, Beaumont, and Trinidad.

INDUSTRIES

The oil industry with its related activities is the most important one at the present time. In 1935 the 34 million barrels of oil produced within this area had an approximate value of $34,000,000 before refining, and was worth an additional $8,000,000 refined. Houston, Beaumont, and Port Arthur are the important refining centers. More than 20 pipe lines bring crude oil to these three cities, the storage capacity at Beaumont and Port Arthur exceeding 50 million barrels. Lumbermen and others retaining their land for timber growth find that oil leases or royalties furnish welcome financial aid between cutting periods.

Most of the remaining industries are concentrated in the large coastal cities. At Houston are located foundries and machine shops, railroad shops, cement and chemical plants, cotton compresses, flour mills, packing plants, and a large pulp mill. Although chiefly an oil-refining center, Beaumont has foundries and machine shops, rice mills, and cotton compresses. Lufkin, in Angelina County, is an important producer of oil-field machinery. The forest industries will be treated in detail later.

TAXES

In 1931, the total real property taxes per $100 of assessed valuation averaged $4.93. According to Texas law, the assessed valuation should be the true and full value, but in practice the assessment varies from 10 percent to over 100 percent of the full value. Timber and land are assessed together, cut-over land having an assessed valuation of about $5 per acre, while that of land with timber generally ranges from $5 to $10. In Polk County in 1929, taxes paid by 16 lumber companies averaged 21 cents per acre on land and timber, the highest tax being for land with old-growth timber at 24 cents and the lowest at 13 cents for land partly stocked to second growth. This is an approximate rate of 30 mills per dollar of assessed value.

Tax delinquency varies in individual counties. In 1934, in Jefferson, Tyler, and Liberty Counties, less than 3 percent of the lands were in tax default for 3 or more years. In other counties the figure was as high as 33 percent, with 15 percent the average for 16 counties of the unit. The degree of tax default, which is not necessarily an indication of land abandonment by private owners, varies with the prevailing prosperity of the section. Owing to the possibility of discovering oil on much of the land, taxes are often paid on land that is at present unproductive, with the hope of obtaining a return in the future. Some lumber companies are also holding their forest land, feeling that a profit can be made through continuous yields on a management basis, even though land taxes are relatively high.

LAND OWNERSHIP

Large ownerships of land are common. Lumber companies are the most important large holders, 33 companies having controlled more than 2 million acres in 1929. Other landholding companies, however, also own large acreages; and a subsidiary of a large oil company owns nearly a tenth of the total land area in the unit. Oil com-

panies generally lease rather than own land, paying a fixed rate per acre. According to the 1935 census, the 35,400 farms scattered throughout the unit made up 32 percent of the area and had an average size of 90 acres. Half of these farms were operated by full or part owners.

The State of Texas owns five small State forests, of which four are within the unit, totaling more than 4,000 acres in Houston, Tyler, Montgomery, and Newton Counties. The State cooperates with private landowners to maintain 85,000 acres of game preserves. Land approved for purchase by the Federal Government, to make up four national forests, amounted to 629,659 acres in October 1936. Of this amount 614,004 acres were in complete Federal ownership as of June 30, 1937.

Table 1 shows the distribution of the land area according to the classes of land use that were recognized by the Survey.

TABLE 1.—*Land area classified according to land use*

Form of use	Distribution of total area		Form of use	Distribution of total area	
Nonforest:			Nonforest—Continued:	*Acres*	*Percent*
Agricultural:			Total agricultural	2,730,200	27.6
In cultivation:	*Acres*	*Percent*	Other nonforest	542,400	5.5
Old cropland	1,262,500	12.8			
New cropland	16,400	.2	Total nonforest	3,272,600	33.1
Out of cultivation:					
Idle	169,900	1.7	Forest:		
Abandoned	83,000	.8	Productive	6,609,500	66.8
Pasture	1,198,400	12.1	Nonproductive	11,700	.1
Total agricultural	2,730,200	27.6	Total forest	6,621,200	66.9
			Total all uses	9,893,800	100.0

Description of the Forest

THE forests of this unit are formed predominantly of three associations of species. Best known is the longleaf pine forest, which extends westward from the Sabine River through Newton, Jasper, Tyler, and Polk Counties, with small disconnected areas in adjacent counties. Bordering the longleaf (and often merging into it) is the shortleaf-loblolly-hardwood forest, which covers the entire western and northern parts of the unit, and on the south forms a belt between the longleaf area and the coastal prairie. Third is the hardwood association, occurring as bottom-land hardwoods along the main rivers, such as the Sabine, Neches, and Trinity, and as upland and scrub hardwoods in scattered tracts throughout the pine stands.

For convenience in description, the forest has been classified (1) as to forest type on the basis of association of tree species, and (2) as to forest condition on the basis of stand, age, and cutting history.

Forest-Type Groups

The longleaf pine group includes pure longleaf, longleaf-loblolly, longleaf-shortleaf, and longleaf-hardwood types (see map at end of report). Of these, the pure type is most common, dominating 9 percent (table 2) of the forest area, or approximately 600,000 acres, located mainly in the rolling uplands of Newton, Jasper, Tyler, and Polk Counties. The mixed types are a result of full or partial cutting of longleaf followed by an influx of other species and are often composed of a residual stand of longleaf in mixture with second-growth shortleaf, loblolly, and hardwoods. These mixed types are common along the western and northern boundaries of the longleaf belt.

The shortleaf-loblolly-hardwood group includes pure shortleaf pine, pure loblolly, shortleaf-loblolly, shortleaf-hardwood, and loblolly-hardwood types. This group of types covers 60 percent of the forest area of the unit, or approximately 4 million acres. Loblolly, pure or in mixture with hardwoods, is the prevailing type in southeastern Montgomery County, in Liberty, in the western part of Hardin, and in Orange County. In the western and northern counties of the unit, shortleaf pine takes a more important place in the association. All of the types in this group occur on all topographic situations. Both the shortleaf and loblolly types are common in the rolling hill country, but loblolly seems to thrive best in the flatwoods along the coast. Adaptable to all sites and reproducing abundantly, this group is destined to have an increasing acreage in this unit.

The hardwood group consists of the upland-hardwood, bottom land-hardwood, scrub-hardwood, and cypress-tupelo types. Combined they make up about 26 percent of the forest area. Most important is the bottom land-hardwood type, totaling slightly over 1 million acres. It occurs along the Sabine, Neches, Trinity, and smaller rivers. Red and black gum, red and white oaks, magnolia, ash, and cypress are commonly found in these bottoms. Approaching the coast, these species are sometimes replaced by stands of the cypress-tupelo type, which terminates at the marshes. This type covers about 50,000 acres, mostly along the Sabine and Neches Rivers. The upland-hardwood type is composed of mixed hardwoods, such as post oak, southern red oak, black oak, red and black gum, and hickory. This type occurs in small areas scattered throughout the unit, probably achieving its best development in the "redlands" belt of Sabine and San Augustine

Counties. The scrub-hardwood type is a mixture of stunted, low-quality hardwoods of little commercial value, occurring where soil or moisture conditions do not favor rapid tree growth. Such stands are found in western Houston and Walker Counties as well as in the eastern part of Liberty County. A transitory form of this type also occurs on some of the clear-cut longleaf land, particularly in the northern part of Tyler County. Less than 200,000 acres were typed as scrub hardwoods.

Table 2 shows the area of the different forest types by topographic situations and also the percent of the total forest area in each type.

TABLE 2.—*Forest area* [1] *classified according to forest type and topographic situation*

Forest type	Flatwoods	Rolling uplands	Swamps and stream bottoms	All situations	
	Acres	*Acres*	*Acres*	*Acres*	*Percent*
Longleaf pine group:					
Longleaf	75,100	544,000	800	619,900	9.4
Longleaf-loblolly	25,800	94,700	800	121,300	1.8
Longleaf-shortleaf	3,900	130,700	800	135,400	2.1
Longleaf-hardwood	1,600	52,400	800	54,800	.8
Total	106,400	821,800	3,200	931,400	14.1
Shortleaf-loblolly-hardwood group:					
Shortleaf	20,300	550,300	3,900	574,500	8.7
Loblolly	439,900	449,300	102,600	991,800	15.0
Shortleaf-loblolly	109,600	608,200	25,100	742,900	11.3
Shortleaf-hardwood	27,400	428,200	28,100	483,700	7.3
Loblolly-hardwood	369,500	512,000	303,600	1,185,100	17.9
Total	966,700	2,548,000	463,300	3,978,000	60.2
Hardwood group:					
Upland hardwood	9,300	305,300	1,600	316,200	4.8
Bottom-land hardwood	214,500	30,500	926,000	1,171,000	17.7
Scrub hardwood	11,000	152,600	4,700	168,300	2.5
Cypress-tupelo	800		43,800	44,600	.7
Total	235,600	488,400	976,100	1,700,100	25.7
Total all groups	1,308,700	3,858,200	1,442,600	6,609,500	

[1] The 11,700 acres of nonproductive forest area shown in table 1 are not included. Flatwoods cover 19.8 percent of the area; rolling uplands, 58.4 percent; and swamps and stream bottoms, 21.8 percent.

TABLE 3.—*Species composition of the forest type groups, showing proportion of net cubic volume in various species*

Species	Longleaf pine group	Shortleaf-loblolly-hardwood group	Hardwood group	All groups
	Percent	*Percent*	*Percent*	*Percent*
Longleaf pine	67.5	0.4	0.1	4.5
Loblolly pine	10.5	47.8	4.8	35.1
Shortleaf pine	13.4	25.3	1.1	18.7
Red gum	1.7	5.4	15.4	7.6
Black and tupelo gums	.8	2.2	10.6	4.2
Red oaks	1.7	6.3	22.2	9.9
White oaks	1.1	4.9	13.0	6.6
Scrub oaks	2.5	2.0	2.0	2.0
Ash	[1]	.5	3.7	1.2
Cypress		.1	2.3	.6
Other hardwoods	.8	5.1	24.8	9.6
Total	100.0	100.0	100.0	100.0

[1] Negligible.

Table 3 presents the composition of the forest type groups and the percentage of the net cubic volume of the type group in each species.

Forest Conditions

On the basis of stand, age, and cutting history, the forests fall into three broad conditions—old growth, second growth, and clear-cut, as already defined. For precision in classification these conditions are subdivided in the following manner: (1) Old-growth uncut and old-growth partly cut; (2) second-growth sawlog-size uncut and partly cut, second-growth under-sawlog-size uncut and partly cut, and reproduction; and (3) clear-cut. The respective areas falling in the three type groups are given in table 4.

TABLE 4.—*Forest area classified according to forest condition and forest type group*

Forest condition	Longleaf pine group	Shortleaf-loblolly-hardwood group	Hardwood group	All type groups	
	Acres	*Acres*	*Acres*	*Acres*	*Percent*
Old growth:					
Uncut	25,900	155,000	324,000	504,900	7.6
Partly cut	102,400	120,700	340,500	563,600	8.6
Total	128,300	275,700	664,500	1,068,500	16.2
Second growth:					
Sawlog size:					
Uncut	175,400	1,889,400	428,200	2,493,000	37.7
Partly cut	39,800	679,500	176,900	896,200	13.6
Under sawlog size:					
Uncut	287,300	1,008,100	353,800	1,649,200	24.9
Partly cut	11,000	43,100	28,100	82,200	1.2
Reproduction	94,000	64,900	45,400	204,300	3.1
Total	607,500	3,685,000	1,032,400	5,324,900	80.5
Clear-cut [1]	195,600	17,300	3,200	216,100	3.3
All conditions	931,400	3,978,000	1,700,100	6,609,500	
	Percent	*Percent*	*Percent*		
	14.1	60.2	25.7		100.0

[1] Includes 1,600 acres of fire-killed condition

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FIGURE 1.—*Second-growth shortleaf pine stands, in which the larger trees were saplings at time of logging in 1907*

The various type groups in the old-growth condition occupy about 1 million acres, or 16 percent of the total forest area, divided into longleaf pine, 2; shortleaf-loblolly-hardwoods, 4; and hardwoods, 10 percent. Most of the old-growth uncut longleaf pine is found in large tracts, some of which are several thousand acres in extent. Partly cut stands more often exist as small acreages of residual trees, scattered throughout the second-growth stands. Old-growth stands of shortleaf-loblolly-hardwoods usually occur in scattered patches of a few acres each; continuous bodies are rarely found. The old-growth hardwoods prevail in large, unbroken areas along the main stream bottoms.

