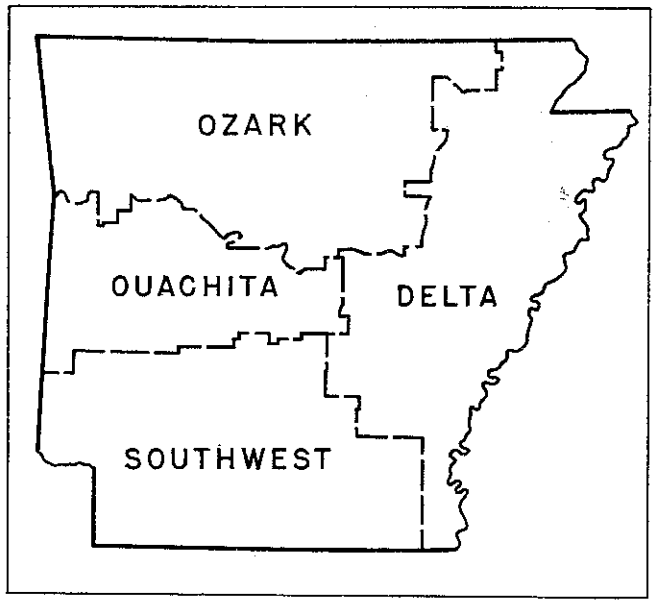
TIMBER SUPPLIES for INDUSTRY in ARKANSAS



United States Department of Agriculture

Forest Service

Forest Resource Report No. 11

SOUTHERN FOREST EXPERIMENT STATION

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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST RESOURCE REPORT NO. 11 AUGUST 1956

Timber Supplies for Industry in Arkansas

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SOUTHERN FOREST EXPERIMENT STATION
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Preface

THIS IS ONE of a series of State reports on the nationwide Forest Survey being conducted by the Forest Service, U. S. Department of Agriculture. It is primarily the product of the new Forest survey of Arkansas, completed in 1951, but it also draws on the first Forest Survey of 1934–36 to show changes in forest conditions during the intervening years. The initial inventory included the southwest, Ouachita, and Delta regions; the Ozark region was not covered by the first Forest Survey.

It is hoped that this publication will contribute toward a better understanding of Arkansas' timber economy and toward wiser use of the forest.

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Highlights of the Timber Situation

ARKANSAS' ECONOMY depends heavily upon the State's forest resource. In value added by manufacture, wood-using industries far outrank all others; they also furnish a livelihood for almost half of all employees engaged in manufacturing.

Primary wood-using enterprises include more than 1,000 sawmills and nearly 200 nonlumber establishments—pulp mills, veneer plants, and others. There are many remanufacturing plants such as the furniture factories at Little Rock and Fort Smith.

The forests that feed this huge industry cover 19 million acres—nearly six-tenths of the State's land area. The proportion of commercial forest is highest, 71 percent, in the southwest (fig. 1). Widespread

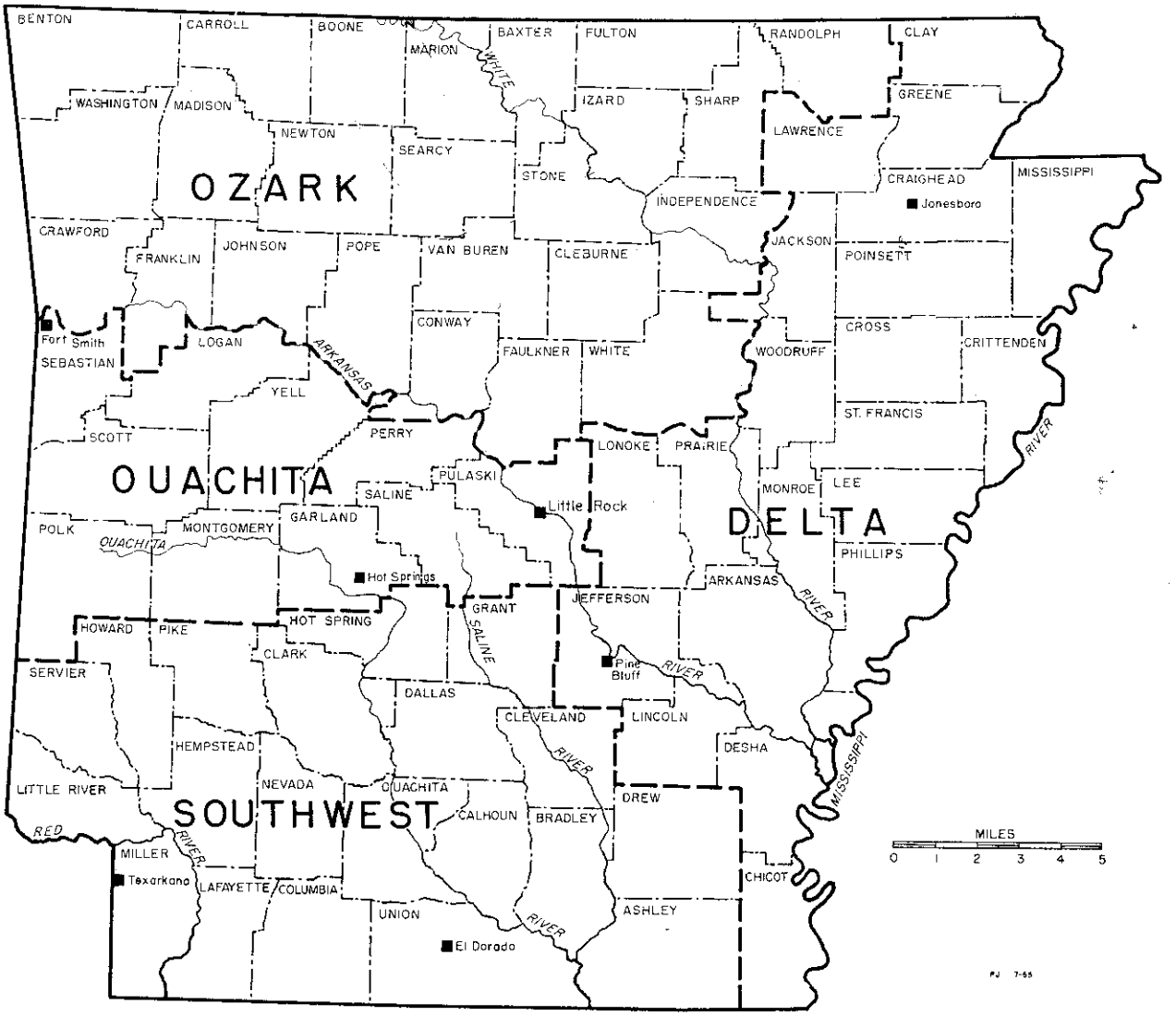

FIGURE 1.—*Forest Survey regions in Arkansas.*

land clearing for agriculture has left the Delta the least forested—only 37 percent. Private owners hold 85 percent of the forest land.

The sawtimber supply on commercial forest land amounts to 37 billion board-feet. Volume in all merchantable trees 5 inches and larger in diameter is 11 billion cubic feet, of which two-fifths is southern pine.

Although timber now appears to be growing faster than it is being cut, the total volume in the resurveyed part of Arkansas is less than in 1935. The trees are also of smaller average size. The inventory shrinkage is due partly to heavy cutting during and since World War II and partly to land clearing in the Delta region.

The forests of the Delta, largely hardwood, contain 7.2 billion board-feet of sawtimber—22 percent less than in 1935. The forested area also decreased about one-fifth.

The Ouachita Mountains have 5.9 billion board-feet of sawtimber, about two-thirds pine. This is 6 percent less than at the time of the first survey. Liquidation of old-growth pine accounted for much of the decline. The volume of all pines 5 inches and larger in diameter dropped 4 percent, whereas volume in hardwoods, especially small ones, increased considerably. The increase in the proportion of hardwoods is largely undesirable because pine in the Ouachitas is the more valuable tree.

In southwest Arkansas, pine sawtimber totals 11.3 billion board-feet, and hardwood 6.9 billion board-feet. The volume of all pines 5 inches and larger in diameter is 8 percent less than in 1936, while volume in hardwoods has increased 3 percent. Although southwest Arkansas has less pine than in 1936, substantial forestry gains have been made in part of the region. In a 7-county area where almost half the forest is in large industrial holdings, there is 33 percent more pine sawtimber than in 1936.

On big industrial holdings—mainly in southwest Arkansas—and on public lands forest productivity has been much improved during the past 20 years. These achievements have not yet been paralleled on the small forest holdings that make up the bulk of the commercial timberland. The findings of the Forest Survey indicate the need for wider application of basic remedies—better fire control, timber stand improvement, planting, and improved timber utilization.

The Place of Forests in Arkansas' Econony

WITH CLOSE TO three-fifths of Arkansas' land area in forest, it is not surprising that timber and timber-using industries are important to the State's economy. Timber manufacture has been a leading branch of industry from the time of the first formal record. Many communities began as sawmill towns.

The forest-based industries of the State are of two broad kinds. Primary manufacturing plants take logs and bolts direct from the forest and produce first-step items such as lumber, veneer, and pulp. Secondary or remanufacturing industries convert initial products into furniture, flooring, paper, and other items. There is a growing tendency for primary plants to extend operations into remanufacture. Some of the more frequent conbinations include paper and bag plants attached to pulp mills, flooring plants to sawmills, and container plants to veneer mills.

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FIGURE 2.—*Timber harvesting provides many jobs.*

Timber Is a Leading Source of Wealth

The value of raw timber (logs, bolts, and other round or split products) cut in Arkansas for domestic use and sale was about $82 million in 1950. Sawlogs for lumber are by far the most important. Fuelwood ranks second in total value; although most fuelwood is not sold for cash, living costs of many low-income rural families would be greatly increased without it. Pulpwood, which is third in total value, considerably exceeds fuelwood in terms of cash income.

Manufacturing within the State creates additional millions of dollars in value. According to the Census,[1] value added by manufacture in forest-based industries—lumber, paper, furniture—amounted to $121 million in 1950. These industries, entirely or partly dependent upon the timber resource for raw material, made up 38 percent of the total value added by manufacture in the State and provided jobs for 47 percent of all employees engaged in manufacturing (fig. 2).

[1] United States Bureau of the Census. Annual survey of manufactures: 1949 and 1950. 182 pp., illus. 1952.

Nontimber Values Are Important

This report is primarily concerned with the forest as a source of timber for industry. But the contribution of Arkansas' forests to other values—water, wildlife, and recreation—though not easily expressed in monetary terms, is enormous.

Watershed protection is a paramount aim in the management of the national forests in Arkansas, since

