

NO9-065



United States
Department of
Agriculture

Forest Service

Southern Forest
Experiment Station

New Orleans,
Louisiana

Resource Bulletin
SO-147



Forest Resources of Mississippi

John F. Kelly, Mike Sims



CONTENTS

HIGHLIGHTS .....	.1
INTRODUCTION .....	.2
HISTORY OF MISSISSIPPI'S FORESTS .....	.2
FOREST AREA .....	.2
Forest Types .....	.3
Ownership	4
Plantations .....	.8
Stand Size .....	.9
STAND STRUCTURE .....	.9
Number of Trees .....	.9
Stocking .....	.10
Basal Area .....	.10
Comment on Stand Structure Trends .....	.12
TIMBER VOLUME .....	.14
Growing Stock	14
Sawtimber .....	.15
Tree Grade Trends .....	.15
Saw-log Lengths and Saw-log Top Inside-bark Diameters .....	.19
Cull-tree Volume .....	.26
BIOMASS WEIGHTS AND SPECIES DISTRIBUTION .....	.26
GROWTH, REMOVALS, AND MORTALITY .....	.33
Components of Change	33
Trends in Growth, Removals, and Mortality .....	.33
Growth and Removals Trends by Ownership .....	.36
Growth and Removals of All Live Timber .....	.36
MANAGEMENT TREATMENTS .....	.37
MANAGEMENT OPPORTUNITIES .....	.37
Pine Stands	38
Mixed Stands	38
Hardwood Stands	40
TIMBER OUTLOOK	40
TIMBER PRODUCTS OUTPUT	41
Saw Logs	41
Pulpwood	41
Other Products and Fuelwood .....	.43
LITERATURE CITED	43
APPENDIX	45
Survey Methods	46
Reliability of the Data	46
Definition of Terms	46
Species List	50
Standard Tables	53

Forest Resources of Mississippi

John F. Kelly and Mike Sims

HIGHLIGHTS

Some important findings of the 1987 Mississippi forest survey are presented below. Unless otherwise noted, the comparisons are with the previous survey, which was in 1977.

- Hardwood forests are displacing pine forests on upland sites. Pine forests have declined in area by 9 percent, while oak-history forests have increased 26 percent. Oak-hickory is the dominant forest type in the State, comprising almost one-third of the timberland. Oak-pine stands have increased in area by 2 percent.
- The area of plantations has increased 50 percent to 2.8 million acres. In the South survey region, 1 out of every 4 acres of timberland is planted. Forest industry owns more planted area than either public or nonindustrial private owners.
- As stands are maturing, more area is covered by sawtimber-size stands, which increased 9 percent. Sawtimber stands now account for 48 percent of timberland; poletimber stands and sapling-seedling stands each account for about 25 percent of the area. Forest industry lands are 41 percent sapling-seedling size stands, the dominant class on this ownership.
- The presence of fewer small trees and more large trees (213.0 inches in d.b.h.) is a sign that stands are maturing. The number of growing-stock trees has also decreased, and the number of cull trees has increased.
- Softwood cull volume has increased 43 percent and hardwood cull volume, 22 percent. The basal area of cull trees has increased 14 percent and now equals 26 percent of total basal area. The increase in cull-tree basal area has contributed to higher average stocking.
- Total softwood growing-stock volume is essentially unchanged. The inventory of softwood growing stock in the 1977 and 1987 surveys is at its highest since the forest surveys in Mississippi began. More volume is in large trees (d.b.h. 213.0 inches) and less in small trees than in 1977.
- Hardwood growing-stock volume increased 23 percent and occurred in all tree sizes except the smallest.
- Softwood sawtimber volume increased 11 percent; hardwood, 31 percent. The volume in the highest quality trees (grade 1) has decreased.
- The 10 most common tree species in Mississippi, in order of decreasing biomass weight, are loblolly pine, sweetgum, water oak, shortleaf pine, white oak, southern red oak, hickory, cherrybark oak, post oak, and blackgum.
- The chief component of timber growth is now the incremental increase in larger (survivor) trees; in the 1977 survey, growth was dominated by the movement of smaller trees into the merchantable category (ingrowth).
- Average annual softwood growing-stock growth has declined 15 percent since the 1967 to 1977 survey period, while average annual softwood removals have increased 35 percent. Softwood removals now approximate growth.
- Average annual hardwood growing-stock is 25 percent higher than in the 1967 to 1977 period; removals have increased 22 percent. Hardwood growth exceeds removals by 81 percent.
- Average annual sawtimber growth has increased for both softwoods and hardwoods, as have removals. Although growth still exceeds removals for both species groups, the margin for softwood is currently only 18 percent, down from 67 percent in the previous survey period.