The second-growth condition includes all ages of second-growth stands, from reproduction through

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FIGURE 2.—*A typical clear-cut longleaf tract with scattered clumps of young growth*

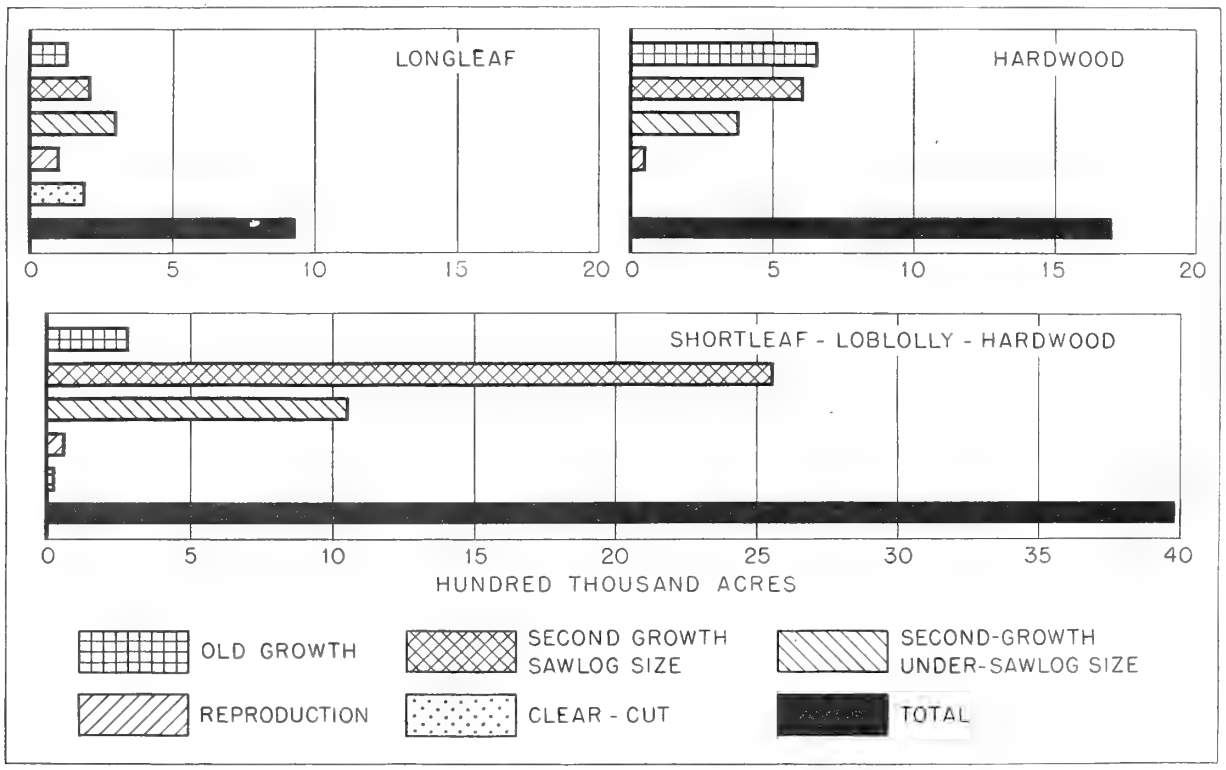

FIGURE 3.—*Forest area in the various type groups and forest conditions*

the sapling stage up to and including saw timber (fig. 1). These stands occupy about 81 percent of the forest area, totaling over 5 million acres (table 4). By forest type groups, in terms of proportion of the total forest area, this condition is classified as longleaf pine, 9 percent; shortleaf-loblolly-hardwoods, 56 percent; hardwoods, 16 percent. Second-growth stands occur throughout the unit in areas ranging from a few acres to blocks of thousands of acres. These second-growth stands, forming an almost continuous cover over a great part of the unit, characterize the forests of east Texas.

Only 3 percent of the forest area, or slightly over 200,000 acres, is clear-cut. Practically all of this is found in areas originally stocked with longleaf pine. Extensive acreages occur northwest of Jasper in the rolling uplands bordering the Neches and Angelina Rivers, while smaller tracts (fig. 2) are scattered through Jasper, Newton, Hardin, and Tyler Counties.

Figure 3, contrasting the relative proportion of forest conditions in each type group, brings out important differences in the forest cover. The greater portion of the clear-cut area is in the longleaf pine group, while the hardwood group has the largest proportion of old growth. The shortleaf-loblolly-hardwood association has 93 percent of its area in second growth; and this is gradually taking over areas that once were longleaf pine.

Stocking

Uncut old-growth pine stands generally are stocked with 20 to 50 mature trees per acre, containing 4,000 to 15,000 board feet. Undergrowth is seldom present. Where these stands have been partly cut, wide variations exist in the degree of stocking, and second-growth trees may occupy the larger openings.

Second-growth longleaf pine stands are not uniformly stocked; dense clumps alternate with open or sparsely stocked stands. Widely scattered residual trees from the original old growth may be present to create a two-storied appearance. The second-growth shortleaf-loblolly-hardwood areas, however, are stocked more uniformly with many trees of all ages. The heaviest stocking occurs on old abandoned fields; stands observed in San Jacinto County supported 130 merchantable trees per acre, with a volume of 15,000 board feet, in addition to the saplings.

With the exception of the scrub-hardwood stands, the hardwood types are well stocked. Young trees of varying sizes and ages are intermingled with the older merchantable trees, and when the latter are logged, necessarily by a rough selection system, there is always sufficient advance growth remaining to provide for the continuance of well-stocked stands. Openings provided by removal of the mature trees are soon restocked with seedlings. Since, however, the common practice is to remove the best trees and especially the more valuable species, the hardwood types must eventually deteriorate in commercial value, unless improved cutting methods are followed that will insure the perpetuation of the more valuable material.

In figure 4 the number of trees in the 2-inch class seems out of proportion to the number in the other

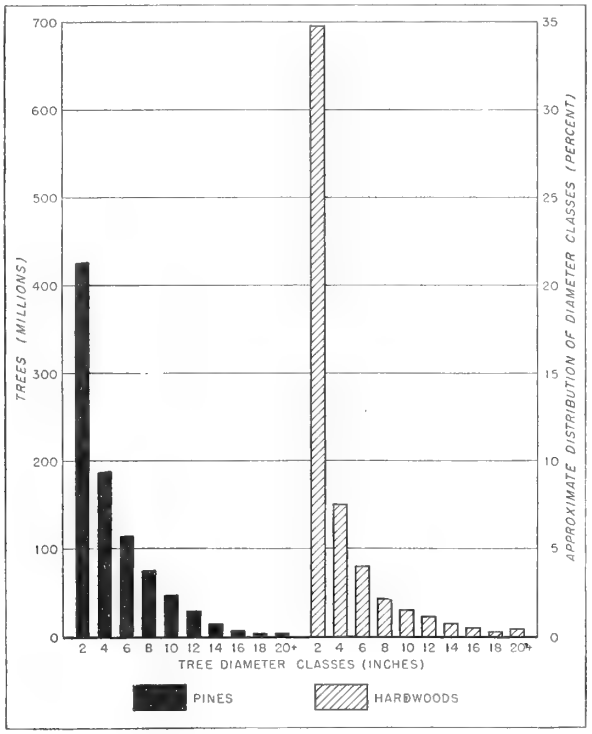

FIGURE 4.—*Total number of trees in the various diameter classes. Pines total 903 million, or 45.9 percent, and hardwoods 1,065 million, or 54.1 percent*

diameter classes. According to table 4, 80.5 percent of the forest area is in second-growth stands. Such stands are generally all-aged and have sufficient seed trees so that young seedlings rapidly fill in the openings, forming a complete understory beneath the larger trees. With the intensification of fire control during the past few years, the loss of seedlings by fire has been greatly reduced, with the result that the number of trees as shown in the 2-inch class may represent the natural restocking of the forest when the fire hazard is at least partly controlled. It is not to be expected that all of these 2-inch trees will grow to useful size, as natural mortality is ever present; but if fire control accomplishes its purpose, each succeeding 2-inch diameter class should have more trees, until maximum density is reached.

Good trees below sawlog size form 93 percent of the forests of the unit, of which pines account for 41 percent and hardwoods 52 percent (fig. 4). Many of these small hardwoods are partially defective or of inferior species; their removal would greatly improve the productive capacity of the forest. Trees 17 inches and larger in diameter, which yield the highest grades of lumber, make up only 1 percent of the total stand.

In figure 5 the age-class and volume distribution of the present forest in the longleaf- and shortleaf-

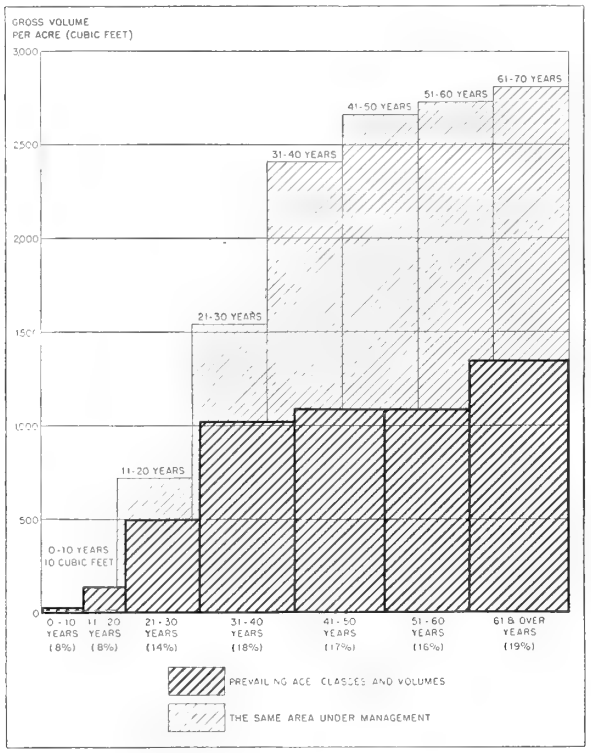

FIGURE 5.—*Prevailing age class and volume distribution (1935) compared with those on the same area under management. Gross volume per acre is measured inside bark on trees 5 inches d. b. h. and larger, turpentine butts not included. Under management, each age class occupies 14.3 percent of the total*

loblolly-hardwood types are compared with those on a managed forest of the same general type handled on a rotation of 70 years. The portion of the figure showing the prevailing age classes and volumes represents a rough division of the 4,909,400 acres of the present forest in these types into areas characterized by the respective age classes. The volume per acre and extent of occurrence of each age class is based upon the actual stand as it existed at the time of the survey. In the managed forest the area is divided into seven equal areas, each containing one age class. The per-acre volumes are the averages of the best stocked 10 percent of the uncut stands on the weighted average site in each age class of the present pine and pine-hardwood stand.

Inspection of this figure reveals several important facts about the present forest. (1) The average stand is understocked, in that its present volume is only 48 percent of that of the managed stand. (2) The distribution of age classes by area closely approximates that of the managed stand, the chief discrepancies being in the two age classes below 21 years, which together occupy only about half of the area desirable in a managed forest. (3) The ideal distribution of age classes could be attained theoretically by a gradual cutting of a small percentage of the area in each of the four oldest age classes during the next 10-year period, so that the areas in stands below 21 years of age would be increased proportionately.

Volume per Acre

Tables giving the average volume per acre do not show the extremes within a particular type and condition but they do indicate the range in volumes of the various conditions in a given type or type group, and in addition they portray the relative abundance of the various species groups. A better conception of the make-up of the forest may be obtained from table 5, which gives average board-foot and cordwood volumes per acre of the shortleaf-loblolly-hardwood group, constituting more than 60 percent of the forested area. The board-foot volume is expressed in the International ¼-inch rule and includes only saw-timber material; the cordwood volume is of all sound trees at least 5 inches d. b. h., including the saw-timber material expressed in board feet.[1]

[1] A more complete and detailed presentation of the average volumes per acre of forest land can be found in Southern Forest Survey Release No. 26, Volumes on an Average Acre in the Various Units of the Pine Hardwood Region West of the Mississippi, issued July 12, 1937.

TABLE 5.—*Net board-foot (International ¼-inch rule) and cordwood volume per acre of the shortleaf-loblolly-hardwood group, classified according to species group and forest condition*

Forest condition	Shortleaf-loblolly pines [1]		Pulping hardwoods		Nonpulping hardwoods		All species groups	
Old growth:	*Board feet*	*Cords*	*Board feet*	*Cords*	*Board feet*	*Cords*	*Board feet*	*Cords*
Uncut	8,160	20.4	740	3.9	1,140	5.1	10,040	29.4
Partly cut	3,660	10.3	580	2.7	850	3.9	5,090	16.9
Second growth:								
Sawlog size:								
Uncut	3,830	13.6	280	1.7	440	2.7	4,550	18.0
Partly cut	2,250	9.1	210	1.4	360	2.4	2,820	12.9
Under sawlog size	300	2.8	30	.5	60	1.0	390	4.3
Reproduction	120	.4	----------	.1	20	.1	140	.6
Clear-cut	80	.3	----------	----------	20	.1	100	.4
Weighted average	2,710	9.9	220	1.4	360	2.2	3,290	13.5

[1] Includes a negligible quantity of longleaf.

Age

The old-growth timber stands are characterized by trees varying in age from 70 to over 150 years. The typical trees in sawlog-size second-growth pine stands are 30 to 70 years old (average about 45). Hardwood stands of the same condition are somewhat older, averaging about 70 years of age. Second-growth stands under sawlog size of both pine and hardwood are characterized by trees 10 to 50 years old, but most of these stands are 20 to 30 years. Most of the trees of both pine and hardwood in the reproduction condition are less than 10 years old.

Site

Differences in the productive capacity of forest land are dependent upon many factors, such as topography, soil, moisture, and drainage. The term "site" is used to include the combination of these many factors and is a valuable measure of possible productivity. In pines, the site index is the height of the average dominant trees at 50 years of age. A site on which dominant trees of the prevailing species grow 80 feet or more the first 50 years will produce the maximum volume per acre in tall, well-formed trees in a shorter time than poorer sites with a lower site index. Figure 6 compares the approximate percentage of site classes in each of the three pure pine types. The sites are designated as "50 feet and less," "60 and 70 feet," and "80 feet and over."