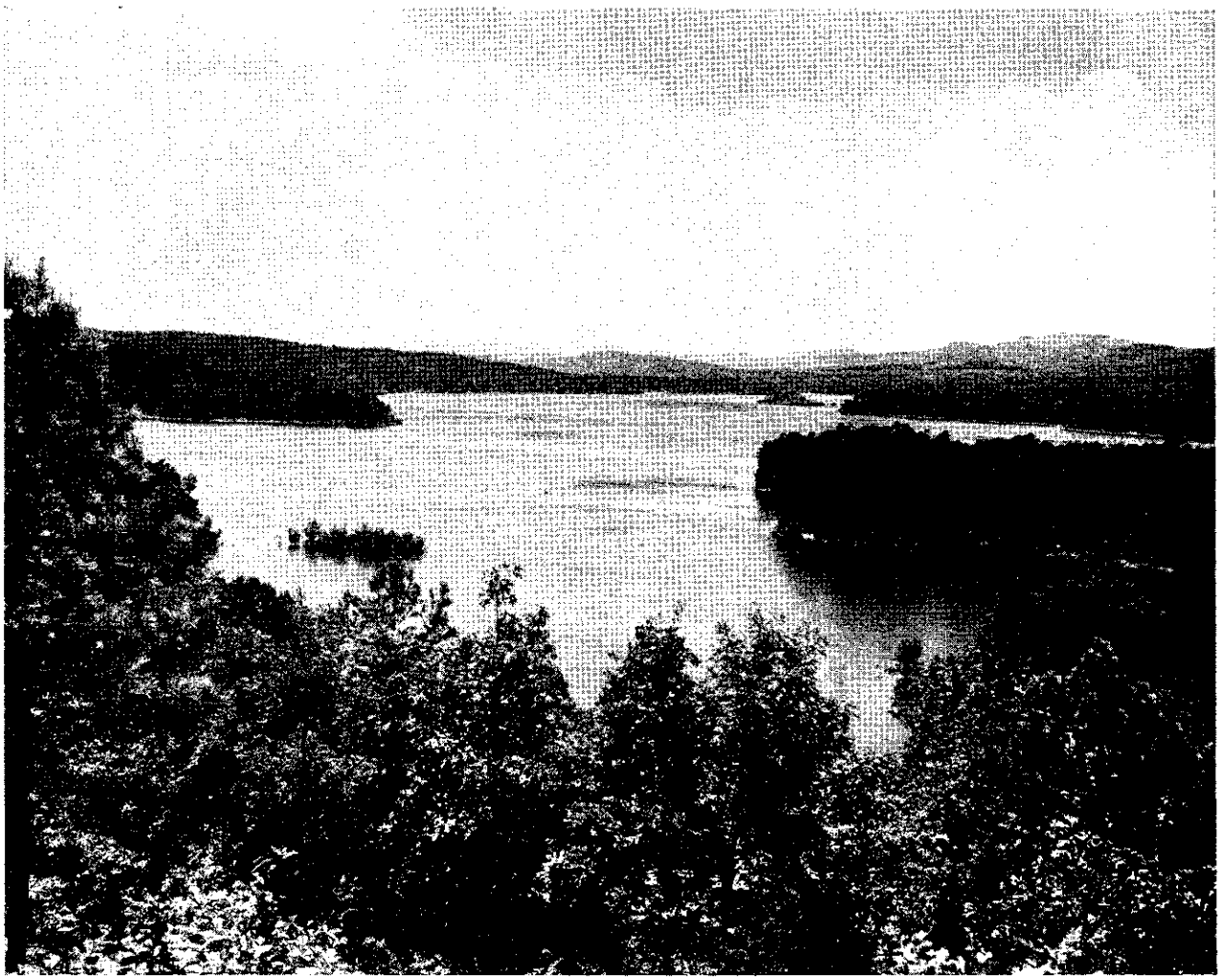

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FIGURE 3.—*The forested watershed of Lake Winona supplies clear water for Little Rock.*

water is a major resource. Maintaining good vegetative cover (mainly trees) on the watersheds reduces flood crests and helps to provide a steady flow of clean water for the streams they feed. Many Arkansas cities obtain water from forested watersheds (fig. 3). Little Rock, the State capital, depends upon the Ouachita National Forest for its water for both domestic and industrial use. Arkansas' second largest city, Fort Smith, depends on the Ozark National Forest. Water from forest lands is becoming increasingly important as industry and urban populations expand.

The recreation industry depends heavily upon the scenic attractions of Arkansas' mountain forests and streams to draw thousands of tourists annually. A few statistics indicate the magnitude of this forest use. In 1951, the national forests attracted about 530,000 visitors, Hot Springs National Park had 300,000, and the seven State parks drew more than 660,000. Numerous privately owned resorts benefit from the dollars spent by forest visitors.

The abundance of many wildlife species hinges upon the maintenance of suitable forest habitat. Sportsmen in Arkansas spend some $900,000 a year for hunting licenses and other fees. Many people depend upon trapping for part of their income; the annual fur catch is worth close to a million dollars.[2]

[2] Arkansas Game and Fish Commission. A survey of Arkansas game. Ark. Game and Fish Com., Federal Aid Pub. Proj. 11-R, 155 pp., illus. 1951.

Timber Use in Arkansas

ARKANSAS' PRIMARY wood-using plants range in size from 2 multimillion-dollar pulp mills to more than 1,000 portable sawmills, some of which represent investments of only a few thousand dollars. Nearly 200 nonlumber establishments are scattered over the State. There are also a half dozen plants that treat wood products with chemical preservatives.

Timber utilization alternatives in Arkansas are legion. Pines are cut into yard lumber, poles, piling, mine props, and fence posts. And, of course, large quantities are pulped for kraft paper. Hardwoods are processed into standard factory lumber, railroad crossties, structural timbers, package veneer, bourbon barrel staves, slack barrel staves, and handle stock. Also produced is a host of lesser items such as furniture squares, excelsior, ski blanks, cedar lumber, shuttle blocks, gunstock blanks, and charcoal.

A large additional amount of wood never gets into commerce but is cut and used on the farm for fuel, posts, and round timbers.

Lumber the Major Industry

Lumber has long been—and still remains—Arkansas' leading forest product. Sawlogs make up about half of the State's annual timber output. Though hardwood production was sharply stimulated by strong markets during the past decade, pine output still exceeds hardwood.

The lumber industry began its rapid growth in the 1880's, when the building of railroads opened up national markets. Peak output was reached in 1909—in this year more than 2 billion board-feet were manufactured. Thereafter, production declined slowly but steadily until the middle thirties. By then the bulk of the original timber had been cut, and second growth was rapidly becoming important. Since the thirties, production has climbed and is now about 900 million board-feet annually (fig. 4).

Roughly two-fifths of the State's lumber output comes from large mills—those cutting at least 5 million board-feet in a single year. Several of the biggest

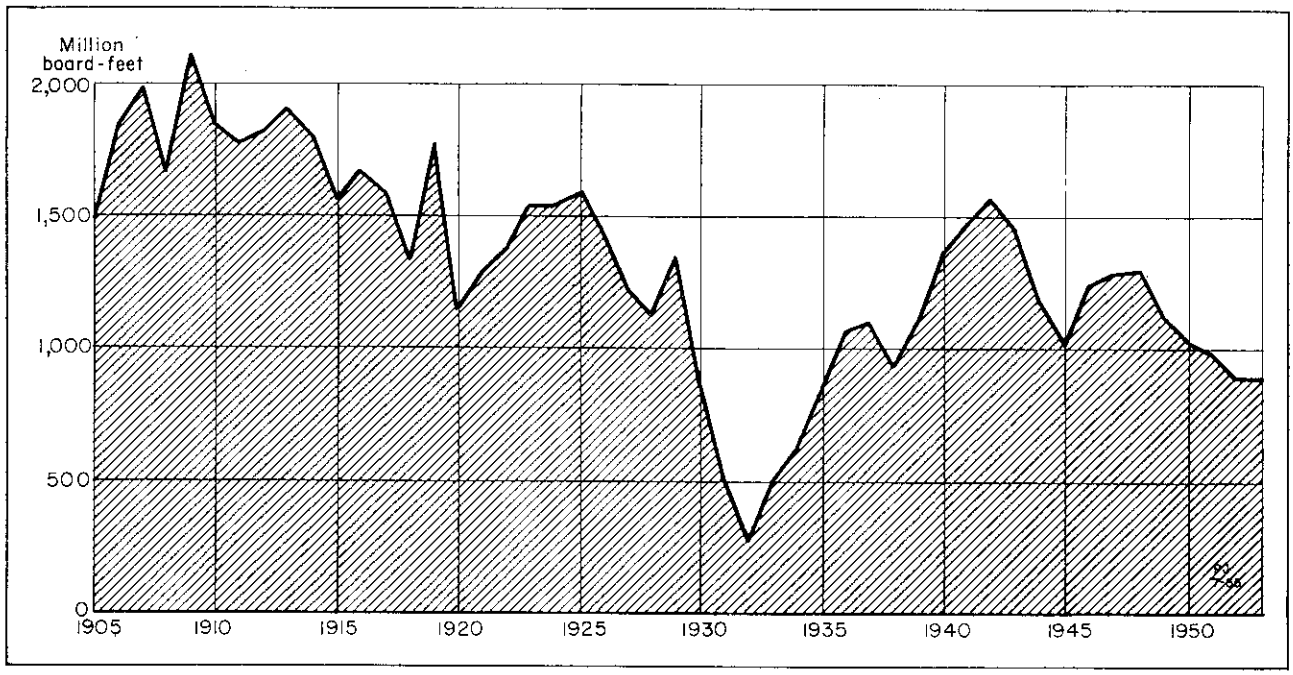

FIGURE 4.—*Lumber production in Arkansas, 1905–53.*

mills in this class cut more than 10 million board-feet annually. Many large mills are backed by extensive forest holdings to insure part, if not all, of their timber needs (fig. 5). These mills are situated principally in the southern half of the State; small mills are the rule in the northern half.

The big rise in the number of small sawmills in Arkansas began with the virtual exhaustion of virgin timber. Small mills generally buy standing timber or logs from owners of small woodlands. These mills work in smaller and lighter timber stands than do large mills (fig. 6) and not uncommonly are moved to each tract cut, though sometimes logs are hauled from woodlot to mill by truck. Many small mills employ farm labor during slack crop seasons and frequently operate only part of the year. Because they own little timberland and because their capital investment is low, the operators seldom have much interest in improved forest practices.

Arkansas' small mills will no doubt continue to be numerous and locally important. But they face increasing competition for pine stumpage, especially from the expanding pulpwood industry. To a considerable extent, the same tree sizes are used by both small sawmills and pulp mills.[3] An increasing proportion of the State's lumber output is also likely to come from the larger mills whose forests are being built up under planned management.

Pulpwood Cut Reaches New High

Pulpwood production in Arkansas, which until 1952 had been fairly stable for over a decade, reached a new high in 1953 and again in 1954 (fig. 7). In addition to the record harvest of 826 thousand cords of rough roundwood in 1954, more than 20 thousand cords of pulp chips were produced from wood residues—chiefly sawmill slabs and edgings. Most of the pulpwood is processed by the State's two pulp mills at Camden and Crossett (fig. 8). The rest is exported, mainly to mills in north Louisiana.

Some expansion of pulping facilities in Arkansas and nearby areas has recently taken place and further

[3] Sternitzke, Herbert S., and James, Lee M. Arkansas timber stands before and after cutting. U. S. Forest Serv., South. Forest Expt. Sta., Forest Survey Release 67. 15 pp., illus. 1951. [Processed.]

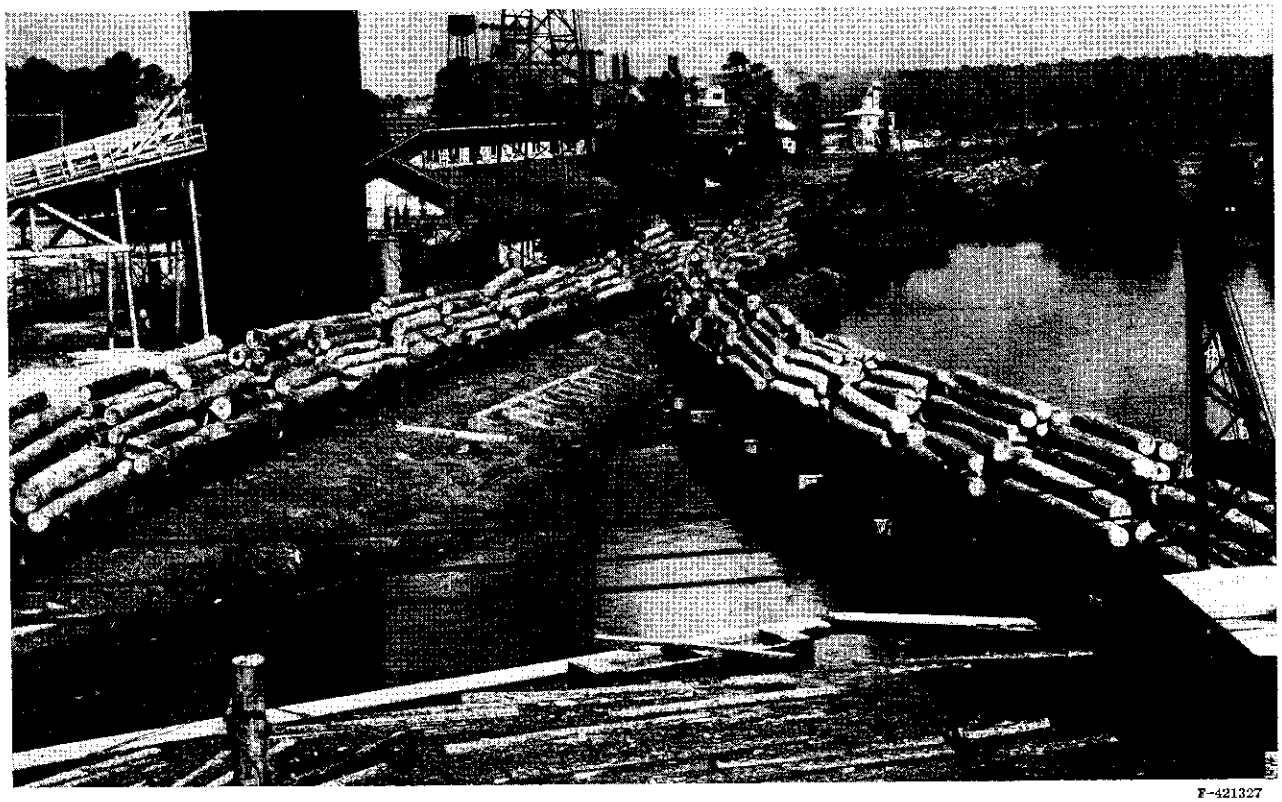

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FIGURE 5.—*Many large sawmills are backed by forests that assure a steady supply of logs.*