- Mortality (principally of softwoods) has increased. The volume of softwood growing-stock mortality has increased 55 percent, while hardwood has increased only 5 percent. Softwood mortality now exceeds hardwood; in the previous survey hardwood mortality was higher.
- Treatment opportunities were identified on slightly more than half the timberland. Hardwood stands generally could benefit more from treatment than pine stands, largely because they have a higher incidence of cull trees. Current growth is only 46 percent of the potential growth for fully stocked natural stands.

INTRODUCTION

This report summarizes results from the sixth forest survey of Mississippi. The survey is part of a national effort authorized by the McSweeney-McNary Act of 1928 and modified by legislation in 1974 and 1978.

The first forest survey of the State was in the 1930's, the second followed the Second World War in the 1940's (Forest Economics Staff 1946; USDA FS 1949). Subsequent surveys have been at approximately 10-year intervals (USDA FS 1958; VanSickle and VanHooser 1969; Murphy 1978). Over the years the forest surveys have changed to provide a greater variety of data. For example, data are now collected for nontimber resources, an increasingly important aspect of the State's forests. This report describes timber; a companion report will examine other resources (Rudis, 1989). A series of regional reports covers the five survey regions in Mississippi (Kelly and Hines 1987a-e).

This report describes the status and trends of forest resources in Mississippi, indicated by the 1987 forest survey. The description of resource trends concentrates on changes since the previous survey in 1977. For comparison, the 1977 survey data were reprocessed to agree with current definitions and procedures.

HISTORY OF MISSISSIPPI'S FORESTS

Forests were a dominant feature of Mississippi during the colonial period (James 1951). Longleaf pine forests extended from the coast as far north as Kemper County. In other parts of the State, shortleaf pine was common, often mixed with such hardwoods as red oaks, hickory, black gum, and chestnut. Loblolly and slash pines were present, but not to the extent that they are today. In the Delta and other

bottomlands throughout the State, a variety of hardwood species grew to large sizes (James 1951).

After the State was settled and with the beginning of the cotton boom around 1800, agriculture began to play a big role in the extent and character of Mississippi's forests (James 1951). Most of the land originally used for cotton farming was in the uplands. Poor farming practices caused severe erosion of many upland fields, and these areas were abandoned and reverted to forests. This led to large-scale opening of the Delta for cotton farming, and the Delta continues to be a farming center in the State. As eroded uplands were abandoned, loblolly pine became more common, since this was often the pioneering tree species on these sites.

Until shortly after 1900, the timber economy was almost negligible. But with the exhaustion of large supplies of timber in the Lake States, lumber companies moved south and into Mississippi. In 1925 lumber production in the State, peaked. After the old-growth forests were gone, the large-scale timber operations moved on, but a small timber industry remained and eventually began to grow along with the second-growth forests. Today, the timber industry is a principal component in Mississippi's economy (Porterfield and others 1978; Schallau and others 1988).

FOREST AREA

The land area of Mississippi is 30.2 million acres. Of this, nearly 17.0 million acres (56 percent) are forested, as estimated by the 1987 survey (table 1). Only 8,600 acres of the 17.0 million are reserved from timber utilization; the balance is timberland (see Appendix for definitions).

Since the first forest survey in 1934, timberland area in the State has not fluctuated greatly (table I). In 1934 there were 16.2 million acres of timberland. A high point was reached in 1957 at 17.2 million acres. Some parts of the State have changed greatly in timberland acreage, however. The Delta region now has almost 1.4 million acres of timberland, a 38-percent decrease from 1934. On the other hand, timberland in the North region has increased 37 percent.

Since 1977, timberland area has increased by 2 percent (296,800 acres). Despite this small net change, there have been land use changes involving large areas in the past 10 years (table II). There were additions to timberland amounting to 1.0 million acres since 1977. These additions were partly offset by the clearing of 699,300 acres, which yielded the net increase of 296,800 acres.