The hardwood area was segregated into three broad site classes (good, fair, and poor), based upon height, form, and general thriftiness of the trees. In figure 7, giving the percentage of the sites in each hardwood type, the cypress-tupelo type with 96 percent of its area in fair or good

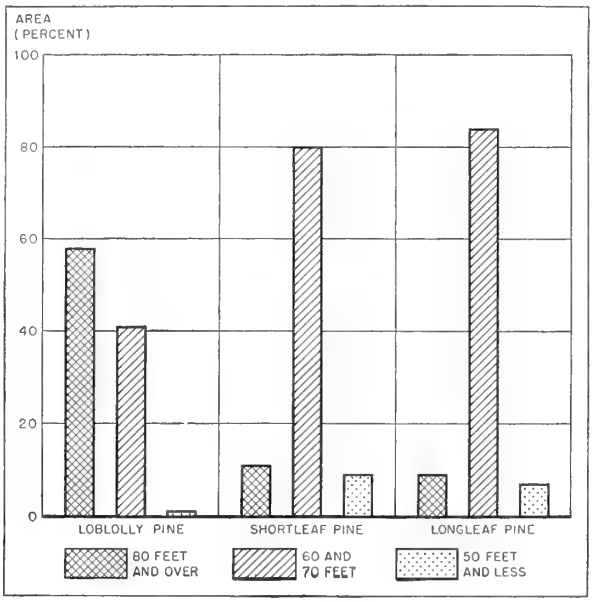

FIGURE 6.—*Percent of area in pine types in three site classes*

sites, is in marked contrast to the scrub-hardwood type with 98 percent of its area in poor sites. These two types illustrate the difference in site quality that obtains on two entirely distinct topographic situations; the cypress-tupelo type occurs in the deep, fertile soil of the river bottoms, while the scrub hardwoods are found on the dry, sterile soil of the rolling uplands.

Reproduction

The seedlings and sprouts under 1 inch d. b. h. constitute the forest reproduction. Data on distribution and density of reproduction were recorded throughout the unit. In the shortleaf-loblolly-hardwood types the reproduction is similar to the parent stand in species association. Where fire has been absent over a period of years the pine reproduction forms a dense stand beneath the older trees. Seedling counts in 1-year-old reproduction in unburned areas in several counties showed an average stand of 24,000 seedlings per acre. Where

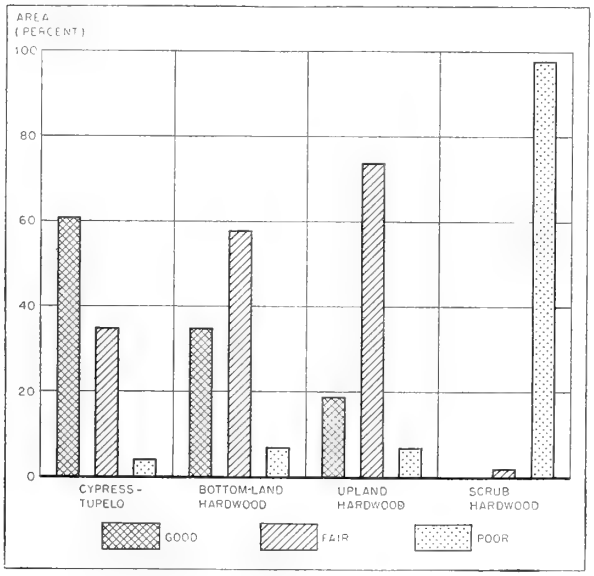

FIGURE 7.—*Percent of area in hardwood types in three site classes*

fires have occurred, the reproduction is in dense patches up to several acres in extent, but is confined to the spots that escaped the flames. This is typical of large areas in the shortleaf-loblolly-hardwood types.

In the longleaf pine types, reproduction is irregular. Along the northern and western edges of the longleaf belt, shortleaf and loblolly are restocking former longleaf land. Partly cut longleaf stands often have an understory of these two species, either pure or mixed. Much of the longleaf reproduction occurs in dense groups in openings in the older stands. Where the longleaf has been clear-cut, there are many barren areas with few seedlings, caused doubtless by the fact that only 27 percent of this clear-cut acreage has as many as three seed trees per acre. Field observations of hog damage and of brown spot, a disease that attacks longleaf seedlings, disclose that they are not generally serious throughout the longleaf area. Heavy brown-spot damage was found on only 5 percent of the longleaf plots observed, while hog damage was recorded on only 3 percent of the longleaf plots. If protected from fire and allowed an adequate number of seed trees, the pine forest of eastern Texas will reproduce itself as fast as it is cut over. In the hardwood types, the reproduction found in all openings is sufficient to perpetuate the stands without noticeable change in species composition.

Although proper silvicultural measures will insure the prompt restocking of newly cut-over forest land, older cuttings still remain a problem. In 1935, about 150,000 acres of clear-cut longleaf lands were so deteriorated as to show no promise of restocking by natural means within a reasonable time. It will be necessary to employ artificial reforestation, the technique of which is yet in its infancy, to return this land to early productivity.

In the selection of trees to be planted, careful consideration should be given to the advantages and disadvantages of slash pine. Its advantages over longleaf are chiefly the possible economies in seedling production and planting, its rapid growth, and its high yield of naval stores. Experimental planting by the Texas Forest Service has demonstrated that slash pine will grow well for at least the first 10 years after planting. These advantages are not to be lightly dismissed; but on the other hand, recent studies indicate that slash pine is highly susceptible to rust infection. Given favorable conditions for dissemination of the rust diseases during the early life of a plantation, a large proportion of the trees may be killed or seriously deformed. Also the exclusion of fire, which is necessary for the early development of slash pine, favors the rust, as fire prevention encourages the development of the oaks on certain areas where rust is endemic. Another disadvantage is that slash pine is out of its natural range in Texas, and its behavior here throughout its life span is not definitely known. Since data are lacking on the possibility of growing slash pine to maturity in Texas, it is recommended that this species if used should be planted with longleaf rather than in pure stands.

Fire

Fires, chronicled in charred stumps and scarred trees, have occurred at irregular intervals on 62 percent of the forest area. Prevalence of fire varies with the forest type. Ninety-five percent of the longleaf pine land has been burned by fires of varying degrees of intensity. In the shortleaf-loblolly-hardwood types, 70 percent of the acreage shows evidence of past fires. Fires originating in the pine types often continue into the hardwood areas, of which 25 percent showed evidence of fires.

The common fire is a ground fire that advances slowly through the underbrush along an irregular front, seldom reaching the tops to form crown fires. The shortleaf-loblolly-hardwood types are most susceptible to fire damage; reproduction and young second growth often are killed outright. Once established, longleaf pine is very resistant to fires, damage being mainly limited to scars on the lower stem. Fire damage to merchantable pines accounts for about 10 percent of the volume deducted for woods cull. Fires in hardwoods generally kill the reproduction and some of the young second growth. A large proportion of the woods cull of hardwoods is due to fire and the resulting decay.

The fire danger is greatest in the spring and summer, continuing into the late fall if rainfall is below normal. Before a fire-protection system was inaugurated in east Texas, it was the general custom of the local inhabitants to burn over the woods every year. The protective system established by the State under the Clarke-McNary Act, with the assistance of Federal and private funds, has as one of its functions the education of the citizenry concerning the damage caused by woods burning. In 1935, of the 3,500 fires recorded by by the Texas Forest Service, 35 percent were of incendiary origin, and 39 percent were caused by careless smokers. The protection system has recently been extended and greatly improved through the addition of new towers, telephone lines, forest roads, and additional personnel and equipment. By the end of 1935, 77 percent of the forest area of the unit was under protection by the State and Federal Forest Services. In the protected territory, the area burned annually and the damage caused thereby have been reduced to very small amounts. There is still, however, need for expansion of the intensive protection measures, and this should be carried out.

Volume Estimates

THE volumes of sound wood in the unit are estimated in three forms: saw-timber volume, cordwood volume, and these two combined in a cubic-foot volume. The saw-timber estimate includes all the material that has the size and quality to make lumber, while the cordwood estimate includes material not considered usable for saw-timber but which is convertible into such low-grade commodities as pulpwood, fuel wood, and fence posts. These two volumes do not overlap and when added together represent the total resource. The table giving the volume in cubic feet inside bark shows the sum of the volumes of the two previous classes of material, expressed in a measure common to both.

Saw-timber Volume

To be included in the saw-timber volume estimate, pine and cypress trees must have a diameter at breast height of at least 9 inches outside bark, and hardwoods must be at least 13 inches in diameter. In addition, merchantable trees must contain either one sound butt log 12 feet or more in length, or 50 percent of their gross volume in sound material. The estimates are based on current utilization practice as to stump heights, minimum top diameters, and woods cull. Volume was included to the upper limit of usable material in the tops rather than to a fixed top diameter, but no pine logs less than 5.5 inches in diameter at the small end or any hardwood logs less than 8.5 inches in diameter at the small end were included. The top diameter of pines actually averaged 9.9 inches.

The total net saw-timber volume as of January 1, 1935, expressed in the Doyle rule, is 12¼ billion board feet. Table 6 presents this volume by species, and also the International-rule (¼-inch kerf) volume of nearly 19½ billion board feet, which closely approximates green lumber tally, and the Scribner-rule volume of about 17 billion feet. About 90 percent of the total net saw-timber volume occurs in stands of more than 2,000 board feet per acre. Stands of this density occur on 50 percent of the forest area.

TABLE 6.—*Net volume in Doyle, Scribner, and International ¼-inch rules classified according to species group*

Species group [1]	Doyle	Scribner	International
Pines:	*M board feet*	*M board feet*	*M board feet*
Longleaf	726,600	1,020,000	1,175,600
Shortleaf	1,883,600	3,003,300	3,601,200
Loblolly	4,482,300	6,513,400	7,633,000
Total	7,092,500	10,536,700	12,409,800
Hardwoods:			
Red gum	1,011,200	1,231,800	1,353,700
Black gum	558,600	685,600	787,700
Red oaks	1,424,200	1,728,200	1,891,400
White oaks	1,070,100	1,290,000	1,409,100
Ash	117,800	153,400	167,500
Other hardwoods	977,000	1,253,900	1,381,700
Total	5,158,900	6,342,900	6,991,100
All species	12,251,400	16,879,600	19,400,900

[1] Volumes of scrub oaks and special-use species are not included.

Table 7 distributes the board-foot volume by the Doyle rule into species groups and forest conditions. The pine species account for about 58 percent of the total board-foot volume and amount to over 7 billion board feet. About 4½ billion feet of this is loblolly pine, the largest share of any single species in the unit. The pine volume, expressed in percent of the total volume, is divided into longleaf, 6 percent; shortleaf, 15 percent; and loblolly, 37 percent.

TABLE 7.—*Net volume in Doyle rule classified according to species group and forest condition*

Species group	Old growth		Second growth			All forest conditions	
	Uncut	Partly cut	Sawlog size		Under sawlog size [1]		
			Uncut	Partly cut			
Pines:	*M board feet*	*M board feet*	*M board feet*	*M board feet*	*M board feet*	*M board feet*	*Percent*
Longleaf	195,000	264,200	191,300	34,700	41,400	726,600	5.9
Shortleaf	290,600	121,300	1,134,500	278,800	58,400	1,883,600	15.4
Loblolly	692,200	229,600	2,963,400	505,300	91,800	4,482,300	36.6
Total	1,177,800	615,100	4,289,200	818,800	191,600	7,092,500	57.9
Hardwoods:							
Red gum	348,000	188,000	347,100	100,900	27,200	1,011,200	8.2
Black gum	171,800	133,600	203,800	42,600	6,800	558,600	4.6
Red oaks	408,300	268,500	538,300	177,700	31,400	1,424,200	11.6
White oaks	318,600	220,300	376,600	130,300	24,300	1,070,100	8.7
Ash	42,500	23,500	42,400	6,700	2,700	117,800	1.0
Other hardwoods	341,200	243,200	284,800	82,400	25,400	977,000	8.0
Total	1,630,400	1,077,100	1,793,000	540,600	117,800	5,158,900	42.1
All species	2,808,200	1,692,200	6,082,200	1,359,400	309,400	12,251,400	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*		
	22.9	13.8	49.7	11.1	2.5		100.0

[1] Includes uncut, partly cut, reproduction, and clear-cut.

Hardwood species contain 42 percent of the total board-foot volume, or more than 5 billion feet. Red gum, red oaks, and white oaks, with over 1 billion board feet each, make up two-thirds of this volume.

Of the volume in the various forest conditions, 97.5 percent, or nearly 12 billion board feet, is in sawlog-size stands, and these occupy 67.5 percent of the forest area. They have an average volume of 2,680 board feet per acre. Second-growth sawlog-size stands contain nearly 7½ billion board feet, or 61 percent of the total volume. The uncut stands of this condition average 2,440 board feet per acre, and the partly cut stands 1,520 board feet. The combined volume of old-growth stands amounts to about 37 percent of the total volume in the unit. Old-growth uncut stands average 5,560 board feet per acre, and partly cut stands 3,000 board feet.

Owing to the topography, continuous working seasons, and cheap transportation to the mill, virtually all parts of the unit can be logged. Of the total volume of saw timber, over 86 percent is in stands of 600 feet or more per acre and under prevailing market conditions could be operated at a profit. In addition, 11 percent is in partly cut second-growth sawlog-size stands, with a minimum volume in 1935 of 400 feet per acre; the average pine increment per acre of these stands in 1935 was nearly 160 board feet.

In table 8, the board-foot volume of pine and hardwood is shown in the several diameter classes and forest conditions. More than half of the pine volume is in the 10- to 16-inch diameter classes. The hardwood volume is about equally divided between trees 20 inches d. b. h. and larger, which include most of the highest grade material, and trees below 20 inches, containing most of the lower grade material. In the pines there are about 1½ billion board feet in the old-growth condition in trees 14 inches d. b. h. and larger, in which is found the bulk of the high-grade pine saw timber and 22 percent of the total pine saw timber. Hardwoods at least 20 inches d. b. h. in the old-growth condition contain a volume of 1¾ billion feet, or 35 percent of the total hardwood volume.