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FIGURE 6.—*Portable sawmills produce much of Arkansas' lumber.*

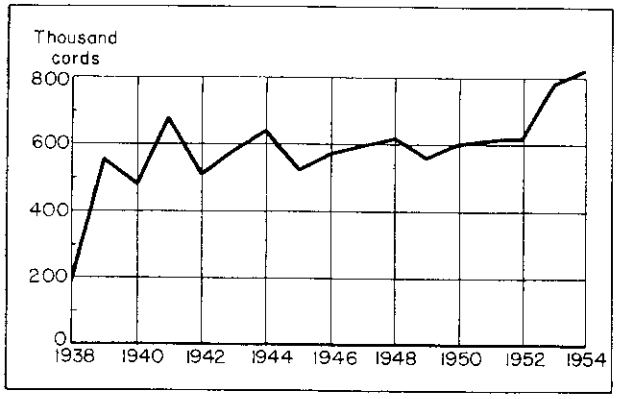

FIGURE 7.—*Pulpwood production in Arkansas, 1938–54.*

increases are in prospect. This expansion will increase the demand for softwood growing stock, i. e., pines now or prospectively suitable for lumber products as well as pulpwood. But somewhat wider use is being made of hardwoods, of which there is a plentiful supply. The amount of hardwood cut for pulp has gradually increased from 50 thousand cords in 1948 to 100 thousand cords in 1954. Today hardwood accounts for more than a tenth of all pulpwood. Output will increase further when a new mill at Crossett begins pulping hardwood by semichemical processes.

Development of efficient mechanical log barkers and slab chippers for converting sawmill residues into chips has opened up new sources of low-cost raw material for the industry. The amount of pulpable residue from Arkansas' large pine sawmills is estimated at 100 thousand cords annually. At least 9 sawmills in Arkansas have installed equipment for making pulp chips from their residues, and more installations seem certain in the near future.

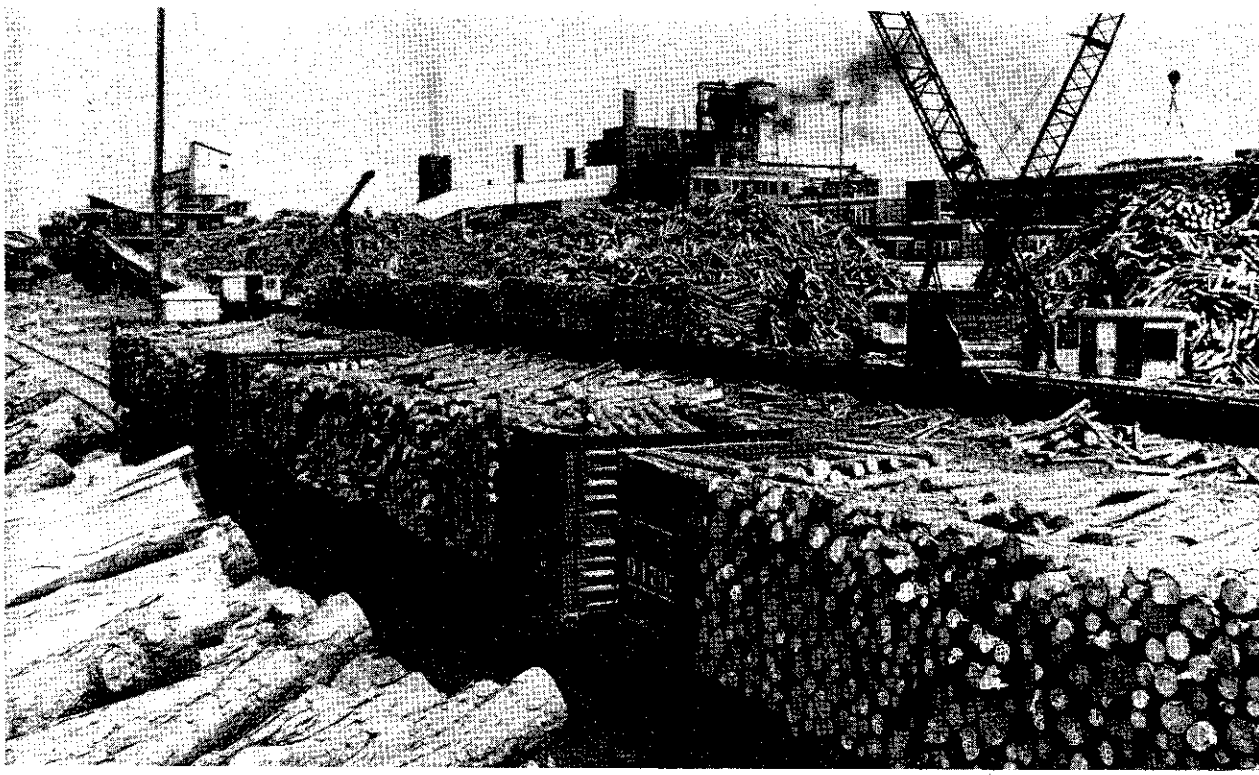

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FIGURE 8.—*Pulpwood is a major claimant of Arkansas timber.*

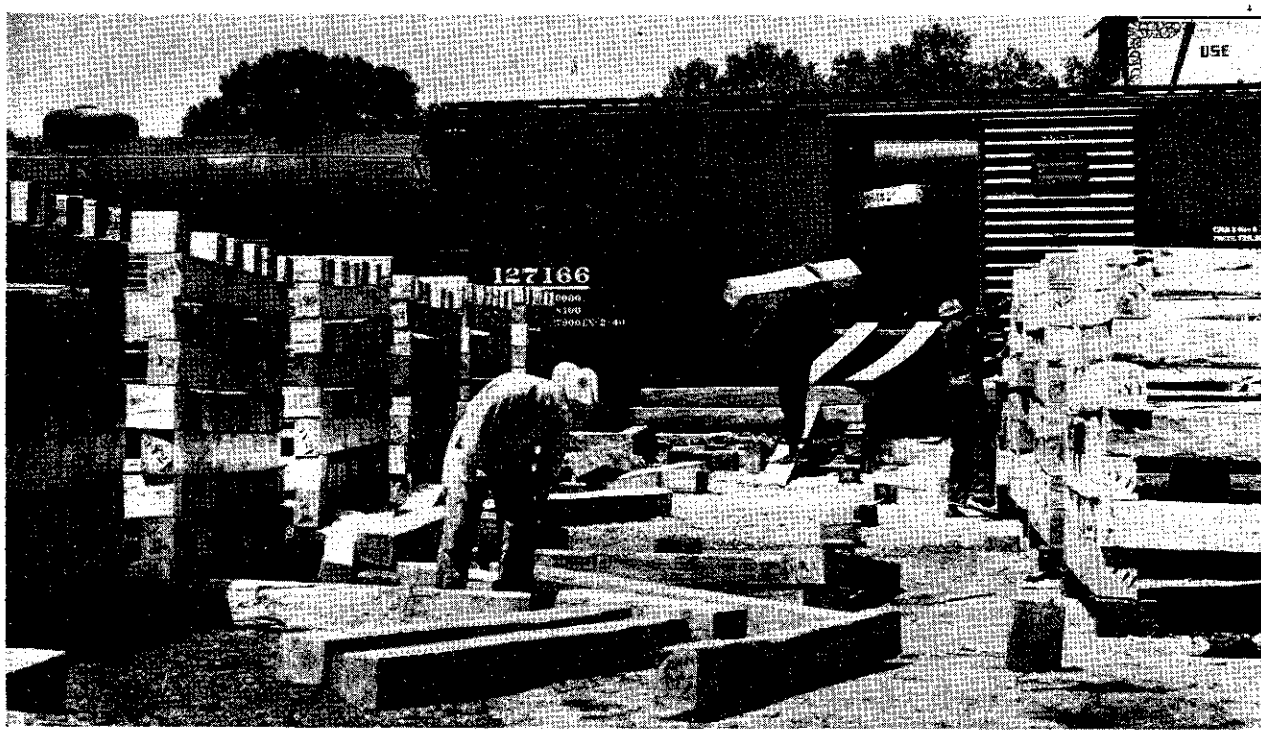

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FIGURE 9.—*These hewn pine and gum ties were cut by farmers in their spare time.*

Specialty Products Are Locally Important

Industrial wood other than lumber and pulpwood—veneer logs, cooperage bolts, handle-stock bolts, and the like—make up about one-tenth of Arkansas' timber production. Individually none of these items accounts for more than 2 percent of the annual timber output. But in many small communities, their harvest and manufacture are important sources of local employment and forest-owner income (fig. 9).

Most specialty products are made in small plants whose mainstay is stumpage from farm woodlands and other small tracts (fig. 10). Handle-stock plants are most common in the Delta and southwestern parts of the State (fig. 11), where the principal supplies of hickory and ash are found. The distribution of cooperage plants is governed by the supplies of white oak in the manufacture of tight cooperage and of certain other species, notably sweetgum, for slack cooperage. The veneer plants are situated conveniently to soft-textured hardwoods, particularly the gums, which are most in demand for package veneers.

The outlook for Arkansas' leading specialty products—tight cooperage, package veneer, hewn ties, and handle stock—cannot be readily forecast. But it is apparent that these items compete continuously with other products. Other types of containers have replaced many traditional uses of tight barrels; the paperboard carton offers keen competition to the veneer package; sawn ties have absorbed most of the hewn tie market; and increased use of power tools has affected the demand for wooden handles.

Volume of Farm-Use Products is Large

Fuelwood, fence posts, and miscellaneous farm timbers account for at least a quarter of Arkansas' timber output.

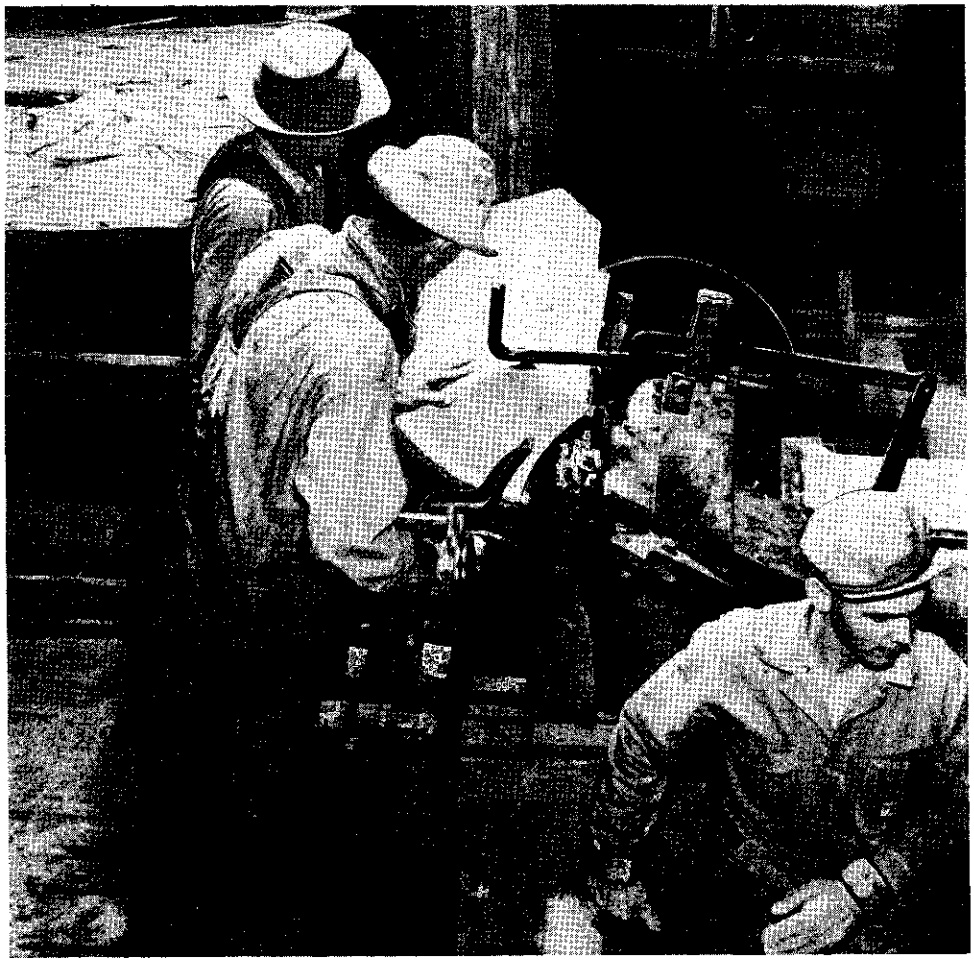

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FIGURE 10.—*White oak staves, here being cut on a barrel saw, are a leading specialty product in the Ozark Mountains.*

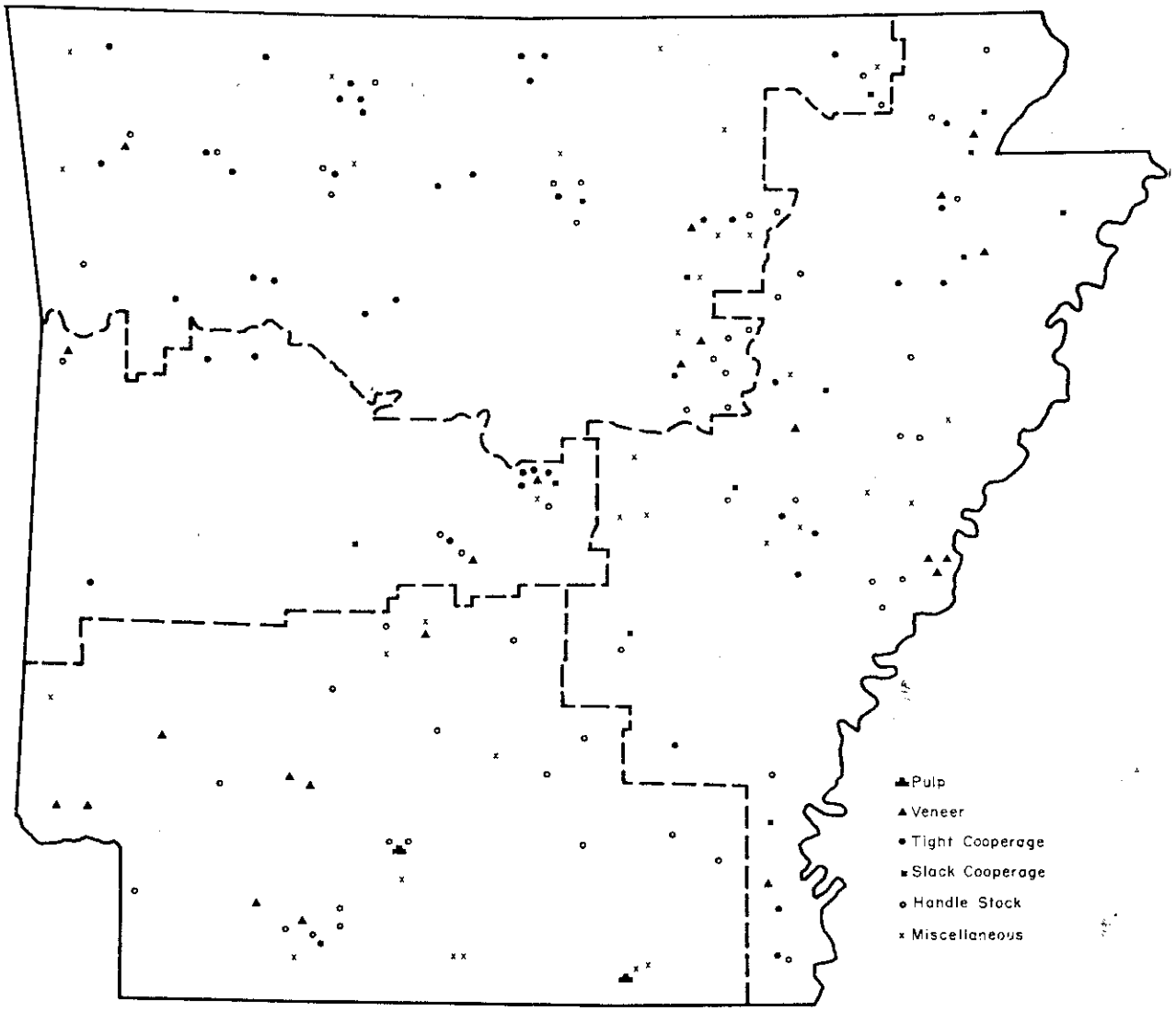

FIGURE 11.—*Distribution of primary wood-using plants, other than sawmills.*

Wood for fuel makes up the bulk of this volume, though its use is decreasing. In the late 1930's, for example, fuelwood production was close to 3 million cords annually; by 1948 it had dropped to less than 1.5 million. Greater use of oil and gas is cutting deeply into the traditional use of wood for cooking and heating on the farm. A sizeable amount of the fuelwood, about one-third, comes from timber that is of little value for industrial products—dead trees, tops of trees cut for other uses, limby and rotten trees.

The Forest Resource

THE STABILITY OF the wood-using industry depends largely upon the condition of the forest resource. Arkansas' long history of land clearing and commercial lumbering has had a tremendous influence on the forest. In the next section, resource trends will be discussed. Here, only the present forests are considered.

Almost Three-Fifths of the State is Forest

In its forest conditions, Arkansas is a State of great contrasts. Topography and soil are mainly responsible, and these range from low river bottoms, regularly subject to flooding, to high, exposed, and rocky slopes and ridges of the Ouachita and Ozark Mountains. On the basis of these differences, the State's 19 million acres of forest [4]—57 percent of the land area—may be broadly divided into four regions: the Delta, comprising the present and former flood plain of the Mississippi River; the southwestern part of the State, lying principally on the Coastal Plain; the Ouachita Mountains; and the Ozark Mountains.

The Delta is generally flat except for some of the older and higher terraces (former flood plains). Because of the Delta's fertile soils a higher proportion of land has been cleared for agriculture in this area than in the rest of the State. Only 37 percent remains forested. The forests now occur on the lower lying, more poorly drained areas; on the batture, or the land situated between the levee and the river and therefore subject to flooding; and on the backwater area adjacent to the junctions of the White River and the Arkansas and the Arkansas and the Mississippi, where prolonged flooding regularly occurs. The forests of the Delta are composed entirely of hardwoods (fig. 12) and cypress, except that pine is found on some of the older terraces.

In southwest Arkansas, the topography ranges from level to rough, but is generally rolling. The region has large areas of low agricultural productivity, and 71 percent of the land is forested. Loblolly and shortleaf pines, usually in mixture with hardwoods, are found on three-fifths of the forested area, with loblolly pine most abundant toward the south (fig. 13). Bottom-land hardwoods occur rather extensively along the Ouachita, Red, and Saline Rivers, and are also found on many widely scattered, smaller stream bottoms. Upland hardwood forests occur for the most part only locally.[5]

The Ouachita Mountains fan out westward from Little Rock, with the Arkansas River forming a north boundary. Too rough in many sections for agriculture, the land is 70 percent forested. Shortleaf pine predominates and, in pure stands or in mixture with hardwoods, occurs on seven-tenths of the forested area (fig. 14). Upland hardwood forests occupy most of the remainder and are most extensive in Sebastian, Logan, and Yell Counties. Bottom-land hardwoods comprise a relatively small acreage.

The Ozark Mountain region, situated west of the Delta and north of the Arkansas River, makes up almost one-third of the State. The region, with both rugged mountains and relatively fertile plateaus, is 58 percent forested (fig. 15). Upland hardwoods predominate on four-fifths of the forest. Shortleaf pine has its greatest occurrence in the southeastern part. Redcedar is found locally in the north portion.

Forest Industry is a Major Landowner

Arkansas' forests are mostly privately owned. The ownership of the State's 19 million forest acres has an important bearing on the timber supply.

Twenty percent of the commercial forest land is held by forest industry, chiefly large lumber and pulp

[4] For detailed statistics on forest acreage—as well as on timber volume, growth, and cut—see *Forest Statistics for Arkansas.* U. S. Forest Serv., South. Forest Expt. Sta. Forest Survey Release 71, 50 pp. 1953. [Processed.]

[5] See map following page 31 for areas characterized by major forest types.

FIGURE 12.—*Nearly half of Arkansas' big hardwoods are concentrated in the Delta.* F-350894

FIGURE 13.—*Southwest Arkansas has the fastest growing pine stands in the State.* F-421351

FIGURE 14.—*Shortleaf pine is the most important timber species in the Ouachita Mountains.* F-426763

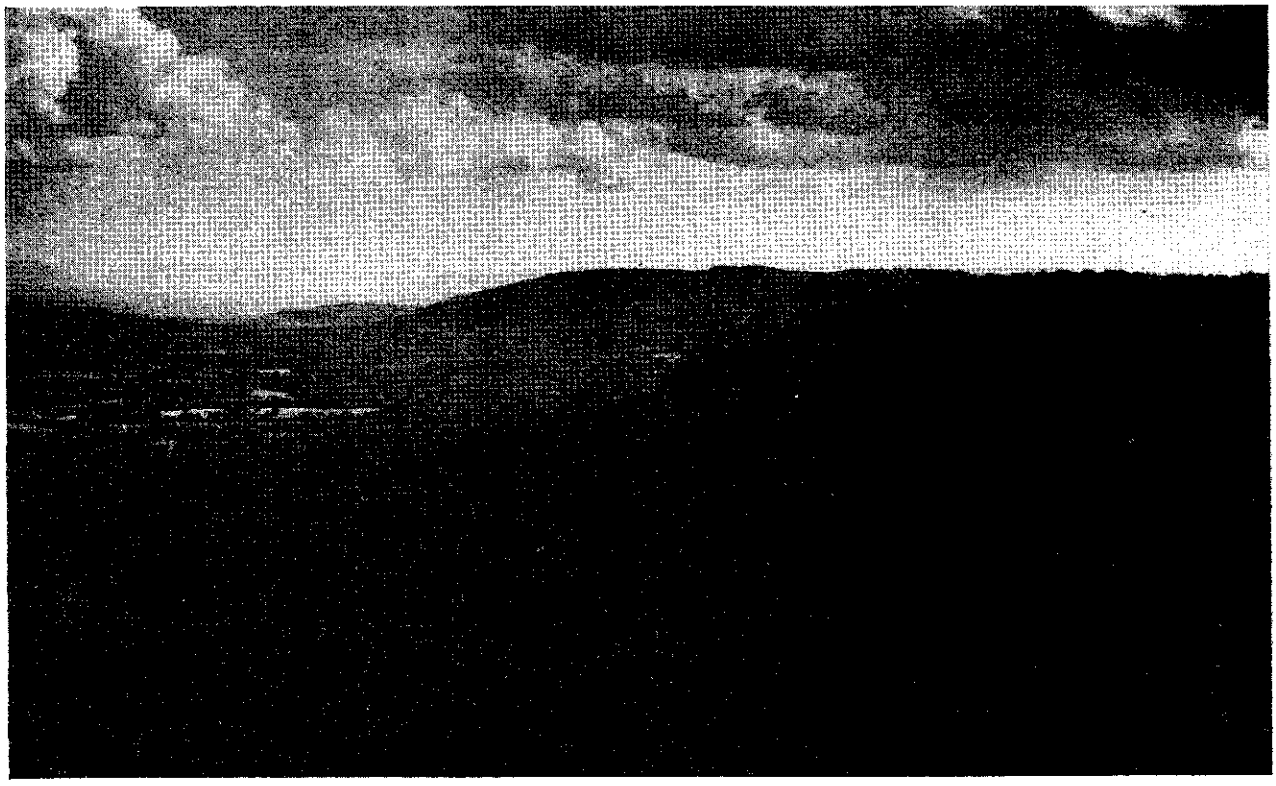

FIGURE 15.—*Ozark forests are chiefly hardwoods; the region is famous for its white oak timber.* F-478622

companies. These holdings are concentrated in the southwest region; to a lesser extent they are found in the Ouachita Mountains and the Delta. Because of their heavy investment in fixed plant and their need for a steady flow of raw material, the big industrial companies generally practice a high caliber of timber management on their holdings. This is especially noticeable in the southwestern pine belt.