To obtain a better concept of the general quality of the timber, 4,000 representative sample trees were graded. The merchantable pine trees were graded on a tree basis and were classified as to general grade (smooth, limby, or rough). The hardwoods were handled by individual logs, and each log was assigned to grade 1, 2, or 3, depending upon its quality (see description of grades, p. v).

TABLE 8.—*Net volume in Doyle rule classified according to diameter class and forest condition*

Species and diameter (inches)	Old growth		Second growth			All forest conditions	
	Uncut	Partly cut	Sawlog size		Under sawlog size [1]		
			Uncut	Partly cut			
Pines:	*M board feet*	*M board feet*	*M board feet*	*M board feet*	*M board feet*	*M board feet*	*Percent*
10 and 12	110, 300	94, 500	1, 520, 400	428, 800	143, 600	2, 297, 600	18. 8
14 and 16	223, 900	175, 800	1, 622, 900	269, 000	42, 500	2, 334, 100	19. 0
18 and 20	289, 100	149, 800	745, 100	80, 600	5, 500	1, 270, 100	10. 4
22 and more	554, 500	195, 000	400, 800	40, 400		1, 190, 700	9. 7
Total	1, 177, 800	615, 100	4, 289, 200	818, 800	191, 600	7, 092, 500	57. 9
Hardwoods:							
10 and 12 [2]	3, 200	4, 100	2, 900	800	1, 200	12, 200	. 1
14, 16, and 18	501, 900	407, 400	1, 052, 700	316, 300	99, 500	2, 377, 800	19. 4
20 and more	1, 125, 300	665, 600	737, 400	223, 500	17, 100	2, 768, 900	22. 6
Total	1, 630, 400	1, 077, 100	1, 793, 000	540, 600	117, 800	5, 158, 900	42. 1
All species	2, 808, 200	1, 692, 200	6, 082, 200	1, 359, 400	309, 400	12, 251, 400	100. 0
Summary:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		
Pines	16. 6	8. 7	60. 5	11. 5	2. 7		100. 0
Hardwoods	31. 6	20. 9	34. 7	10. 5	2. 3		100. 0

[1] Includes uncut, partly cut, clear cut, and reproduction.

[2] Cypress only.

Figure 8 indicates for the pines and three selected hardwoods combined (red gum, red oak, and white oak) the percent of tree and log grades occurring

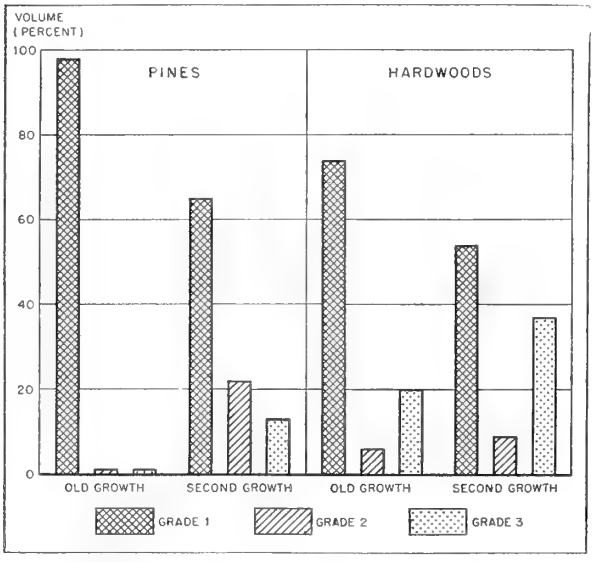

FIGURE 8.—*Percent of tree grades (pines) and log grades (hardwoods) in two forest conditions*

in the old-growth and second-growth conditions. This figure represents observations on a relatively small number of trees and should be used as a general index rather than as an exact portrayal of grades existing within the unit.

Cordwood Volume

The total cordwood volume in the unit is 98 million cords, of which 44 million cords are saw-timber volume found in merchantable trees. The remaining sound non-saw-timber volume, which is suitable for pulpwood, fuel wood, distillation wood, and other miscellaneous uses, but of little or no value for saw timber, is expressed in table 9 in terms of cords of standard size (4 by 4 by 8 feet), including bark. It is found in the stems of sound trees under sawlog size, in the tops of sawlog-size trees, and in the sound portions of trees classified as culls. Volume of trees under sawlog size is that of the stem only, taken to a flexible (minimum 4-inch) top. Volume in the tops of trees of sawlog size includes the upper stem only of pines but the upper stem plus lumbs (4-inch and larger) of hardwoods. Similarly, in the pines the volume in sound and rotten cull trees includes only the sound material in the stems, while in the hardwoods it includes that in both stems and limbs.

Table 9 shows this net volume of sound material to be 53¾ million cords, of which about 54 percent is in sound trees under sawlog size, 27 percent in tops of sawlog-size trees, and 19 percent in sound and rotten culls. Although there are 29 million cords of material in sound trees under sawlog

size, it is highly desirable that cutting be limited to that part of the stand not needed to build up and maintain an ample growing stock for a future supply of saw timber. The 24 million cords in tops and in sound and rotten culls, if used at all, may find its chief use as fuel wood. Increased utilization of this class of material would improve the quality of the stands and satisfy some of the requirements of the cordwood industries, and at the same time would conserve the growing stock for the production of saw timber. Utilization possibilities of the total timber stand from the pulpwood standpoint is discussed in the section on special-use resources.

TABLE 9.—*Net volume of sound material not suitable for sawlogs, expressed in cords*

Species group	Sound trees under sawlog size	Tops of sawlog-size trees	Sound and rotten culls	All classes of material	
	Cords	*Cords*	*Cords*	*Cords*	*Percent*
Pines	12,221,100	4,828,600	186,300	17,236,000	32.1
Hardwoods:					
Pulping	6,574,200	3,599,700	3,019,800	13,193,700	24.6
Nonpulping	10,552,000	5,886,800	6,871,000	23,309,800	43.3
Total	17,126,200	9,486,500	9,890,800	36,503,500	67.9
All species	29,347,300	14,315,100	10,077,100	53,739,500	
	Percent 54.6	*Percent* 26.6	*Percent* 18.8		100.0

Cubic-Foot Volume

The total forest resources, including both saw timber and cordwood, expressed in cubic feet inside bark are given in table 10. The total sound volume, excluding bark, of all trees above 5 inches d. b. h. is 6,886 million cubic feet, about evenly divided between pine and hardwood. The 6,231 million cubic feet in sound trees alone is 90 percent of this total resource. The remaining 10 percent in sound volume of sound and rotten cull trees amounts to 655 million cubic feet, of which only 14 million is in pine.

TABLE 10.—*Summary of forest resources in cubic feet (inside bark)*

Species	Sound sawlog-size trees		Sound trees under sawlog size	Total sound-tree volume	Sound culls	Rotten culls	Total sound volume	
	Sawlog material	Upper stems [1]						
Pines:	*M cubic feet*	*M cubic feet*	*M cubic feet*	*M cubic feet*	*M cubic feet*	*M cubic feet*	*M cubic feet*	*Percent*
Longleaf	194,210	32,240	43,790	270,240	310	410	270,960	3.9
Shortleaf	628,850	119,150	360,170	1,108,170	3,480	750	1,112,400	16.2
Loblolly	1,336,800	220,870	467,430	2,025,100	7,040	2,150	2,034,290	29.5
Total	2,159,860	372,260	871,390	3,403,510	10,830	3,310	3,417,650	49.6
Hardwoods:								
Red gum	220,360	111,280	208,150	539,790	22,610	57,280	619,680	9.0
Black gum	139,380	64,030	96,260	299,670	17,680	40,340	357,690	5.2
Other pulping hardwoods	97,490	49,870	104,390	251,750	24,260	33,970	309,980	4.5
Red oak	310,460	162,310	247,840	720,610	39,700	90,990	851,300	12.3
White oak	231,450	121,820	143,960	497,230	21,050	42,430	560,710	8.1
Scrub oak					144,220	11,130	155,350	2.3
Ash	28,540	14,300	40,090	82,930	9,110	8,020	100,060	1.5
Special-use species			[2] 28,270	28,270	6,470	5,130	39,870	.6
Other nonpulping hardwoods	137,860	70,140	198,960	406,960	32,340	34,250	473,550	6.9
Total	1,165,540	593,750	1,067,920	2,827,210	317,440	323,540	3,468,190	50.4
All species	3,325,400	966,010	1,939,310	6,230,720	328,270	326,850	6,885,840	
	Percent 48.3	*Percent* 14.0	*Percent* 28.2	*Percent* 90.5	*Percent* 4.8	*Percent* 4.7		100.0

[1] In hardwoods this volume includes limbs 4 inches in diameter and larger.

[2] Includes 1,094,000 cubic feet of upper stems.

Forest Increment Versus Drain

Increment per acre

THE increment or the volume growth of a forest stand is the balance between growth and the combined effect of death and decay. Individual trees will increase their net sound volume only when their growth exceeds loss that may occur through decay. Likewise stands of timber increase in volume only when the net growth of the individual trees plus the volume added by trees that move up into the stand from the seedling sizes exceeds the loss of volume in trees that die or decay during the period. Table 11 shows the net growth rates of pines and hardwoods in the various forest conditions during 1935, assuming no cutting during the year. In the undersawlog sizes the conspicuously high rates are due to the large volume of trees recruited into the stand during the year from trees that were too small to include in the inventory at the beginning of the year. In sawlog-size conditions the proportion of recruited volume from the small trees in the stand is less, contributing to a lower rate of increment.

TABLE 11.—*Percent of annual increase of stands in the various forest conditions, 1935*

Forest condition	Pine		Hardwood	
	Board feet	Cubic feet	Board feet	Cubic feet
Old growth:	*Percent*	*Percent*	*Percent*	*Percent*
Uncut	2.2	2.5	2.5	2.2
Partly cut	4.0	4.7	3.0	2.4
Second growth:				
Sawlog size:				
Uncut	8.4	6.5	4.3	3.8
Partly cut	8.8	6.3	5.2	3.7
Under sawlog size	38.3	18.1	13.5	7.0
Reproduction, clear-cut, and fire-killed	7.7	5.1	9.7	3.5
Weighted average	8.3	6.9	3.8	3.5

The results of multiplying the average volumes per acre by the percents given above are shown in table 12, in which the increment per acre is expressed in board feet (International ¼-inch rule), cubic feet inside bark, and cords. The pine and hardwood components should be added for the total growth per acre.

TABLE 12.—*Increment on the average acre in the various forest conditions, 1935* [1]

Forest condition	Pine component			Hardwood component		
Old growth:	*Board feet*	*Cubic feet*	*Cords*	*Board feet*	*Cubic feet*	*Cords*
Uncut	72	16	0.21	104	22	0232
Partly cut	66	17	.22	76	15	.23
Second growth:						
Sawlog size:						
Uncut	262	55	.72	43	14	.21
Partly cut	159	35	.47	44	11	.17
Under sawlog size	88	27	.36	14	8	.12
Reproduction, clear-cut, and fire-killed	5	1	.02	1	-------	-------
Weighted average	155	35	.46	40	12	.18

[1] Cubic-foot increment is measured inside bark.

Annual Volume Increment

In applying the increment rates shown in table 12 to the growing stock in order to find the volume increment for the year, suitable deductions were made for the growth on trees that were removed from the stands in the course of logging and other utilization operations. The increases shown in table 13, therefore, represent an estimate of the actual amount of wood added to the volume of the inventory during 1935, before utilization drain was deducted. The increment expressed in board feet in both pine and hardwood is the increase in volume of saw-timber material only. The incre-

ment expressed in cubic feet includes both saw timber and material in trees under sawlog size, as well as upper stems in merchantable pines. The material in upper stems and limbs of merchantable hardwood trees is not included. Increment in board-foot material is expressed in the International (¼-inch) rule, the equivalent of mill tally, in order that it may be compared later with commodity drain, which is expressed in this unit of measure.

TABLE 13.—*Forest increment in board feet* [1] *and cubic feet* [2] *in the various forest conditions, 1935*

Forest condition	Pine increment		Hardwood increment		Total increment	
	M board feet	*M cubic feet*	*M board feet*	*M cubic feet*	*M board feet*	*M cubic feet*
Old growth	67,900	16,380	93,200	18,740	161,100	35,120
Second growth:						
Sawlog size	783,700	165,550	146,700	43,530	930,400	209,080
Under sawlog size	150,500	45,800	23,800	12,750	174,300	58,550
Reproduction, clear-cut, and fire-killed	2,300	440	300	50	2,600	490
All conditions	1,004,400	228,170	264,000	75,070	1,268,400	303,240

[1] International ¼-inch rule.

[2] Excluding bark.

Forest Industries and Commodity Drain

Although the development of forest industries in southeastern Texas began as early as 1830, very little expansion occurred until after 1880, when the short-line railroads began extending their lines to connect with the larger roads that had traversed the unit and penetrated the West. This gave an outlet for forest products to the new and growing markets in the western prairies. At this time production began to rise gradually, reaching its highest level in 1907, but from that date to 1929 there was a gradual decrease, and in 1932 the volume of forest products marketed was the lowest in 40 years. The trend from 1933 through 1935 was upward and has undoubtedly continued in this direction through 1936 and 1937. According to the 1930 census, forest-products industries rank third in number of people employed in the unit, agriculture being first and oil second.