The forest holdings of farmers and other nonindustrial private owners—businessmen, professional workers, wage earners, banks, and the like—are important in any discussion of Arkansas' timber supplies. Most of these holdings are of small size, but all together they make up about 65 percent of the commercial forest land. Although they still supply much of the timber used by forest industries, by and large they fall far below their income-producing potential. Improving forest productivity on these heterogeneous ownerships offers a big opportunity for increasing the timber supply. In recent years the Arkansas State Forestry Commission has added forest-management and timber-marketing assistance to its services to help farmers and other small landowners improve their forest practices. But much educational work remains to be done.

Publicly owned forest totals almost 3 million acres—15 percent of the commercial forest acreage. The bulk of this is in national forest. The establishment of the present Ouachita and Ozark National Forests, in 1907 and 1908, was the first concrete step toward assurance of future timber crops in Arkansas.

One-Fourth of All Timber Has Little Value

All-timber volume in Arkansas amounts to 15 billion cubic feet in trees 5 inches in diameter at breast height and larger. But in terms of sound, well-formed trees called growing stock,[6] this volume reduces to 11 billion cubic feet. The rest is largely in very crooked, limby, or rotten trees, termed culls. Though products like fuelwood, fence posts, or pulpwood can sometimes be profitably cut from culls, such trees are for the most part of little commercial use by present standards. The main source of the timber cut in Arkansas is the 6 billion cubic feet (37 billion board-feet) of logs in sawtimber trees; smaller trees are mainly a reserve pool for the future sawlog supply.

[6] The technical and uncommon terms used in this report, as well as certain common terms given special meaning, are defined in the Appendix.

Southwest Arkansas Has Bulk of Pine Sawtimber

Almost half of Arkansas' 37 billion board-feet [7] of standing sawtimber is softwood, mainly southern pine. Of the hardwoods, oak, gum, and hickory are the most common. Pine sawtimber is heavily concentrated in southwest Arkansas (fig. 16). Hardwood is most abundant in the Delta and the southwest.

The usefulness of the sawtimber resource for industrial purposes depends upon its quality. To measure the quality of Arkansas' sawtimber, hardwoods were inventoried by log grade and softwoods by tree grade.

Less than 5.3 billion board-feet, scarcely a quarter of the hardwood sawtimber, is in good-quality logs—that is, logs which are of grade 1 and 2 and which on the average yield at least 40 percent of their net volume in No. 1 Common or better lumber. Thus, the great bulk of the hardwood resource, nearly 14.8 billion board-feet, is of a quality below that generally preferred by saw and veneer mills and is of little immediate use to these industries.

Because sawtimber quality as expressed by log grade is related to tree size, the proportion of good-quality logs mounts rapidly with increasing tree diameter. In hardwoods 20 inches in d. b. h. and larger, for example, more than three-fifths of the volume is in good-quality logs; in 14- to 18-inch trees, about one-fifth. But in the 12-inch class, virtually all of the volume is in low-grade logs. As the trees grow in size, however, many of the lower quality logs will improve in grade. The great volume now in hard-

[7] All figures of board-foot volume in this report are net volume by the International ¼-inch log rule.

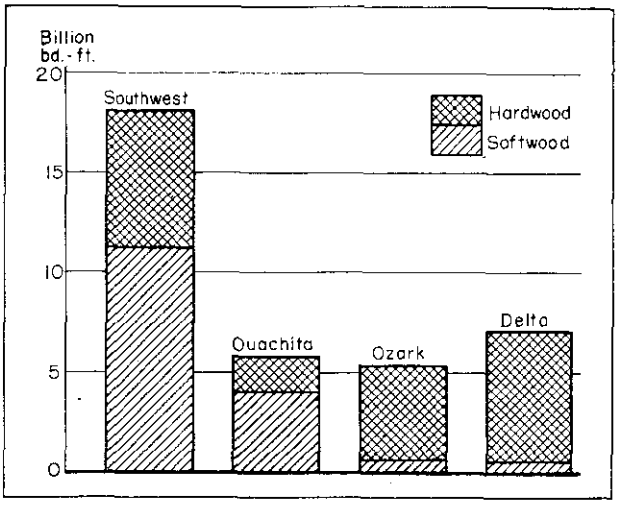

FIGURE 16.—*Sawtimber volume by survey region.*

woods of small diameter will provide the high-quality volume of the future if permitted to grow. Among softwoods, much the same situation prevails for tree size and quality (table 1).

As noted earlier, big lumber and pulp companies usually follow improved forest practices on their holdings. It is not surprising, therefore, that there is a much heavier concentration of sawtimber on these properties than on other private holdings. Within the State's southwestern region, sawtimber volume averages more than 4,500 board-feet per acre on large forest-industry holdings as compared to 2,100 board-feet on all other private ownerships. For the entire State the contrast is even sharper: almost 4,200 board-feet per acre as compared to less than 1,500. The extensive nonindustrial holdings could supply much more timber for industry from year to year if they supported heavier stands of sawtimber.

About 75 percent of Arkansas' sawlog supply is concentrated in stands containing enough volume—at least 1,500 board-feet per acre—to be generally operable for commercial timber products. Over the State, these sawtimber stands occupy one-third of the forest land. In the Ozarks, where the forests are most heavily depleted and slowest to revive after cutting, only 17 percent of the forest acreage is in sawtimber. But in southwest Arkansas, where good forest management is more common, 49 percent of the stands are sawtimber—the highest proportion for any region.

Immature stands, in which most of the trees are below sawlog-size, predominate in all regions. To a large extent the future of Arkansas' timber economy hinges upon the treatment given these young-growth areas. With the necessary protection from wildfire and premature harvesting, they will provide a greatly increased sawtimber resource. This resource can be the basis for an even larger wood-using industry in the State than at present.

Considering good trees of all sizes, including established seedlings, slightly more than half of Arkansas' timber stands are well stocked (fig. 17). Many of the trees, however, are still too small to be of much commercial use, and the volume and quality in sawtimber trees is much less than it could be under good forest management. Over the State, the loblolly-shortleaf pine type is the best stocked; upland hardwoods, the poorest. As fire protection is further improved and extended, the acreage of well-stocked forest will probably increase considerably—the thrifty young growth now springing up on millions of acres will have a much better chance of survival.

But more effective use of growing space is also impeded by large numbers of rough and rotten cull hardwoods, many of which are the product of past fires. About one in every five trees of poletimber size and larger is a cull. The Ozarks, which has the highest proportion of upland hardwood stands and the poorest stocking, also has the greatest proportion of culls—one in every three trees. Similarly, the better stocking and the higher proportion of pines in the Ouachitas are reflected in the lower proportion of culls—less than one tree in six. Reducing the number of cull hardwoods, by utilizing or by deadening them, will go a long way toward helping Arkansas' forests to produce more merchantable volume than they are currently growing.

TABLE 1.—*Sawtimber volume by softwood tree grade, hardwood log grade, and tree diameter, 1948–51*

Species group and d. b. h. class (inches)	All grades	Grade 1	Grade 2	Lower grades
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*
Softwood:				
10 to 12	7,184.7	640.0	1,498.4	5,046.3
14 to 18	7,799.1	1,948.9	2,470.2	3,380.0
20 and up	1,791.6	700.0	503.1	588.5
Total	16,775.4	3,288.9	4,471.7	9,014.8
Hardwood:				
12	4,042.8	----	2.3	4,040.5
14 to 18	10,726.0	52.3	1,872.7	8,801.0
20 and up	5,254.4	1,435.7	1,896.7	1,922.0
Total	20,023.2	1,488.0	3,771.7	14,763.5
All classes	36,798.6	4,776.9	8,243.4	23,778.3

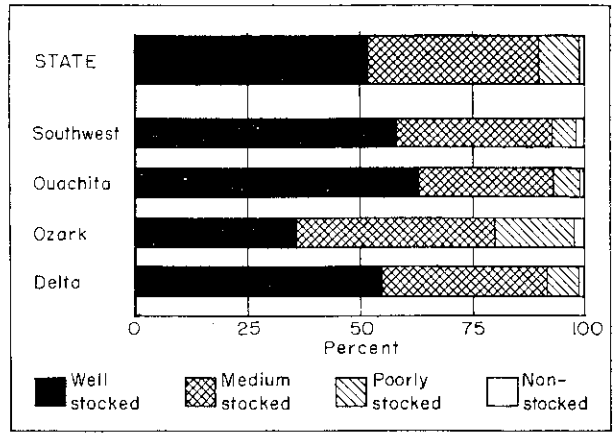

FIGURE 17.—*Tree stocking in commercial forests by survey region.*

Growth Exceeds Timber Cut

The forests of Arkansas now appear to be growing more timber, both pine and hardwood, than is being cut. Because many timber stands are not fully stocked, however, growth is still only about half the potential yield. Some of the problems spotlighted earlier—cutting practices on small holdings, wildfire, and cull hardwoods—are among the obstacles to attaining fully productive forests.

In 1952, when the latest cutting statistics were compiled, logging removed 380 million cubic feet, including 1.6 billion board-feet of sawtimber. By contrast, net annual growth amounted to 573 million cubic feet, including 2.3 billion board-feet of sawtimber (fig. 18). This suggests that a turning point may have been reached, and that forest productivity has begun to improve. If so, the improvement has been recent, for comparison with the initial forest inventory shows that the timber supply declined in the years 1934–51.

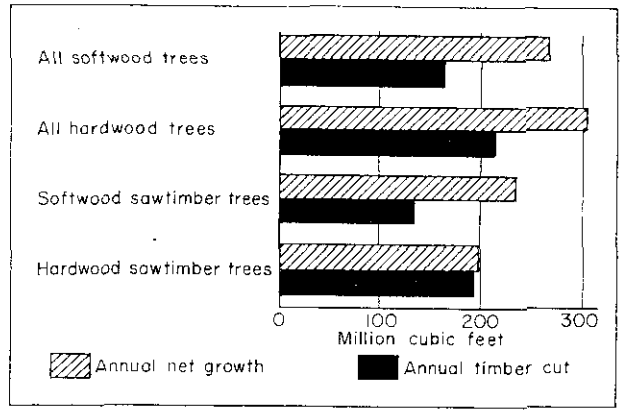

FIGURE 18.—*Relationship of growth to annual cut of growing stock.*

Forest Resource Changes: 1934-51

THE FORESTS OF the southwest, Ouachita, and Delta regions, which include more than two-thirds of Arkansas' forest land area, were initially surveyed in the mid-1930's. A resurvey was completed in 1951.

During the interval between surveys, reversion to forest on abandoned upland farms was somewhat overbalanced by extensive land clearing on the fertile alluvial soils. The shift to greater agricultural use of lowlands has been evident in much of the South during the past two decades.

In Arkansas' uplands, hardwood and mixed pine-hardwood acreage increased at the expense of pine acreage. This hardwood expansion reflects to a considerable extent the effect of cutting practices that removed only the preferred pine and left the hardwood. Development of residual hardwoods in pine-hardwood mixtures can be readily checked by good forest management, but until recent years this phase of management received little attention.

Throughout the area resurveyed, volume in softwoods (mainly pine) declined, while upland hardwood species gained. In the bottom lands, where hardwoods prevail, timber volume declined in general accord with the big reduction in forest acreage.

The impact of volume changes upon numbers of trees by diameter class is indicated in figure 19. These changes only show the overall shifts that occurred between surveys, i. e., the net effect of accretion of growing stock on some properties and of depletion on others.

It will be noted that among hardwoods there were declines only in the larger sizes, which are in keen demand for factory lumber. In softwoods, only the 2-inch class increased appreciably. Tree size affects marketability less in softwoods than in hardwoods. Even small pines are in ready demand for both lumber and pulpwood.

Southwest Arkansas Provides Contrasts in Forest Practices

The southwestern part contains the only large area in the State where there has been a sizable gain in pine volume since the middle 1930's. This gain seems to be associated with size of ownership and interest in improved management.

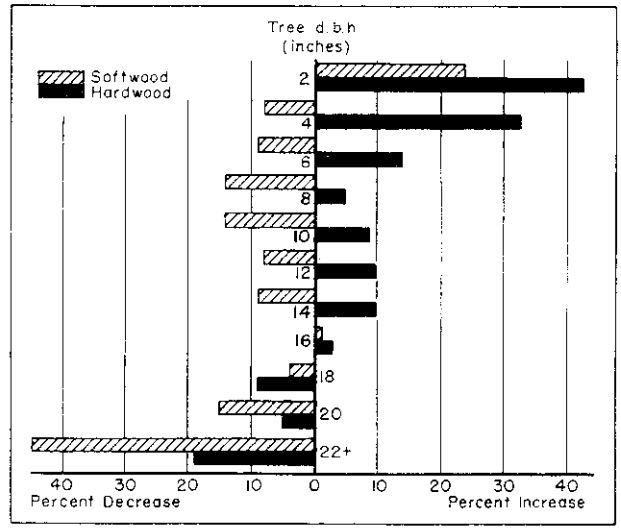

FIGURE 19.—*Change in number of live trees between surveys by diameter class (southwest, Ouachita, and Delta regions).*

Pine sawtimber has increased 33 percent in the area embracing Ashley, Bradley, Calhoun, Cleveland, Dallas, Drew, and Grant Counties—from 4.6 billion board-feet in 1936 to 6.2 billion in 1949. The increase in pine growing stock has been 17 percent.

This 7-county area, flanked by the Mississippi Delta on the east and the Ouachita River on the west, contains 2.4 million acres of commercial forest, predominantly loblolly and shortleaf pines with intermingled upland hardwoods. Nearly all the forest is privately owned, almost half by large lumber and pulp companies that employ professional foresters to manage their lands.

Between 1935 and 1938 most of the large landowners began to make partial cuttings and thinnings (fig. 20). Many also adopted the practice of harvesting less than growth. Timber stand improvement work, which began during World War II, has been undertaken on a large scale since 1945. Planting of open areas and understocked stands has increased in the past 10 years.

The large volume gains in these 7 counties have not been duplicated in the 13-county area directly westward, where the bulk of the forest is on farms or in other small tracts. Heavy cropping reduced pine sawtimber nearly one-fourth during the interval between surveys—from 6½ billion board-feet to 5 billion. Total pine growing stock also dropped about one-

F-350898

FIGURE 20.—*Good thinning practice on the holdings of a large lumber company; the best trees have been left for future growth.*

fourth. Improved management is clearly needed in these 13 counties if the forests are to continue to supply all the wood-using plants that depend on them.

The striking improvement east of the Ouachita River has not been able to reverse trends in the southwest region as a whole. Regionwide, pine decreased in extent and quantity while hardwood increased.

In summary, it appears that most large owners in southwest Arkansas have been improving their management faster than small woodland owners. It is true that the large owners have some advantages in applying good management, so perhaps it is natural that they should have pioneered in cutting conservatively, controlling cull hardwoods, planting denuded areas, and cooperating with the State forester in preventing forest fires. These things are needed on small holdings too, if the owners are to improve timber stocking.

Old-Growth Pine Volume Declines in Ouachitas

In the rugged uplands comprising the Ouachitas, a considerable acreage previously in pine is now of the mixed pine-hardwood type. This change is largely undesirable because pine in the Ouachitas is the more valuable tree. If pine output is to be stepped up, hardwoods must be controlled on areas best suited to pine management.

The effects of hardwood development are apparent in volume changes. Hardwood growing stock increased 14 percent during the interval between surveys; hardwood sawtimber, 7 percent.

In softwoods, the volume changes reflect the gradual liquidation of the old-growth shortleaf pine. There was a decline of nearly 60 percent in the volume of softwoods 20 inches and larger in d. b. h. In 1936, trees of these sizes made up 17 percent of the softwood

sawtimber volume. By 1951, less than 8 percent was in large trees. For poletimber trees, softwood volume increased 10 percent. The net result of these volume shifts was that softwood growing stock registered a 4-percent decline; softwood sawtimber, an 11-percent decline. But if volume in softwoods 20 inches and larger (chiefly old-growth pine) is discounted, softwood trends appear more favorable. Growing stock volume in softwoods below the 20-inch class increased somewhat and sawtimber volume remained virtually unchanged.

More than half the forest acreage in the Ouachitas is held by large industrial owners and public agencies. In general, these owners are managing their lands so as to build up the stocking of second-growth shortleaf pine (fig. 21). But on most other ownerships there is still an urgent need for big improvements in forest practice.

Delta Forests Shrink

Extensive land clearing for agricultural crops caused a 19-percent drop in the Delta's forest acreage between 1935 and 1950 (fig. 22). The small acreage of upland forests within the Delta survey region increased somewhat. But this increase was overshadowed by a 28-percent decline in bottom-land hardwoods, which make up the bulk of the forest land area.

The big regional shrinkage in forest acreage was paralleled by declines of 17 percent in growing-stock volume and 22 percent in sawtimber volume. Although total volume of merchantable timber has fallen off considerably since 1935, timber stocking has changed but slightly. On a per-acre basis, growing-stock volume increased 3 percent and sawtimber volume declined 4 percent.

F-371415

FIGURE 21.—*Timber production in the Ouachita National Forest is planned to yield about 60 million board-feet annually, mostly shortleaf pine.*

FIGURE 22.—*Widespread land clearing for agricultural crops has heavily reduced forest acreage in the Delta.* (*Arkansas Game and Fish Commission photo.*)

Heavy cutting of Delta hardwoods was stimulated by strong timber markets during and since World War II. Because the big trees have been cut most heavily, the proportion of smaller trees has risen. In terms of volume, the decline in trees 20 inches in d. b. h. and larger was four times the decline for smaller sawtimber.

The Delta region still has ample acreage to grow high-quality hardwoods to meet the needs of dependent wood-using industries. Although stocking in big hardwoods has dropped markedly, the improved stocking in smaller trees offers an opportunity to rebuild the growing stock. Much depends upon the extent to which forest managers favor new growth.

Toward More Productive Forests

DURING THE 17 years between the two Forest Surveys in Arkansas, there was more interest in good forest management than in any previous period. The acreage under fire protection was increased threefold. Much of the industrially owned forest was placed under improved management. Public agencies and some timber operators began making strong efforts to get small landowners to use better cutting practices.

Although much as been accomplished, a great deal remains to be done before Arkansas' timber resource is fully developed—especially on small ownerships. Since these small holdings are an important source of industrial timber, the wood-using industry has a big stake in the kind of management used on them.

Arkansas has an abundance of good forest land, valuable tree species, and a favorable location with respect to Midwest markets. Fuller use of the opportunities offered by the forest resource can contribute much to the economy of the State.

It is beyond the scope of this report to formulate a program for attaining more productive forests, but the findings of the Forest Survey suggest some approaches to a better forest situation.

Build Up the Growing Stock

To build up the timber supply it is essential to hold the harvest of merchantable timber to less than the current growth. But certain other measures are also needed to develop more productive forests in Arkansas.

Reduce timber losses from fire.—Through joint public-private efforts, substantial progress has been made in reducing fire losses during the past 20 years. But forest fires still take a heavy annual toll of timber.

Fire protection on State and private lands is provided by the Arkansas State Forestry Commission. A good many private owners have supplemented this public system with measures of their own. The national forests have a separate protection system. All together, the area under organized protection has gradually been extended to more than 18 million acres and now includes all pine lands. Over the past several years, fire losses have been held to about 1 percent of the area protected.

Some 1 million acres, largely Delta hardwood lands, are still without public protection. And in areas already under organized protection, there is need to strengthen fire-fighting forces so that they can cope with periods of above-average fire hazard.

But efficient fire-control methods alone cannot eliminate serious losses. Full cooperation in fire prevention from local residents is also required. Virtually all forest fires in Arkansas are man-caused—either by carelessness or incendiarism—and are therefore preventable.

Eliminate undesirable hardwoods.—Forest productivity is handicapped by large numbers of cull hardwoods—trees that are unmerchantable because of excessive rot, limbiness, or other defects. Throughout Arkansas' hardwood forests about one in every four trees of poletimber size or larger is a cull. These trees occupy growing space that could more profitably be used by thrifty merchantable growth or by new seedling crops.

On forest lands more valuable for growing pine than hardwood, softwood production is severely limited by the presence of both cull and low-grade hardwoods. Special data collected by the survey in southwest Arkansas show that cull and low-grade hardwoods are well established on over half the growing space of the forested uplands in this region.[8] The hardwood problem on pine lands is not restricted to the southwest region; some other sections of the State have it too. But since a high proportion of Arkansas' pine forests are in the southwest, the State's timber economy is bound to be greatly affected by the way the problem is handled here.

There is no quick and easy way to eliminate the hardwoods. On most of the area, the well-proved techniques of girdling or poisoning can be used (fig.

[8] Reynolds, R. R. Timber stand improvement job in southwest Arkansas. South. Lumberman 183 (2289): 43–45, illus. 1951.

23). Forest research indicates that increased pine growth will repay hardwood reduction costs within 10 years.

Step up forest planting.—Two million acres of forest land in Arkansas are either denuded or thinly stocked with commercial tree species. With adequate protection, stocking on some of this area will soon increase naturally. But it is estimated that on about half of the acreage, planting southern pines offers the most effective way to build up the timber supply within a reasonable period.

More than 100,000 acres of forest plantations have already been established in Arkansas. Current planting-stock production at the State's Bluff City nursery is sufficient to plant about 20,000 acres annually.

Improve Timber Utilization

More effective and complete utilization of Arkansas' timber harvest can contribute to a better forest situation. In some areas it can be the basis for expanding the wood-using industry without increasing the timber cut. This means, first, remanufacturing more primary forest products within the State so as to produce more semifinished or finished items such as furniture parts, flooring, and containers. Second, it calls for making fuller use of the timber that is cut.

Expand remanufacturing industries.—Much rough lumber produced in Arkansas is shipped elsewhere for remanufacture into consumer products. Opportunities for expanding secondary wood-manufacturing industries, which could use more of the rough lumber locally, seem distinctly promising. Some primary manufacturers have undertaken remanufacture of their products. As indicated by the increase in small furniture factories and pallet plants, independent secondary manufacture has expanded, too. But opportunities for carrying wood manufacture to more finished stages in Arkansas appear to be far from realized.

Make fuller use of timber cut.—Since existing timber supplies are far from abundant in some sections of the State, more complete utilization of the timber crop is essential to help in meeting industrial and domestic needs for raw material. A noteworthy example of close timber utilization is the increasing use for pulp of material formerly regarded as waste wood—slabs and edgings from sawmills, veneer cores, and tops of pines cut for lumber (fig. 24).

F-469384

FIGURE 23.—*Young pines grow rapidly when overtopping cull hardwoods are deadened.*

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FIGURE 24.—*Harvesting pulpwood from the tops of trees cut for sawlogs. Such practices conserve the timber supply.*

Full use of the available resource also calls for putting each tree harvested, and each part of each tree, into the products for which it is best suited. This means, for example, that firewood should not be cut from growing stock, and that logs suitable for veneer should not be cut into railway ties. Industrial concerns that employ technical forestry staffs generally do follow the principle of putting timber to its highest economic use. If the small owner would seek the assistance that is available from both the State Forester and some industrial foresters, he, too, could greatly improve his forest income.

Arkansas' Forests and the Future

To a large extent Arkansas' present forests reflect the kind of treatment that they have received. Despite past heavy use, the resource is still substantial. On the other hand, the quality of merchantable timber is low, cull volume is considerable, growth is far below its potential, and softwoods are being replaced on some areas by less desirable hardwoods.

Under conservative timber management the forests could produce twice as much sawtimber as they are currently growing. Considerable progress has already been made on both public and large industrial holdings.

But on the small holdings that make up the bulk of Arkansas' commercial forest land, the problem of attaining good forestry still looms large. Greater emphasis on the measures suggested here—better fire control, timber stand improvement, planting, and improved timber utilization—can help create a more favorable forest situation. In the long run it will mean more jobs and greater economic returns from the forest.

Appendix

The Field Survey and Its Accuracy

Forest Land Area and Timber Volume

THE 1948–51 ESTIMATES of forest acreage and timber volume are based upon a systematic sampling method using a forest-nonforest classification on aerial photographs and on-the-ground measurement of quarter-acre sample plots. In the Delta and Ozark regions, pairs of plots were located every 3 miles on lines 3 miles apart; in the southwest and Ouachita regions the average spacing was 4 miles on lines 3 miles apart.

Accuracy of the estimates may be affected by two types of error. The first type stems from the use of a sample to estimate the whole and from variability of the item being sampled. This type is termed sampling error; it is susceptible to a mathematical evaluation of the probability of error. The second type of error derives from human mistakes in measurement, judgment, arithmetic, or recording, and from limitations of method or equipment. Effects of this second type of error—often referred to as reporting and estimating error—cannot be appraised mathematically, but the Forest Survey constantly attempts to hold such errors to a minimum by proper training and good supervision, and by emphasis on careful work.

Statistical analysis of the data, using random-sampling formulas, indicates a sampling error of 0.4 percent for the State estimate of total forest area, 1.7 percent for total cubic-foot volume, and 2.1 percent for total board-foot volume. However, because a systematic sample is generally more efficient than a random sample of the same size, these estimates of sampling error may be considered as setting an upper limit of error rather than as expressing the actual probability of error.