LUMBER

As shown in table 14, there were 175 active sawmills in the unit in 1935, 72 percent of which were cutting pine only. The lumber industries are well distributed throughout the unit (fig. 9). Lumber production in 1935 was 644 million board feet, of which 81 percent was pine and the remainder mixed hardwoods, such as magnolia, ash, beech, gum, and red and white oak. All but 24 million board feet of the lumber produced came from logs cut within the unit. Mill capacities range from 2,000 to 210,000 board feet per day. Mills cutting over 40,000 feet per day (fig. 10) produced 78 percent of the total lumber cut. More than half of the lumber produced in the unit came from old-growth timber. The portable and semiportable mills, which cut less than 20,000 feet per day, were using second-growth timber entirely. About 65 percent of the lumber produced in this area was sold within the State, and another 5 percent elsewhere in the South. The lumber industries in the unit furnished about 2 million man-days of employment in that year, about half of the employees being whites and the rest Negroes. Judging from the 1936 increase in cut for the whole State, the cut in this unit for 1936 was about 788 million feet.

TABLE 14.—*Number of sawmills of the various size-classes, productive capacity, production ratio, and employment provided, 1935*

Daily 10-hour capacity of mill (M board feet)	Mills cutting				Total annual production capacity (lumber tally)	Ratio of 1935 production to capacity	Labor provided		
	Pine	Hardwood	Mixed	Total			Woods	Mills	Total
	Number	*Number*	*Number*	*Number*	*M board feet*	*Percent*	*1,000 man-days*	*1,000 man-days*	*1,000 man-days*
Under 5	7	5	9	21	11,200	20	2	4	6
5 to 9	35	4	2	41	58,800	17	10	15	25
10 to 19	42	2	6	50	193,200	18	31	60	91
20 to 39	23	8	3	34	246,500	38	89	191	280
40 to 79	6	5	3	14	213,700	55	164	287	451
80 and over	13	2		15	623,400	62	422	647	1,069
Total or average	126	26	23	175	1,346,800	48	718	1,204	1,922

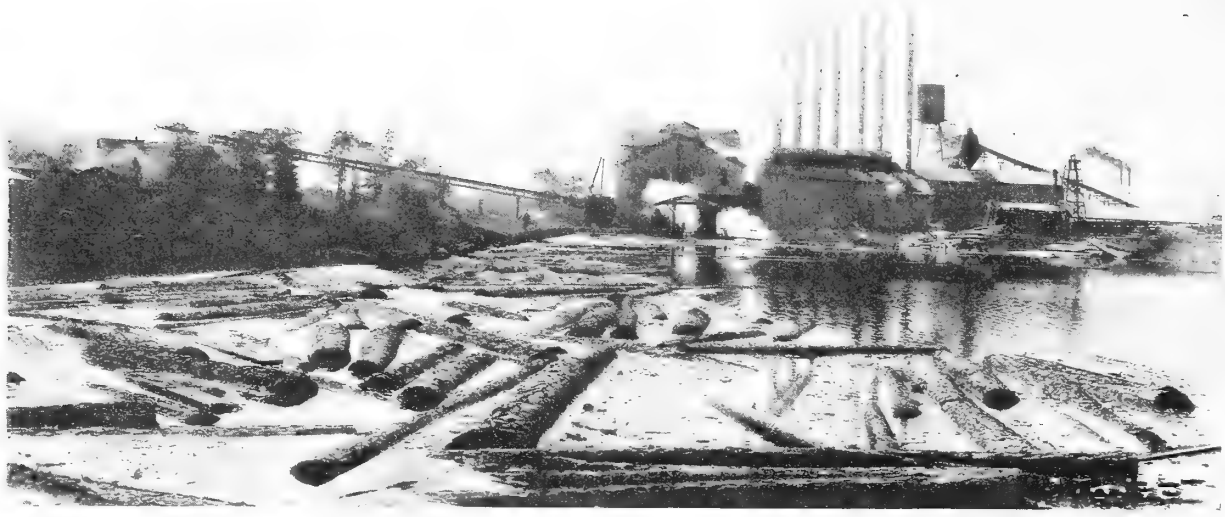

FIGURE 10.—*A large pine sawmill.* F258178

The 620 million board feet of lumber produced from local timber, augmented by some 16 million feet of saw timber cut in the unit and supplied to outside mills, made a total saw-timber drain occasioned by the lumber industry of 636 million board feet, or, including incidental waste, 103,390,000 cubic feet. This accounts for 69 percent of the total commodity drain in the unit, which differs from the actual production of sawmills and other wood-using plants and activities by the amount of woods waste incidental to manufacture.

CROSS TIES

During 1935 there were produced within the unit 1,423,000 cross ties, of which 66 percent were pine and the remainder mixed hardwoods. About 85 percent of the pine trees used for ties were as small as 12 and 14 inches d. b. h. Hardwood trees used for ties ranged from 12 to 24 inches in diameter. Most of the ties were sold to local railroads and treating plants. Cross-tie operations furnished 213,000 man-days of labor.

The requirement of the cross-tie industry in saw timber was 69,800,000 board feet, which, including incidental waste, was equivalent to a drain of 11,940,000 cubic feet against the good-tree inventory, or 8 percent of the total cubic-foot drain.

POLES AND PILES

In all, 144,000 poles and piles were produced in the unit in 1935, all of which came from pine timber. This industry furnished about 26,000 man-days of labor in the woods. Sawlog-size trees used in the production of poles and piles in this area in 1935 contained 8,000,000 board feet. Under-sawlog-size trees used during the same period contained 250,000 cubic feet. Total cubic-foot drain of sawlog- and under-sawlog-size material, including incidental waste, was 1,780,000 cubic feet, or 1 percent of the total cubic-foot drain of all forest industries operating in this area.

PULPWOOD

In 1935 there were no pulp mills operating in the unit. No pulpwood was cut and none has been included in the utilization drain. The new pulp mill at Houston, completed early in 1937, will cause an estimated annual drain of 100,000 cords of pine pulpwood from the unit. A pulp and paper mill at Orange has been idle for several

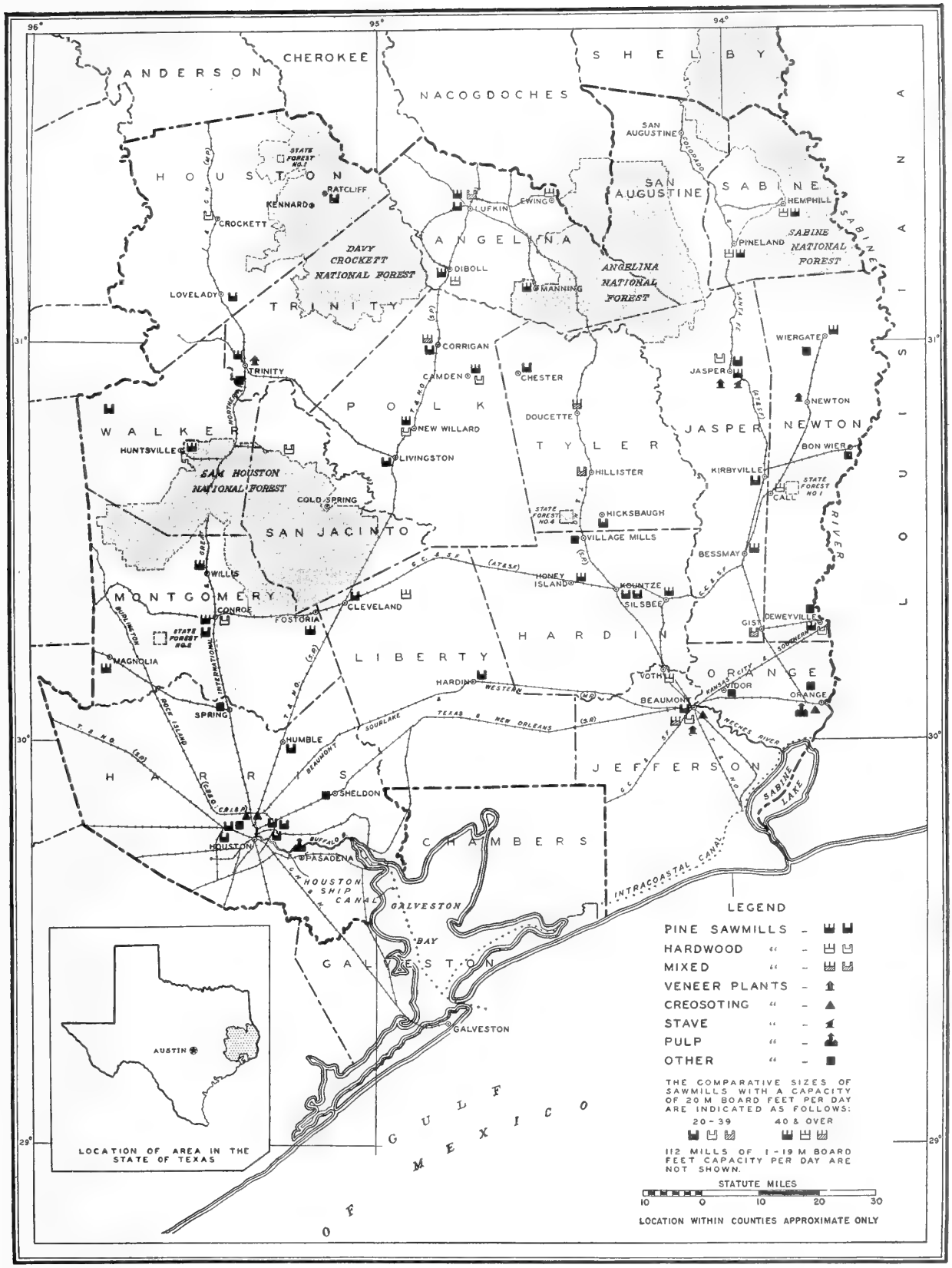

FIGURE 9.—*Wood-using plants in southeastern Texas.*

years but is now making paper from purchased pulp and is expected to resume the production of pulp in 1939.

VENEER AND CONTAINERS

Located within the unit are four veneer and package plants, while two more north of the unit draw a portion of their timber from it. The capacity of the individual plants ranges from 12,000 to 16,000 board feet per day. The average size log cut during 1935 was 15 inches in diameter. Of the species cut, 19 percent was pine; the rest, gum, beech, and magnolia. In this same year these plants used 12,600,000 board feet of pine and hardwood material for veneer; and this industry furnished 65,000 man-days of labor. Southern markets buy 70 percent of the production, while most of the remainder is shipped to markets in the Northeastern States.

The veneer industries caused a total drain, including incidental waste, of 1,860,000 cubic feet, or 1 percent of the total cubic-foot drain occasioned by all forest industries operating within the unit.

COOPERAGE

One cooperage plant within the unit, and another to the west draw all their timber from the unit. These two plants consumed 3,400,000 board feet of pine and hardwood material during 1935. One plant is cutting white oak 14 inches in diameter and above for bourbon staves and similar products. The other is cutting only second-growth pine for staves and heading for slack cooperage. These two plants furnished 13,000 man-days of employment in 1935. Southern markets consume about 4 percent of the products, other States 33 percent, and the export trade 63 percent.

Merchantable material (plus incidental waste) used for the production of cooperage in 1935 totaled 520,000 cubic feet. Cooperage drain was less than 0.5 percent of the total cubic-foot drain in the unit.

FUEL WOOD

Even though there is a bountiful supply of gas in the unit, a large demand for fuel wood bids fair

FIGURE 11.—*Utilization of scrub oak stands for fuel wood.*

to continue. During 1935 there were nearly 658,000 cords of pine and hardwood used for fuel, of which 344,000 came from dead or cull material (fig. 11) and 314,000 were drain on the good-tree inventory. Of the total volume consumed for domestic purposes, 75 percent was used in rural farm homes, 13 percent in rural nonfarm homes, and 12 percent in urban homes. The commercial users are country stores, cotton gins, schools, and laundries. Almost all of the fuel wood is cut by farmers, and it is estimated that its production furnishes 987,000 man-days of labor in the unit each year.

In 1935 the volume of fuel wood cut from sawlog-size trees approximated 66 million board feet. The sound under-sawlog-size timber used for the same purpose exceeded 11¼ million cubic feet. The total cubic-foot drain of fuel wood on the good-tree inventory (plus incidental waste) for 1935 was estimated to be 23½ million cubic feet, or 16 percent of the total commodity drain. Precise data on which to base such estimates were difficult to obtain, even though a sampling study was carried on for that purpose. The volumes as stated must be considered as approximations only.

FENCE POSTS

Very little of the forest land is under fence. Pastures and cultivated areas make up the bulk of the fenced acreage. Practically all of the fences are of wire with wooden posts, most of which are red or post oak, although some sap pine posts are used. It is estimated that 3¼ million fence posts were cut and placed in 1935, of which two-fifths were considered to be from good trees. A volume of nearly 3 million board feet was cut from saw timber and 680,000 cubic feet from under-sawlog-size timber in the production of these posts. Total drain from good trees in 1935, including waste, was more than a million cubic feet, or 1 percent of the total commodity drain. Cutting of fence posts furnished to farmers 43,000 man-days of labor anually.