As the acreage and volumes for the State are broken down by Survey region, county, forest type, species, and other subdivisions of the data, the possibility of error increases and is greatest for the smallest items. The order of this increase is suggested in the following tabulation, which shows the sampling error to which the estimates may be liable on a probability of two chances in three.

Forest area		Cubic volume		Board-foot volume	
Size of area sampled	Maximum sampling error	Volume sampled	Maximum sampling error	Volume sampled	Maximum sampling error
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board-feet*	*Percent*
19,000	0.4	11,000	1.7	36,500	2.1
10,000	.6	5,000	2.5	20,000	2.9
5,000	.8	2,500	3.6	10,000	4.0
2,000	1.2	1,000	5.7	4,000	6.4
500	2.5	300	10.3	1,000	12.7
50	7.9	30	32.7	100	40.3

In computing the changes that took place between 1934–36 and 1948–51, the data from the first Forest Survey were adjusted to make them as closely comparable as possible to data from the second survey. This adjustment was necessary because of certain basic differences between the two sets of data. For example, published estimates from the first survey were based on a total land area of 33,616,000 acres in Arkansas. Since then, more accurate measurement by the U. S. Bureau of the Census has established a revised figure of 33,744,000 acres. Thus, although actual land acreage has changed little, if at all, the estimate of land acreage has increased, affecting forest-area and timber-volume estimates in like proportion. Again, the lower diameter limit for hardwood sawtimber trees was dropped from 13.0 inches d. b. h. on the first survey to 11.0 inches on the second survey, in line with changing utilization practices.

In addition to these major points, a number of procedural differences between the two surveys had to be taken into account. In every case, the data from the first survey were adjusted to conform to the standards of the second survey before change was computed.

The sampling error in the data on change in forest acreage and timber volume cannot be estimated. In the 1934–36 survey, sample plots were spaced one-eighth of a mile apart on lines 10 miles apart. An estimate of sampling error was not made. However,

the error in the estimate of the State forest acreage was probably very small, as it is for the second survey; and the indicated change in total forest acreage may be considered essentially correct. Indicated changes for survey regions and other portions of the total acreage should be valued in proportion to the magnitude of the item and of the change. Because of the possible effect of nonsampling as well as of sampling errors, changes in timber volume are shown only for major groupings of the data.

Growth

Growth estimates are based on radial-growth measurements of sample trees on Forest Survey plots. No attempt was made to calculate sampling error in the growth estimates.

Production and Annual Cut

Estimates of annual cut are conversions of production estimates. Sawlog production was estimated from a survey of lumber production conducted by the U. S. Bureau of the Census. For other commodities a canvass of manufacturers was conducted by the Forest Service. Commercial log and bolt production, other than for lumber, was obtained by a 100-percent canvass of establishments or producers. Production of fuelwood and fence posts and of timber for miscellaneous domestic use on farms was estimated from an area sample. The data on production of each commodity were converted to annual cut of growing stock by using timber cut-to-production ratios derived from measurements taken on sample cutting areas.

The sampling errors to which the State cubic-foot estimates of annual cut are liable, on a probability of two chances in three, are found in the following tabulation:

Product:	*Sampling error of annual cut (percent)*
Sawlogs	2.9
Veneer logs	8.4
Cooperage bolts	11.6
Pulpwood	2.3
Fuelwood	22.0
Chemical wood	4.1
Poles and piling	2.4
Posts	10.7
Hewn ties	8.4
Round mine timbers	1.3
Miscellaneous logs and bolts	8.8
All products	3.4

Definitions of Terms

Forest Land Classes

FOREST LAND.—Includes (a) land that is at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees have been removed to less than 10 percent stocking and which has not been developed for other uses; and (c) afforested areas.

COMMERCIAL FOREST LAND.—Forest land that is (a) producing, or is physically capable of producing, usable crops of wood (usually sawtimber); (b) economically available now or prospectively; and (c) not withdrawn from timber utilization.

NONCOMMERCIAL FOREST LAND.—Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land, and (b) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Tree Species

COMMERCIAL SPECIES.—Includes species that normally have value for commercial timber products; excludes so-called weed or noncommercial species such as blackjack oak, scrub post oak, blue beech, sourwood.

SOFTWOODS.—Loblolly pine (*Pinus taeda*), shortleaf pine (*P. echinata*), baldcypress (*Taxodium distichum*), and eastern redcedar (*Juniperus virginiana*).

HARDWOODS.—Broad-leaved species, of which the most numerous are the oaks (*Quercus* spp.), hickories (*Carya* spp.), and sweetgum (*Liquidambar styraciflua*).

Forest Type

The forest types discussed in the text are local types in general use by industry and forestry agencies in Arkansas. The local type classification is based upon the number of dominant and codominant trees that govern stand-size class.

LOBLOLLY-SHORTLEAF PINE.—Stands in which loblolly and shortleaf pines comprise 75 percent or more of the trees.

LOBLOLLY-SHORTLEAF PINE-HARDWOOD.—Stands in which loblolly and shortleaf pines comprise at least 25 percent of the trees, but less than 75 percent.

CEDAR.—Stands in which eastern redcedar comprises at least 25 percent of the trees.

UPLAND HARDWOOD.—Stands in which upland hardwoods comprise 75 percent or more of the trees, and no pine is present.

UPLAND HARDWOOD-PINE.—Stands in which upland hardwoods comprise 75 percent or more of the trees, and some pine is present.

BOTTOM-LAND HARDWOOD.—Stands in which bottom-land hardwoods and cypress comprise 75 percent or more of the trees.

Class of Timber

SAWTIMBER TREES.—Live trees of commercial species at least 9.0 inches d. b. h. in softwoods and 11.0 inches d. b. h. in hardwoods, that contain at least a 12-foot merchantable butt log—or, if the butt log is a cull, at least 50 percent of the gross sawlog volume is in merchantable logs. To be merchantable, a log must meet the following requirements:

(a) In softwoods, logs having a minimum 6-inch small-end diameter inside bark and at least one-third sound, with sweep or crook not exceeding two-thirds of the small-end diameter. Cedar logs must have sound heartwood.

(b) In hardwoods, logs having a minimum 8-inch small-end diameter inside bark and meeting the specifications of a standard lumber log or a tie and timber log.

POLETIMBER TREES.—Trees of commercial species that meet regional specifications of soundness and form and that are of the following diameters at breast height: softwoods 5.0 to 9.0 inches; hardwoods 5.0 to 11.0 inches. (Such trees will usually become sawtimber trees if left to grow.)

SEEDLING AND SAPLING TREES.—Live trees of commercial species less than 5.0 inches in diameter at breast height and of good form and vigor.

CULL TREES.—Live trees of sawtimber or poletimber size that are unmerchantable for sawlogs now or prospectively because of defect, rot, or species.

Rotten cull trees.—Live trees of sawtimber or poletimber size that fail to meet regional specifications of proportion of sound volume to total volume.

Sound cull trees.—Live trees of sawtimber or poletimber size that meet regional specifications of freedom from rot but will not make at least one merchantable sawlog now or prospectively according to regional specifications because of roughness, poor form, or species.

Stand-Size Class

LARGE SAWTIMBER.—Stands with sawtimber trees having a minimum net volume per acre of 1,500 board-feet, International ¼-inch rule, and at least half of this volume in softwoods 15.0 inches d. b. h. and larger, and hardwoods 17.0 inches d. b. h. and larger.

SMALL SAWTIMBER.—Stands with sawtimber trees having a minimum net volume per acre of 1,500 board-feet, International ¼-inch rule, but not meeting specifications for large sawtimber.

POLETIMBER.—Stands failing to meet the sawtimber stand specification but at least 10 percent stocked with poletimber and larger (5.0 inches d. b. h. and larger) trees and with at least half the minimum stocking in poletimber trees.

SEEDLING AND SAPLING.—Stands not qualifying as either sawtimber or poletimber stands but having at least 10 percent stocking of commercial tree species and with at least half the minimum stocking in seedling and sapling trees.

NONSTOCKED AND OTHER AREAS.—Commercial forest land not qualifying as sawtimber, poletimber, or seedling and sapling stands.

Tree Stocking

Stocking is the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. Stands are considered to be well stocked when the percentage of full stocking is 70 or above, medium stocked when the percentage is 40 to 69, poorly stocked when the percentage is 10 to 39, and nonstocked when the percentage is under 10.

Volume

SAWTIMBER VOLUME.—Net volume in board-feet, International ¼-inch rule, of live sawtimber trees to a specified merchantable top.

GROWING STOCK.—Net volume in cubic feet of live sawtimber and live poletimber trees from stump to a minimum 4.0-inch top diameter (of central stem) inside bark.

ALL-TIMBER VOLUME.—Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber

trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top inside bark. Includes bole only of softwoods but both bole and limbs of hardwoods to a minimum 4.0-inch diameter inside bark.

Miscellaneous Definitions

FARM OWNERSHIP.—Private commercial forest land in farms, but excluding lands on which farm operators do not control timber use.

BASAL AREA.—Cross-sectional area, including bark, of trees at breast height, measured in square feet.

D. B. H. (DIAMETER BREAST HIGH).—Tree diameter in inches, outside bark, measured at 4½ feet above ground.

DIAMETER CLASS.—The 2-inch diameter classes extend from 1.0 inch below to 0.9 inch above the stated midpoint. Thus, the 12-inch class includes trees 11.0 inches to and including 12.9 inches d. b. h.

NET ANNUAL GROWTH OF SAWTIMBER.—The change during a specified year in net board-foot volume of live sawtimber on commercial forest land resulting from natural causes.

NET ANNUAL GROWTH OF GROWING STOCK.—The change during a specified year in net cubic-foot volume of growing stock on commercial forest land resulting from natural causes.

ANNUAL CUT OF SAWTIMBER.—The net board-foot volume of live sawtimber trees cut or killed by logging on commercial forest land during a specified year.

ANNUAL CUT OF GROWING STOCK.—The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land during a specified year.

TIMBER PRODUCTS OUTPUT.—The volume of timber products cut from growing stock and other sources.

Softwood Tree Grades

GRADE 1 (SMOOTH TREES [9]).—Not less than 20 feet of clear bole and at least 40 percent of the merchantable length clear of limbs and knots in sections not less than 8 feet in length. All cedar sawtimber trees were graded as No. 1.

GRADE 2 (LIMBY TREES).—Not less than 12 feet of clear bole and 25 to 39 percent of the merchantable length clear of limbs and knots in sections not less than 8 feet in length.

GRADE 3 (ROUGH TREES).—Merchantable trees below grade 2 specifications.

[9] Except as noted in the case of cedar.

Hardwood Log Grades for Standard Lumber Logs [10]

GRADE 1.—Logs having five-sixths or more of their length on the 3 best faces in clear-cuttings not less than 5 feet long; they yield, on the average, at least 65 percent of their volume in No. 1 Common and better grades of lumber.

GRADE 2.—Logs having two-thirds to five-sixths of their entire length on the 3 best faces in clear-cuttings not less than 3 feet long; they yield, on the average, at least 40 percent of their volume in No. 1 Common and better grades of lumber.

GRADE 3.—Logs below grade 2, having one-half or more of their entire length on the 3 best faces in clear-cuttings not less than 2 feet long; they yield, on the average, at least 13 percent of their volume in No. 1 Common and better grades of lumber.

Hardwood Tie and Timber Log Specifications

Logs that do not meet the clear-cutting requirements of standard lumber logs, but that are sound, reasonably straight, and without large knots or knot clusters; they are suitable for ties and low-grade structural timbers.

Standard Tables

The 10 tables that follow will be found in all Forest Survey State reports in order that forest statistics for a group of States can be easily compared or compiled.

TABLE 2.—*Land area, by major classes of land, Arkansas, 1948–57*

Class of land	Area
	Thousand acres
Forest:	
Commercial	19,341.8
Noncommercial:	
Productive—reserved	19.8
Unproductive	2.7
Total	19,364.3
Nonforest [1]	14,379.7
Total, all classes	33,744.0

[1] Includes some acreage of water according to survey standards of area classification but defined by the Bureau of Census as land.

[10] For detailed external specifications of log grades used, see Forest Service Committee on Interim Hardwood Sawlog Grades, "Interim sawlog grades for southern hardwoods." U. S. Forest Serv., South. Forest Expt. Sta., 9 pp., illus. Rev. 1948.

TABLE 3.—*Commercial forest land area, by ownership class, Arkansas, 1948–51*

Ownership class	Area
	Thousand acres
Federally owned or managed:	
National forest	2,292.2
Indian	0
Bureau of Land Management	130.4
Other	390.6
Total	2,813.2
State [1]	102.4
Private:	
Farm	6,751.1
Industrial and other	9,675.1
Total	16,426.2
All ownerships	19,341.8

[1] County and municipal included with State.

TABLE 4.—*Area of commercial forest land, by major forest types, Arkansas, 1948–51*

Forest type [1]	Thousand acres
Loblolly-shortleaf pine [2]	5,895.9
Oak-pine	1,607.3
Oak-hickory	7,441.6
Oak-gum-cypress	4,192.5
Elm-ash-cottonwood	204.5
Total	19,341.8

[1] The forest types in this table conform to standard types defined by the national Forest Survey. These types differ from the forest types in general use by industry and forestry agencies in Arkansas.

[2] Except in the oak-pine type, the species named make up 50 percent or more of the cubic volume of the standard type. In the oak-pine type, southern pines make up 25 to 49 percent of the volume; the remainder is hardwood, mostly upland oaks.

TABLE 5.—*Net volume of live sawtimber and growing stock on commercial forest land, by stand-size class, Arkansas, 1948–51*

Stand-size class	Sawtimber	Growing stock
	Million board-feet	*Million cubic feet*
Sawtimber stands	28,053.5	7,179.5
Poletimber stands	7,967.4	3,627.5
Seedling and sapling stands	739.4	279.6
Nonstocked and other areas not elsewhere classified	38.3	13.2
Total	36,798.6	11,099.8

TABLE 6.—*Net volume of live sawtimber and growing stock on commercial forest land, by ownership class, Arkansas, 1948–51*

Ownership class	Sawtimber	Growing stock
	Million board-feet	*Million cubic feet*
Federally owned or managed:		
National forest	4,229.2	1,184.5
Bureau of Land Management	217.7	64.1
Other	651.9	192.1
Total	5,098.8	1,440.7
State [1]	170.9	50.3
Private:		
Farm	8,716.2	3,016.0
Industrial and other	22,812.7	6,592.8
Total	31,528.9	9,608.8
All ownerships	36,798.6	11,099.8

[1] County and municipal included with State.

TABLE 7.—*Net volume of live sawtimber and growing stock on commercial forest land, by species, Arkansas, 1948–51*

Species	Sawtimber	Growing stock
	Million board-feet	*Million cubic feet*
Softwoods:		
Shortleaf and loblolly pines	16,021.5	3,949.7
Cypress	731.1	135.3
Other eastern softwoods	22.8	17.6
Total	16,775.4	4,122.6
Hardwoods:		
White oaks (*Quercus alba* and *michauxii*)	2,089.7	746.3
Red oaks (*Q. rubra, shumardii,* and *falcata* var. *pagodaefolia*)	1,213.0	379.1
Other white oaks	2,688.5	983.5
Other red oaks	4,814.1	1,648.4
Sugar maple	31.8	9.4
Soft maples	137.6	59.3
Beech	83.5	25.0
Sweetgum	2,580.9	907.2
Tupelo and blackgum	1,255.3	370.0
Ash	419.7	153.3
Hickory	1,907.7	746.7
Cottonwood	349.3	92.8
Basswood	12.8	3.4
Yellow-poplar	5.0	1.2
Black walnut	39.4	13.3
Other eastern hardwoods	2,394.9	838.3
Total	20,023.2	6,977.2
All species	36,798.6	11,099.8

TABLE 8.—*Net volume of live sawtimber on commercial forest land, by diameter class groups and species, Arkansas, 1948–51*

Species	Diameter class groups						Total
	10 inches	12 inches	14 inches	16 inches	18 inches	20 inches and up	
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*
Southern yellow pines	3,206.8	3,784.9	3,338.9	2,583.4	1,514.6	1,592.9	16,021.5
Other eastern softwoods	67.6	125.4	101.8	157.4	103.0	198.7	753.9
White oaks (*Quercus alba* and *michauxii*)		465.7	527.5	367.3	299.5	431.7	2,089.7
Other white oaks		511.9	507.6	481.0	321.3	866.7	2,688.5
Red oaks (*Q. rubra, falcata* var. *pagodaefolia*, and *shumardii*)		239.9	274.2	224.3	174.5	300.1	1,213.0
Other red oaks		1,012.3	1,029.6	792.3	669.1	1,310.8	4,814.1
Sugar maple		7.4	5.2	4.8	1.7	12.7	31.8
Beech		4.7	13.1	20.3	15.0	30.4	83.5
Sweetgum		560.6	646.2	470.3	378.1	525.7	2,580.9
Tupelo and blackgum		180.2	240.6	237.2	211.5	385.8	1,255.3
Yellow-poplar				2.1		2.9	5.0
Other eastern hardwoods		1,062.1	1,083.9	960.3	767.5	1,387.6	5,261.4

TABLE 9.—*Net volume of all timber on commercial forest land, by class of material and species group, Arkansas, 1948–51*

Class of material	Total	Softwoods	Hardwoods
	Million cubic feet	*Million cubic feet*	*Million cubic feet*
Growing stock:			
Sawtimber trees:			
Sawlog portion	5,941.7	2,772.4	3,169.3
Upper stem portion	1,636.9	338.8	1,298.1
Total	7,578.6	3,111.2	4,467.4
Poletimber trees	3,521.2	1,011.4	2,509.8
Total growing stock	11,099.8	4,122.6	6,977.2
Other material:			
Sound cull trees	1,472.3	41.4	1,430.9
Rotten cull trees	1,200.6	19.5	1,181.1
Hardwood limbs	1,061.3		1,061.3
Salvable dead trees	61.3	26.3	35.0
Total other material	3,795.5	87.2	3,708.3
Total, all timber	14,895.3	4,209.8	10,685.5

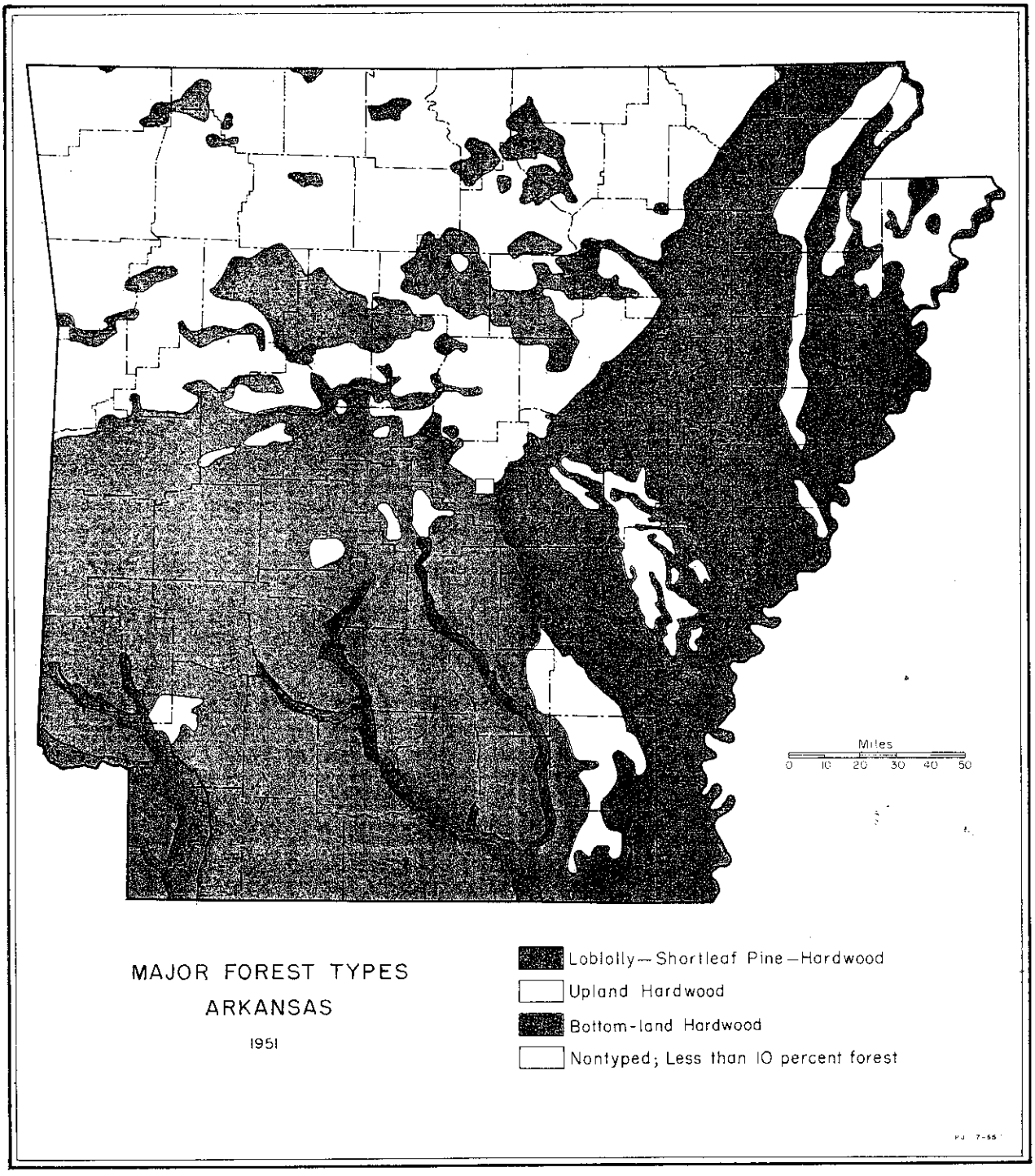
TABLE 10.—*Net annual growth, annual mortality, and annual cut of live sawtimber and growing stock on commercial forest land, by species group, Arkansas, 1948*

Item	Sawtimber			Growing stock		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Net annual growth	2,180.8	1,168.4	1,012.4	614.4	258.8	355.6
Annual mortality	220.8	100.7	120.1	77.2	27.8	49.4
Annual cut:						
Timber products	1,909.6	1,000.7	908.9	381.0	206.7	174.3
Logging residues	145.6	35.1	110.5	96.4	26.7	69.7
Total annual cut	2,055.2	1,035.8	1,019.4	477.4	233.4	244.0

TABLE 11.—*Output of timber products and annual cut of live sawtimber and growing stock, Arkansas, 1948*

Product	Output of timber products					Annual cut of sawtimber			Annual cut of growing stock		
	Volume in standard units		Roundwood volume								
	Standard units	Number	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
			Thousand cubic feet	*Thousand cubic feet*	*Thousand cubic feet*	*Thousand board-feet*	*Thousand board-feet*	*Thousand board-feet*	*Thousand cubic feet*	*Thousand cubic feet*	*Thousand cubic feet*
Sawlogs	MBM [1]	1,429,893	226,288	151,542	74,746	1,449,663	901,842	547,821	294,364	175,683	118,681
Veneer logs and bolts	MBM [1]	70,836	9,917		9,917	81,622		81,622	17,623		17,623
Cooperage logs and bolts	MBM [1]	45,828	6,587		6,587	65,583		65,583	14,216		14,216
Pulpwood	Standard cords [2]	616,726	46,621	42,749	3,872	66,607	60,549	6,058	41,138	38,067	3,071
Fuelwood	Standard cords [2]	[3] 1,349,056	101,228	9,142	92,086	243,868	38,092	205,776	65,870	8,149	57,721
Piling	M linear feet	828	580	580		3,332	3,332		683	683	
Poles	M pieces	261	3,286	3,286	[4]	18,877	18,877		3,869	3,869	[4]
Posts	M pieces	16,771	10,565	4,220	6,345	30,191	565	29,626	12,520	4,043	8,477
Hewn ties	M pieces	736	5,170	264	4,906	38,920	1,731	37,189	8,898	351	8,547
Mine timbers	M cu. ft	506	506	323	183	416	416		542	346	196
Miscellaneous [5]	M cu. ft	[6] 12,656	12,656	1,945	10,711	56,099	10,420	45,679	17,647	2,224	15,423
Total			423,404	214,051	209,353	2,055,178	1,035,824	1,019,354	477,370	233,415	243,955

[1] International ¼-inch rule.
[2] Rough wood basis.
[3] Not including 51.3 million cubic feet of wood from mill residues used for domestic and industrial fuel.
[4] Negligible.
[5] Includes chemical wood, handle stock, excelsior, etc.
[6] Not including 2.5 million cubic feet of mill residues used for miscellaneous products.



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