MISCELLANEOUS USES

There are 10 industrial plants in this group, scattered throughout the unit, with individual consumption capacities of 1,000 to 10,000 board feet per day. The excelsior mills use pine only, the greater percentage of the trees cut being under 10 inches d. b. h. One handle plant is using second-growth pine, averaging 10 to 14 inches d. b. h. Another handle plant uses ash only and requires trees larger than 14 inches d. b. h. Shingle mills are cutting heart cypress, a large percentage of which is taken from dead and down material. Most of the dunnage wood used is a very low grade of hardwood lumber. The mine-prop operations confine their use to young second-growth pines 6 to 8 inches in diameter. The pieces are peeled and are used untreated in Mexican mines. Domestic farm use includes all round and split material taken directly from the forest for general construction and repairs. The land-clearing drain includes the estimated volume of timber felled or girdled each year through the conversion of forest to cropland. This volume is not included in other classifications.

During 1935 the miscellaneous uses caused a drain of 15 million board feet of material from sawlog-size trees and more than 2¾ million cubic feet from under-sawlog-size trees. The total drain from good trees was 5½ million cubic feet, which includes incidental waste, or 4 percent of the total commodity drain. Exclusive of land clearing and farm use, 11,000 man-days of labor were expended in these operations in 1935.

TOTAL COMMODITY DRAIN

Table 15 summarizes the total commodity drain from good trees in 1935 as close to 150 million cubic feet. This volume includes all material cut and utilized, as well as the incidental drain in sound volume left in the forest as a result of cutting. Of this drain, the volume coming from sawlog-size material was 814 million board feet. The best available estimate indicates that the capacity of the forest industries now installed, if all were operating full time for an entire year, would be approximately 1½ billion board feet, exclusive of the demands for cross ties, poles and piles, fuel wood, and fence posts. Should economic conditions warrant operation at full capacity, the drain would exceed the increment as shown for 1935 by at least a quarter of a billion feet. Past records indicate, however, that industrial capacities are seldom reached and never maintained for any length of time, while the unused increment in less-than-capacity years accumulates to help meet the requirements of peak years.

TABLE 15.—*Commodity drain from good trees, 1935*

Commodity	Saw timber [1]			All material [2]		
	Pines	Hardwoods	Total	Pines	Hardwoods	Total
	M board feet	*M board feet*	*M board feet*	*M cubic feet*	*M cubic feet*	*M cubic feet*
Lumber	506, 200	130, 300	636, 500	84, 770	18, 620	103, 390
Cross ties	47, 600	22, 200	69, 800	8, 700	3, 240	11, 940
Poles and piles	8, 000		8, 000	1, 780		1, 780
Veneers	2, 500	10, 100	12, 600	420	1, 440	1, 860
Cooperage	1, 100	2, 300	3, 400	200	320	520
Fuel wood	42, 800	23, 400	66, 200	11, 820	11, 730	23, 550
Fence posts	2, 500	400	2, 900	690	490	1, 180
Miscellaneous	7, 800	7, 300	15, 100	2, 930	2, 600	5, 530
Total	618, 500	196, 000	814, 500	111, 310	38, 440	149, 750

[1] Expressed in International ¼-inch rule, which is used as the equivalent of green lumber tally.
[2] Expressed in cubic feet excluding bark.

EMPLOYMENT IN FOREST INDUSTRIES

In table 16 is shown the production of the various forest industries and the man-days of employment provided in the woods and mill. The production listed is based on the actual cut of the various plants and activities and includes logs and other material brought in from other survey units. It does not include the incidental drain which is part of the commodity drain from good trees shown in table 15. The figures for man-days of labor employed in mills are based upon actual production rather than upon drain; those for man-days of woods labor are based upon material cut from the unit only.

TABLE 16.—*Production and employment data, 1935*

Kind of industry or commodity	Quantity produced in 1935	Employment		
		Woods	Mill	Total
		1,000 man-days	*1,000 man-days*	*1,000 man-days*
Treating plants	5,730,000 cubic feet		102	102
Fuel wood	658,000 cords	987		987
Naval stores	1,000 units	14	2	16
Cross ties	1,423,000 pieces	213		213
Poles and piles	144,000 pieces	26		26
Fence posts	3,293,000 pieces	43		43
Sawmills	644,200,000 board feet	718	1, 204	1, 922
Veneer	11,400,000 board feet	19	46	65
Cooperage	3,600 cords	8	5	13
Miscellaneous [1]	7,000 cords	8	3	11
Total		2, 036	1, 362	3, 398

[1] Does not include domestic farm use or land clearing.

Comparison of Increment and Drain

In table 17 the net annual increment of timber in the saw-timber sizes is compared with the annual commodity drain. The total net increment of good trees in 1935, as given in table 13, was 1,268 million board feet by the International ¼-inch rule. This exceeds the commodity drain by 454 million board feet. In the pines, the commodity drain was 62 percent of the net increment, while in the hardwoods it was 74 percent. The growing stock of pine saw timber was increased by 386 million board feet and the hardwood of the same classification by 68 million board feet.

Figure 12 shows the relation between the net increment and the commodity drain (a rough estimate) in the various forest conditions.

TABLE 17.—*Balance between increment and drain in board feet (International ¼-inch rule)*

Item	Pine	Hardwood	Total
Net growing stock, Jan. 1, 1935	*M board feet* 12, 409, 800	*M board feet* 6, 991, 100	*M board feet* 19, 400, 900
Forest increment, 1935	1, 004, 400	264, 000	1, 268, 400
Commodity drain, 1935	618, 500	196, 000	814, 500
Net growing stock, Jan. 1, 1936	12, 795, 700	7, 059, 100	19, 854, 800
Net increase in growing stock, 1935	385, 900	68, 000	453, 900

The rate of cutting in the old-growth stands greatly exceeds the annual increment, with the

result that the growing stock is being rapidly reduced. The majority of the larger pine mills report that their supply of original-growth timber will be practically cut out within 10 years. Since nearly all the pine mills in the section, however, have for some years been cutting second growth as well as old growth, the exhaustion of the old-growth supply does not necessarily imply a closing down of mills or a reduction in the cut of the unit. The annual increment in second-growth pine

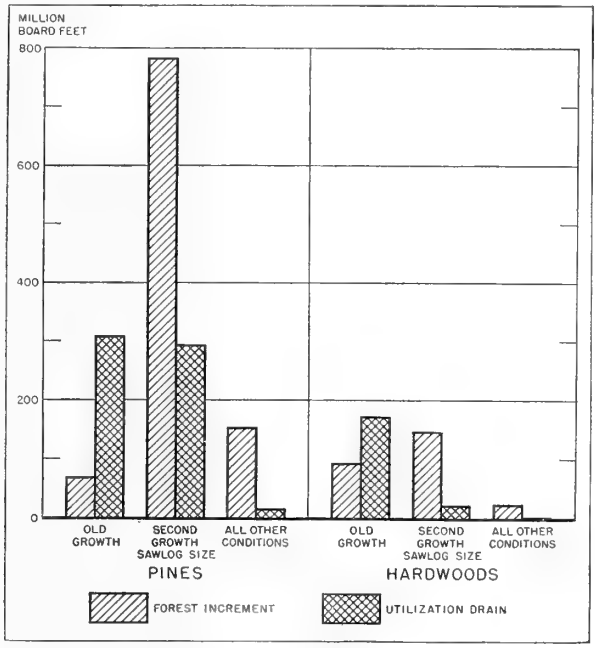

FIGURE 12.—*Comparison of forest increment and commodity drain in 1935 in various forest conditions*

stands is sufficiently large to compensate for the drain on old-growth stands. It will not, however, be equal in quality to the increment on old-growth timber. Eventually there will be a reduction in the output of export timbers, dense-grain flooring, and similar products that are necessarily produced from high-quality old-growth stands. In hardwood stands, the supply of old growth plus its increment will meet the drain against it longer than in old-growth pine stands, but the present increment of high-quality material in second-growth hardwood stands does not compensate for the drain on the old growth.

In 1935, the net increment of good trees was 303 million cubic feet (table 18), exceeding the commodity drain by 153 million. Twenty-nine million feet of this increment was in upper stems of sawlog-size pines and, owing to its inferior quality, will probably be little used by the forest industries; fuel wood, which caused a drain of 24 million cubic feet against the good-tree inventory, would be a suitable use for this class of material. The remaining 274 million cubic feet represents the increase in volume of the under-sawlog-size trees and the saw-timber portion of sawlog-size trees. Approximately 80 percent of this volume increase was in saw-timber stands averaging 2,680 board feet (Doyle) per acre.

TABLE 18.—*Balance between increment and drain in cubic feet*

Item	Pine	Hardwood	Total
	M cubic feet	*M cubic feet*	*M cubic feet*
Net growing stock, Jan. 1, 1935	3,403,510	2,232,370	5,635,880
Forest increment, 1935	228,170	75,070	303,240
Commodity drain, 1935	111,310	38,440	149,750
Net growing stock, Jan. 1, 1936	3,520,370	2,269,000	5,789,370
Net increase in growing stock, 1935	116,860	36,630	153,490

In addition to the sound volume in good trees there is a considerable volume of sound material in both sound and rotten cull trees. It is estimated that the sound volume in cull pine trees increased by half a million cubic feet during 1935, and that similar material in the hardwoods increased by 10 million cubic feet.

It should be realized that this sound volume in cull trees can be utilized only for products in which quality is not essential. Fuel wood, which now takes about 12 million cubic feet of good pines each year, is undoubtedly its best use. As more of the higher quality wood is reserved for use by the wood-using industries, it seems possible and desirable that the use of this sound volume for fuel wood should materially increase, and should take the whole half million feet of increment in cull pines. During 1935 about 8 million cubic feet of cull hardwoods were used for fuel wood—an amount equal to 80 percent of the annual increment of this cull volume.

Special-Use Resources

INCLUDED in the timber estimates already given are supplies of timber of especial value for certain uses which are either as yet undeveloped or at present supplied from timber of a higher quality than is justified. Prominent among these uses are pulpwood, poles and piling, and gum and wood naval stores. This section is designed to point out additional facts about these special-use resources. It should be remembered that the volumes given are *not in addition* to the total volume estimate but are included in it.

Pulpwood

Table 19 shows the cordwood volume—in standard stacked cords (4 by 4 by 8 feet), containing 90 cubic feet of pine and cypress and 80 cubic feet of hardwood, including bark—classified according to species groups, diameter classes, and forest-type groups in all live sound trees (except scrub oak) of which the diameter outside bark at breast height is at least 5 inches. In pines and under-sawlog-size hardwoods, the stem wood is included to a minimum 4-inch top, while in sawlog-size hardwoods and cypress, merchantable material is included to a minimum top diameter of 8.5 inches. The volumes in upper stems of sawlog-size hardwoods, in limbs of all species, and in woods cull have been deducted.

Of the 79 million cords in live, sound trees, about half is in loblolly and shortleaf pine, one-quarter in nonpulping hardwoods, one-sixth in pulping hardwoods, and the remainder in longleaf pine. The pine types make up 77 percent of the total pulping volumes. Sixty-three percent of the pine volume and 51 percent of the pulping hardwood volume are in trees less than 13 inches in diameter—material of the size most suitable for pulpwood. This abundant supply of timber in the smaller diameter classes has a double significance. If the industries of the unit should swing in the near future predominantly toward pulp production, a portion of these smaller sizes immediately will be in demand for pulpwood. If, on the other hand, the lumber industry at present in the area adopts the policy of growing high-quality saw timber, these small trees can be developed into high-value timber. Actually there is sufficient volume and increment in these smaller trees to provide for a reasonable pulpwood cut in addition to the reserve necessary for the production of more valuable saw timber.

The total volume of pulping woods, expressed in cords, includes not only the sound material in the live good trees but also some of the volume in the tops and limbs of merchantable trees and all the sound material in cull trees. Table 20 shows that this total cordwood volume in pines and pulping hardwoods is 64¾ million cords.

TABLE 19.—*Net cordwood volume in pine and hardwood species groups, classified according to tree diameter class and forest type group*

Species group and tree diameter (inches)	Forest type group			All groups	
	Longleaf pine	Shortleaf-loblolly-hardwood	Hardwood		
Longleaf:	*Cords*	*Cords*	*Cords*	*Cords*	*Percent*
6 to 8	547,800	62,500	4,800	615,100	0.8
10 to 12	1,049,200	74,100	5,300	1,128,600	1.5
14 to 16	849,800	44,700	3,000	897,500	1.1
18 to 20	472,400	15,200	----	487,600	.6
22 and more	385,800	8,700	----	394,500	.5
Total	3,305,000	205,200	13,100	3,523,300	4.5
Loblolly and shortleaf pine:					
6 to 8	332,900	10,669,100	603,800	11,605,800	14.7
10 to 12	406,300	14,136,100	337,400	14,879,800	18.9
14 to 16	250,800	8,512,000	95,300	8,858,100	11.2
18 to 20	83,200	3,316,300	32,500	3,432,000	4.4
22 and more	73,100	2,358,600	29,800	2,461,500	3.1
Total	1,146,300	38,992,100	1,098,800	41,237,200	52.3
Pulping hardwoods:					
6 to 8	64,600	1,529,200	1,222,500	2,816,300	3.6
10 to 12	52,300	1,937,100	1,861,700	3,851,100	4.9
14 to 18	33,000	1,623,200	2,021,500	3,677,700	4.6
20 and more	4,000	630,800	2,196,400	2,831,200	3.6
Total	153,900	5,720,300	7,302,100	13,176,300	16.7
Nonpulping hardwoods:					
6 to 8	70,700	2,385,400	1,922,900	4,379,000	5.6
10 to 12	47,600	3,047,600	3,023,100	6,118,300	7.7
14 to 18	38,600	2,383,100	3,372,100	5,793,800	7.3
20 and more	23,100	1,148,800	3,449,100	4,621,000	5.9
Total	180,000	8,964,900	11,767,200	20,912,100	26.5
All species	4,785,200	53,882,500	20,181,200	78,848,900	----
	Percent	*Percent*	*Percent*		
	6.1	68.3	25.6	----	100.0

TABLE 20.—*Net cordwood volume of pulping species classified according to species group and quality class*

Quality class	Pines	Pulping hardwoods	Total pulping species	
Good trees:	*Cords*	*Cords*	*Cords*	*Percent*
Under 13 inches	28,229,300	6,706,500	34,935,800	53.9
13 inches and larger:				
Sawlog material	14,720,200	6,508,900	21,229,100	32.8
Upper stems [1]	1,811,000	3,560,600	5,371,600	8.3
Sound and rotten culls	186,300	3,019,800	3,206,100	5.0
All classes	44,946,800	19,795,800	64,742,600	----
	Percent	*Percent*		
	69.4	30.6	----	100.0

[1] In hardwoods this volume includes limbs 4 inches in diameter and larger.

The volume in stems of sound trees (56 million cords) constitutes the major part of the pulpwood growing stock of the unit and should in general be held intact. Only its annual increment under the of principle sustained yield should be considered for possible utilization; and a considerable part of this will be needed to support the present and future requirements of the lumber, pole, tie, and other wood-using industries. Some part of the increment, however, can be used most advantageously for pulpwood, and to this volume can be added a portion of the 8,577,700 cords of sound material in cull trees and in the upper stems and limbs of sound trees that are cut for other purposes. Under present utilization practices, very little of this material is so used, the only demand made upon it being for fuel wood. Future use is problematical, except as local scarcity or materially increased prices may create a larger demand. The possibilities in salvage of this sound material are indicated in table 20.

The heaviest stands occur in the shortleaf-loblolly-hardwood type, which averages 13½ cords per acre. Some stands in the southwestern portion of the unit contain as high as 40 or more cords per acre. The hardwood types average about 12 cords per acre, more than half of which is nonpulping material. The longleaf types, containing most of the clear-cut acreage, average only 5 cords per acre.

Figure 13 shows the average cordwood volume

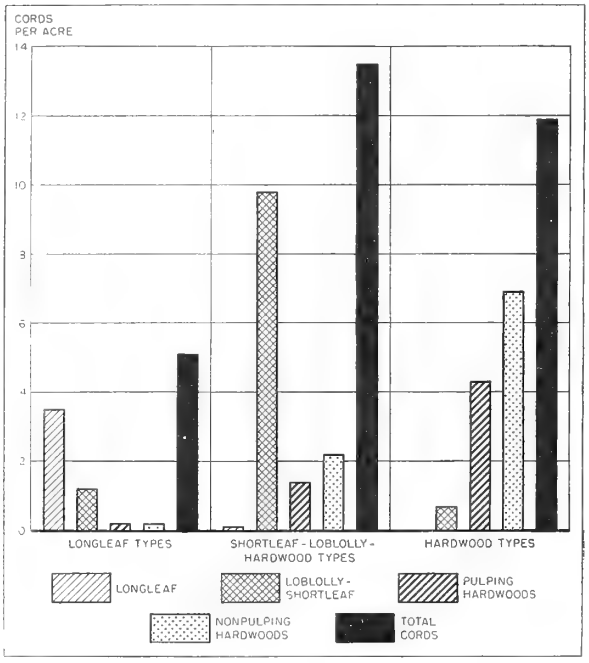

FIGURE 13.—*Cords per acre in the various species groups within major type groups*

per acre of each species group in the type groups. This theoretical volume is obtained by dividing the volume of each species group within the type by the type area, and therefore includes clear-cut and reproduction along with the wooded areas.

The annual increment of pulpwood per acre varies with the type, condition, and degree of stocking. In the shortleaf-loblolly-hardwood type group (table 4) and second-growth sawlog-size uncut condition, there was an average increment in 1935 of 0.9 cord of pine, 0.1 cord of pulping hardwoods, and 0.1 cord of nonpulping hardwoods. Under-sawlog-size stands in this same type group increased that year by 0.5 cord of pine and 0.1 cord of hardwoods. The weighted-average annual increment per acre of all types and conditions was about 0.46 cord of pine, 0.07 cord of pulping hardwoods, and 0.11 cord of nonpulping hardwoods—a total of 0.64 cord per acre. These estimates of increment are based on the stocking of the respective conditions at the time of the inventory; with variations in stocking there will be a corresponding change in the annual increment.

Observations were made on second-growth pine trees throughout the unit to determine their comparative quality. Expressed in percent of the total board-foot volume for that species, 81 percent of the longleaf is in smooth trees, 16 percent in limby, and 3 percent in rough trees. Loblolly has 60 percent of its volume in smooth trees, with about 20 percent in each of the other two grades. Of the shortleaf 67 percent is in smooth trees, 27 percent in limby, and 6 percent in rough. Thus there are approximately 8 million cords of second-growth pine in limby and rough trees.

Land in southeastern Texas, primarily a section of large landownerships, is held chiefly by lumber companies, several of which are keeping their land for permanent operations. In 1929 nearly 4 million acres of forest land was controlled by only 77 separate owners, each of which owned not less than 3,000 acres; one owned more than 700,000 acres. The Federal Government has purchased over half a million acres for national forests. Such land, held on a long-time basis for continuous saw-timber production, should provide large quantities of pulpwood from logging and mill waste, as well as from thinnings and improvement cuttings. Supplementing this will be the cordwood produced on the million acres of forest land held in small tracts by the 35,400 farm operators in the unit.

If a rational policy is followed in the utilization of the annual increment of the unit, that is, if a part is used to supply the requirements for lumber, poles, piles, ties, and similar commodities, a part for pulpwood, and a part is reserved to build up the growing stock, the annual yield of both saw-timber and cordwood could be greatly increased. To illustrate: In the pines alone, if 40 percent of the increment in the 8-, 10-, and 12-inch diameter classes were cut for pulpwood and 60 percent were reserved to grow into sawlog sizes; and if 90 percent of the 14-inch and larger sizes were cut into saw-timber products while the remainder were

reserved, the annual yields would be gradually increased, as shown below:

Year:	Calculated yield
1935.....	726 million board feet and 752,000 cords
1940.....	740 million board feet and 859,000 cords
1945.....	753 million board feet and 982,000 cords

In addition to the above yields from good trees, the saw-timber trees removed each year have at least 164,000 cords of upper-stem wood; and the annual yield from cull trees, assuming 20 years to remove the present accumulation of cull volume, would approximate 9,000 cords. This material is at least suitable for fuel wood, and a small part of it may be used for pulpwood. Taking into account some of the practical limitations, it seems reasonable to believe that about three-fourths of a million cords of pine pulpwood could be removed annually from the stand without endangering the future timber supply of the present industries.

In the pulping hardwoods, the increment of live sound trees 6 to 12 inches d. b. h. will provide an annual pulpwood cut of 177,000 cords, with sufficient growing stock left to maintain and even increase the stand of trees 14 inches and larger. In addition, trees removed for saw timber each year have about 90,000 cords of top wood. The sound volume removable in cull trees is 150,000 cords per year, assuming that the present accumulated volume is harvested over a period of 20 years. Hence, an annual cut of at least 200,000 cords of material suitable for pulpwood seems possible.

These pulpwood estimates presuppose that the cut is well distributed over the unit and that diversified utilization occurs. At present, mills of all kinds and sizes are well scattered throughout the unit and are operating in all kinds of stands. There are no areas in which the timber is inaccessible. Since the land is controlled by a variety of owners with various plans of management, some stands are available for logging at all times. As stated earlier, 86 percent of the annual board-foot increment is taking place on economically accessible sawlog-size stands; but the volume on the remaining timber areas is rapidly increasing also.

Poles and Piles

Included in the total volumes previously discussed are 35 million pine trees suitable for poles or piles. All of these will satisfy the requirements for southern pine poles as set up by the American Standards Association. About 20 percent of the pine trees 7 to 19 inches d. b. h. were considered as pole material by the cruisers of the survey, who found the heaviest concentration of poles and piles in the territory shown in figure 14.

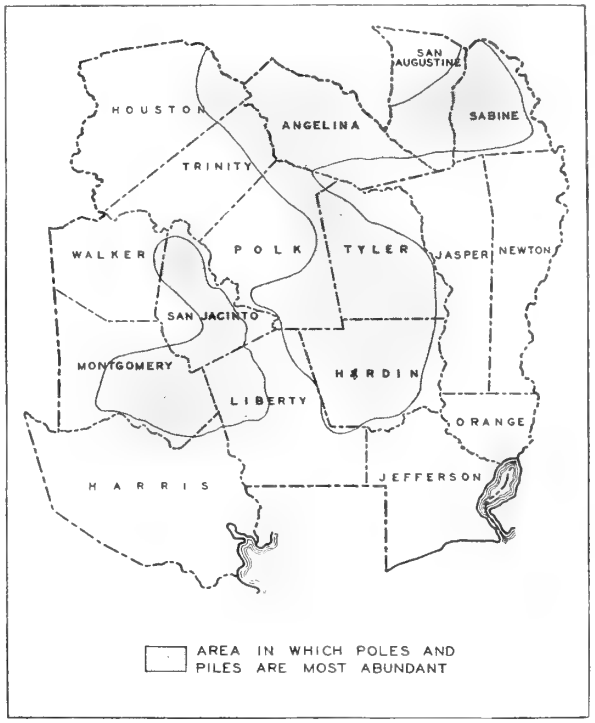

FIGURE 14.—*Location of the main body of the pole and pile timber, as indicated by shading*

Table 21 shows the total number of pine poles and piles classified according to diameter and length. Owing to the recognized difficulty of classifying standing trees for poles and piles, this table may not give the exact number to be found within the unit, but it does show the probable percentage of the total number of each size class. Of the trees suited for poles and piles, 84 percent are under 13 inches d. b. h. outside bark; the remainder are 13 to 19 inches in diameter. Significant is the fact that 70 percent of the total poles and piles are 25 feet or less in length. The commonly used 35-foot length forms only 7 percent of the available supply, while only 1 percent of the present supply of poles and piles are at least 50 feet long. With only 14 percent of the total supply over 30 feet long, pole operators in this unit need to develop a greater market for the shorter and smaller pieces.

TABLE 21.—*Total number of pine poles or piles classified according to length and tree diameter (d. b. h.)*

Diameter of trees outside bark (inches)	20 feet	25 feet	30 feet	35 feet	40 feet	45 feet	50 feet or over	All lengths	
	1,000 sticks	*1,000 sticks*	*1,000 sticks*	*1,000 sticks*	*1,000 sticks*	*1,000 sticks*	*1,000 sticks*	*1,000 sticks*	*Percent*
7.0 to 8.9	7,612	2,521	961	78				11,172	31.8
9.0 to 10.9	5,194	2,783	1,998	777	219	75		11,046	31.4
11.0 to 12.9	2,360	1,938	1,547	833	369	263	63	7,373	21.0
13.0 to 14.9	704	952	770	501	279	182	175	3,563	10.1
15.0 to 16.9	132	369	294	254	178	100	138	1,465	4.2
17.0 to 18.9	3	113	94	106	88	50	78	532	1.5
Total	16,005	8,676	5,664	2,549	1,133	670	454	35,151	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		
	45.5	24.7	16.1	7.3	3.2	1.9	1.3		100.0

Gum Naval Stores

The naval stores industry attained its greatest output in Texas in 1919, with the production of approximately 18,000 barrels of turpentine and

FIGURE 15.—*Location of the principal supply of turpentine timber, as indicated by shading*

60,000 barrels of rosin. Since that time there has been a decline until in 1935 the only active crops in the unit were centered in old-growth timber near Wiergate, in Newton County, where they were being worked in advance of a lumbering operation.

Second-growth stands offer the only opportunity for new operations. Field observations and survey data reveal that there are apparently only two areas in this unit on which there is sufficient stocking of round, second-growth longleaf in nearly pure stands to warrant the establishment of one or more naval stores operations. Figure 15 shows the location and relative size of these areas.

A small area, lying east of Newton, in Newton County, contains approximately 60,000 acres of forest land. Pure stands of longleaf pine have restocked most of this area, with a fairly normal representation of the different size classes. Enough rapidly growing young trees are present in the stand to make long-time operations possible. A larger area, in Tyler, Polk, and Hardin Counties, includes about 290,000 acres of forest land. Although well-stocked with nearly pure stands of round longleaf pine, a large proportion of the trees are of saw-timber size and consequently are in demand by the lumber, cross-tie, and pole industries. Trees in the smaller diameter classes are insufficient in number to insure a permanent supply of timber for naval stores.

In the two areas it is estimated that 50 to 60 crops of cups could be maintained in operation over a period of several years, by a progressive working of the area. Loblolly and shortleaf pines show a strong tendency to supplant longleaf in Texas, and unless measures are taken to prevent this the supply of naval stores timber is not likely to increase.

In each of these areas is an excellent system of paved highways, augmented by roads recently constructed by the Civilian Conservation Corps. Transportation of gum to a central still in each area

would be entirely feasible, since the longest haul would rarely exceed 12 miles.

Gum yields of second-growth longleaf in this area have not been determined, but it is believed that they will equal or exceed yields from second-growth stands in the adjoining States of Louisiana and Mississippi, where the average operation during 1933 produced 43 units per crop on the basis of 34 streaks per season.

Wood Naval Stores

Although old-growth longleaf pine stumps have been accumulating in this unit since before 1900, the present supply is not as great as might be expected. Fires and decay have constantly reduced the volume, and the restocking of cut-over land by young trees has lessened the present availability of otherwise merchantable stumps. No commercial utilization of stump wood had occurred up to the end of 1936.

Supplies of suitable stumps are found mainly in the longleaf type and in areas formerly of this type but now covered by scrub hardwood—an area totaling 612,400 acres. Practically all of the available tonnage is in the flatwoods and rolling uplands; less than 1 percent is in swamps and river bottoms.

As a rule, the difficulty and cost of removing stumps increase with the age and density of the timber stand. Of the total area, 25 percent is covered with saw-timber stands, 45 percent with young second growth, and nearly 30 percent, or 179,000 acres, located chiefly in the eastern part of the unit (fig. 16), is clear-cut. Over 63 percent of the clear-cut area and 45 percent of the total stump-wood area have 14 or more stumps per acre.

The total quantity of stumps at present merchantable and suitable for removal by blasting is about 2 million tons (table 22). Merchantable stumps on clear-cut longleaf land amount to 730,000 tons, or about 38 percent of the present merchantable stump wood. Stumps on areas stocked to reproduction and young second growth amount to 863,000 tons. In addition, there are 345,000 tons in sawlog-size stands. About 76 percent of the total merchantable volume occurs in densities of at least 14 stumps per acre.

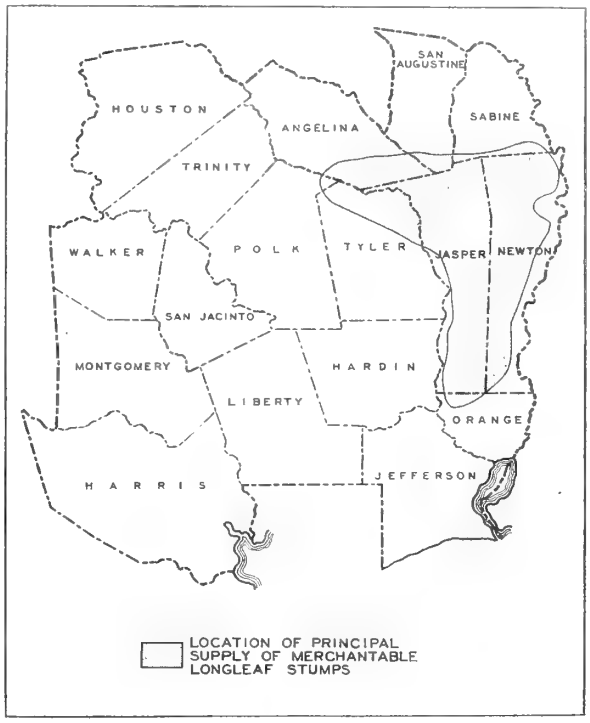

FIGURE 16.—*Location of the principal supply of merchantable longleaf stumps as indicated by shading*

TABLE 22.—*Weight of merchantable longleaf pine stumps removable by blasting, classified according to forest condition and number of stumps per acre*

Stumps per acre	Old growth	Second growth			Clear-cut	On all conditions	
		Sawlog size	Under sawlog size	Reproduction			
	1,000 tons	*1,000 tons*	*1,000 tons*	*1,000 tons*	*1,000 tons*	*1,000 tons*	*Percent*
5 or less	9	13	18	6	6	52	2.7
6 to 13	44	66	158	44	100	412	21.3
14 to 25	54	94	222	62	260	692	35.7
26 or more	41	24	289	64	364	782	40.3
Total	148	197	687	176	730	1,938	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*		
	7.6	10.2	35.4	9.1	37.7		100.0

In addition to the 2 million tons of stumps at present available for removal by blasting, there are nearly 1¾ million tons of well-seasoned stumps located in timber stands so thick that stump wood operations are impracticable at present. Old-growth longleaf pine trees now standing are also a potential source of stumps. On the basis of 6 tons per acre, there will be at least 700,000 tons of stump wood resulting from the removal of the present old-growth longleaf stands. On the ground there is also an unmeasured supply of seasoned top wood that can be used in the manufacture of wood naval stores, as has been done since about 1910.

Considering only the amount of merchantable stump wood at present available, there is enough to supply 78,000 tons per annum over a 25-year period. Calculations based on present yields in steam and solvent plants show that this tonnage would produce annually 63,000 barrels of rosin, 12,000 barrels of turpentine, and 390,000 gallons of pine oil.

Outlook for the Future

TEXAS is the largest State in the Union, but it ranks among the lowest in the South in the proportion of its land area occupied by commercial timber stands. Approximately 10½ million acres of commercial forest land in the State are within the 36 easternmost counties. These forests are the nearest and most logical source of timber supply from which to meet the growing requirements of a population that has more than doubled since 1900. If conservatively handled, they can meet these requirements for material and in so doing furnish needed employment to about 25,000 of the State's population.

The forest resource is of outstanding significance to the population, industries, and utilities of this survey unit, since agriculture cannot be expected to assume any larger place than it now occupies. The petroleum industry, at present of great importance, must eventually decrease in importance as the supplies of oil are reduced. From the standpoint of the State as a whole as well as from that of the southeast portion, there is every justification for a strong and sustained effort to bring these forests up to their maximum production and to encourage the development of wood-using industries of such size and diversity of output as to utilize fully the forest products on a permanent basis.

Southeastern Texas has long been an important center for forest industries. Until recently, large double-band sawmills, such as that at Diboll, with a daily capacity of 120,000 board feet, were the characteristic plants throughout the unit; but as the supply of old-growth timber declines, the large mills are reducing their operations or are being replaced gradually by smaller mills which utilize second-growth timber. With the change in size of mills and character of the timber cut, there have come marked changes in methods of logging and transportation. The prevalence of steam skidders involving clear-cutting is decreasing, whereas the use of animal and tractor logging with a degree of selective cutting has grown to large proportions. Also trucks are rapidly taking the place of railroads for transporting logs from woods to mill.

The production of poles, piles, and railroad ties is increasing. Established mills and operations are now using only a small part of the large volume of low-grade pine and hardwood material available throughout the forest. This large volume of inferior wood is not only a positive hindrance to optimum forest increment, but also represents an economic waste of material that might help maintain new industries of great value to the region. Although the forest stands in southeastern Texas are among the best in the South in volume and growth per acre, they can be materially improved and their value increased. In the past, largely through lack of diversified markets, it has seldom been possible to apply fully integrated utilization in harvesting this timber; but this situation is changing for the better, in that profitable outlets for more low-grade commodities are becoming available. The development of the pulp-and-paper industry in the South has improved the opportunity for more intensive forest management and should continue to do so. If the growing stock is to achieve its full development and contribute its full share to the economic life of the section, there must be a recognition of the deficiencies of the stand, an understanding of what measures are necessary to cure these ills, and a conscious, regionwide movement to put such measures into execution.

About 200,000 acres, mostly in the longleaf pine

type in Newton, Jasper, Angelina, and Tyler Counties, are virtually denuded of trees, as a result of the skidder logging of past decades. Large areas of second-growth stands contain a heavy proportion of hardwood species that may never produce the high-grade lumber now required by the hardwood-lumber industry. While the average timber stand, all types and conditions combined, contains 2,900 board feet per acre, there are many scattered areas throughout the unit in which the density of stocking varies from far above to far below the average. Over extensive areas of second growth, for instance, in the "Big Thicket" of Hardin and Liberty Counties, the stands are too dense and would be greatly improved by the removal of surplus trees. Because they are so largely second growth, the stands are generally deficient in large trees that produce high-grade lumber, and this situation has a strong tendency to become more marked and widespread as the saw-mills depend more and more on second growth and as pulp mills begin to compete for small timber.

To remedy these conditions, the first essential is effective protection from fire over the entire forest area. If fires are prevented, the number of trees per acre will increase, mortality will be materially reduced, and the loss in volume and quality on standing trees will be greatly decreased. Fire protection on the cut-over longleaf pinelands will result in the natural restocking of a part of the area, thus reducing the area that must be artificially restocked through planting.

Another essential step is the removal of cull trees, trees of inferior species, and surplus stems (in overcrowded stands). In order to preserve or improve the present balance between hardwood and pine in several of the widely prevalent forest types, some means must be found for removing and utilizing, if possible, the hardwood as well as the pine. If this is not done, great areas now predominantly pine may become predominantly hardwood in the course of a few decades. Broadly speaking, the introduction of measures to correct the present deficiencies in the stands will depend very largely upon the opportunity to market low-grade all-size material, both pine and hardwood. With the promise of a growing demand for this class of material, more intensive handling of the stands seems to be justified.

It is not expected that the improvement in forest practices outlined here will be instituted throughout the area immediately. There are, however, a considerable number of individual timber owners with a large aggregate acreage who can profitably put their timberlands under full fire protection and engage in sustained-yield operations based upon selective cutting and integrated utilization. Also the several National and State forests within the unit should demonstrate to private owners the best methods of handling their forest property. Public ownership and management seem the logical solution in the larger blocks of denuded longleaf pineland, where at least 150,000 acres probably will have to be planted if they are to be restored to productivity within a reasonable time. Much study and experimentation in silviculture, in utilization, and in marketing are required to solve the many problems of forest management, and these researches should be started at once and vigorously carried forward as a distinct project of the United States Forest Service,[2] in a number of small experimental forests suitably located in the several major forest types.

The growing awareness of the people of Texas that the forest resource must play an important part in the future development of the State augurs well. Timber owners in southeastern Texas should likewise appreciate that realizable profits are ahead for those who manage their properties with conscious intent to grow consecutive crops of timber on the same land, since this section ranks among the best in the South in opportunities for practicing sustained-yield forestry for profit.

[2] The logical place for such a project would be the Southern Forest Experiment Station.

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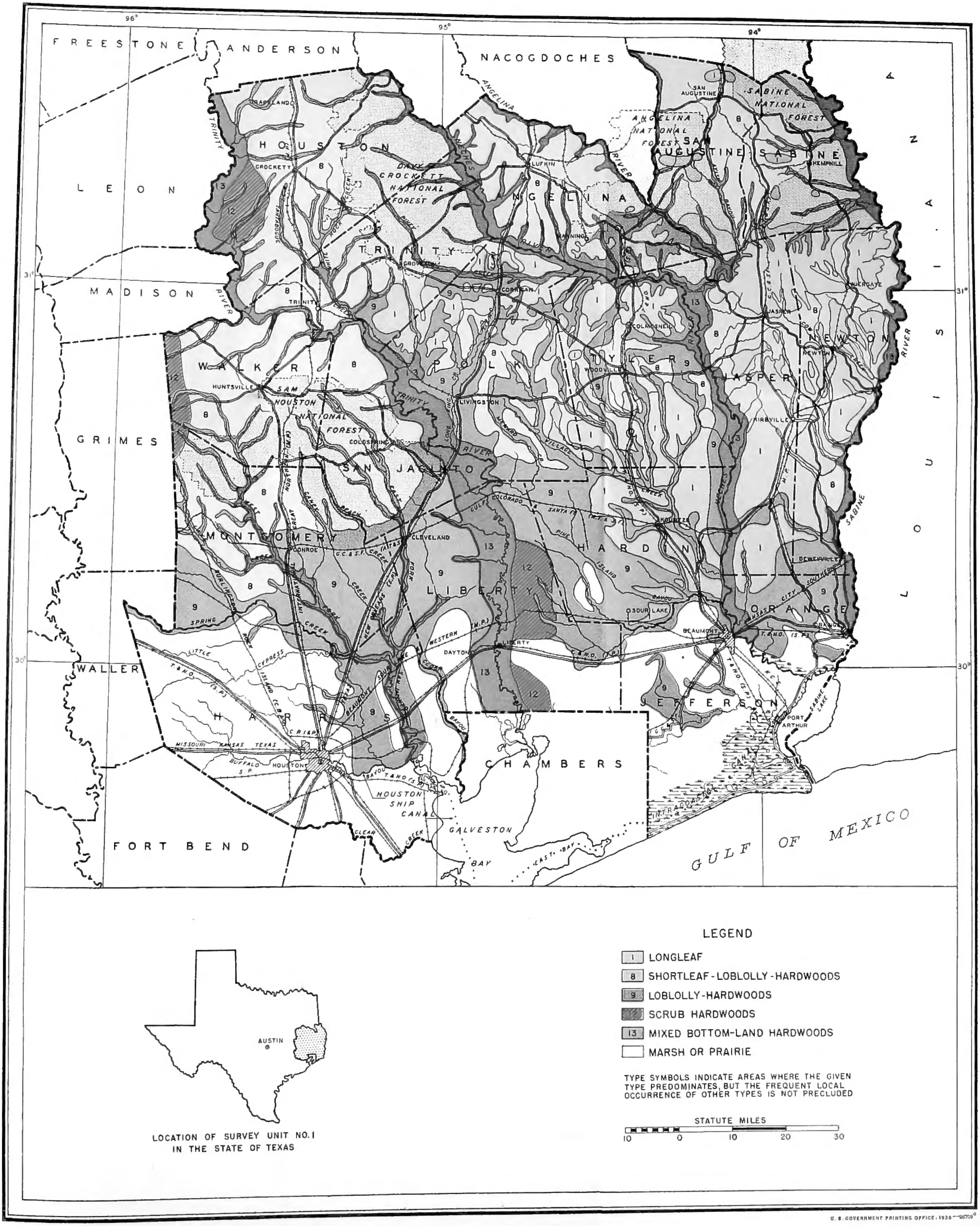

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