Net increases in timberland occurred everywhere except the Delta region, which lost 88,300 acres, or 6

Table I.-Timberland area by survey region, Mississippi, 1934-1987

Survey region	Survey Date					
	1934	1948	1957	1967	1977	1987
	----- Thousand acres -----					
Delta	2,245.3	2,043.2	1,917.1	1,493.8	1,476.6	1,388.3
North	3,209.4	3,722.9	4,204.0	4,194.8	4,251.4	4,401.2
Central	3,484.9	3,554.6	3,792.4	3,959.5	3,879.3	4,097.0
South	4,893.2	4,746.4	4,533.7	4,489.1	4,320.7	4,329.0
Southwest	2,417.1	2,465.4	2,746.7	2,754.7	2,756.8	2,766.0
All regions	16,249.9	16,532.5	17,193.6	16,891.9	16,684.7	16,981.6

'Columns may not add due to rounding.

Table II.-Changes in timberland by survey region, Mississippi, 1977-1987¹

Survey region	All land ²	Timberland	Net change	Additions from:			Diversions to:		
				Total	Agriculture	Other ³	Total	Agriculture	Other'
	----- Thousand acres -----								
Delta	5,584.8	1,388.3	-88.3	22.9	14.3	8.6	111.2	103.8	7.4
North	8,404.2	4,401.2	149.9	358.3	319.7	38.6	208.4	110.4	98.1
Central	5,938.5	4,097.1	217.7	303.1	271.5	31.6	85.3	44.7	40.6
South	6,179.6	4,328.9	8.3	134.1	128.0	6.1	125.8	48.9	76.9
Southwest	4,414.1	2,766.0	9.2	177.8	145.8	32.0	168.5	91.2	77.4
All regions	30,521.2	16,981.5	296.8	996.1	879.3	116.8	699.3	398.9	300.5

¹Columns may not add due to rounding.

²United States Bureau of the Census, Land and Water Area of the United States.

³Includes urban, industrial, highway, noncommercial forest, water, rights-of-way, and other land uses.

percent. This timberland was diverted principally to agricultural uses. Elsewhere, reversion of agricultural land provided much of the additions to timberland area.

During the past 10 years, 9 counties lost at least 20,000 acres of timberland, and 11 counties gained at least 20,000 acres (fig. 1). Currently, 10 counties have at least 75 percent timberland (fig.2).

Forest Types

The dominant forest type in Mississippi continues to be oak-hickory, which covers 5.5 million acres (table III, fig. 3), a 26-percent increase since 1977. Other forest types in order of decreasing area are loblolly-shortleaf pine (a 7-percent decrease since 1977), oak-pine (2-percent decrease), oak-gum-cypress (12-percent decrease), longleaf-slash pine (20-percent decrease), and elm-ash-cottonwood (no significant change). There are also 8,100 acres of nontyped forest land (not currently stocked with trees).

The oak-hickory forest type is not dominant in all regions. Loblolly-shortleaf pine occupies more acres in the Central region, and oak-pine is more common in the South region (table III). Oak-gum-cypress forests are by far the most common in the Delta region, accounting for over one-half the total timber-

land. The oak-hickory type, however, clearly dominates the North and Southwest regions and is common throughout the State. Most forest types are uniformly distributed outside the Delta, except for longleaf-slash pine, which is concentrated in the extreme southeastern portion of the State.

Trends in forest type are attributable principally to natural changes and to activities by land managers. On upland sites pine forest types have declined 9 percent, while hardwood types have increased 26 percent. Many of the pine stands in existence for the past several decades are being harvested. Often the residual stands are left with a significant component of hardwoods and are not regenerated to pines (McWilliams 1988), and the resulting stands are oak-pine or oak-hickory. Additionally, 39 percent of the land that has reverted to forest is in the oak-hickory type.

The decline of the longleaf-slash pine forest type has been dramatic. Since 1957, the area occupied by this type has declined 48 percent, in contrast to the g-percent decline of all pine types. The sharp decline has occurred primarily because land managers have favored the management of other pine species on sites that have long supported longleaf-slash pine.

The regeneration of pine stands has countered natural successional forces and some harvesting and management practices. While these regeneration

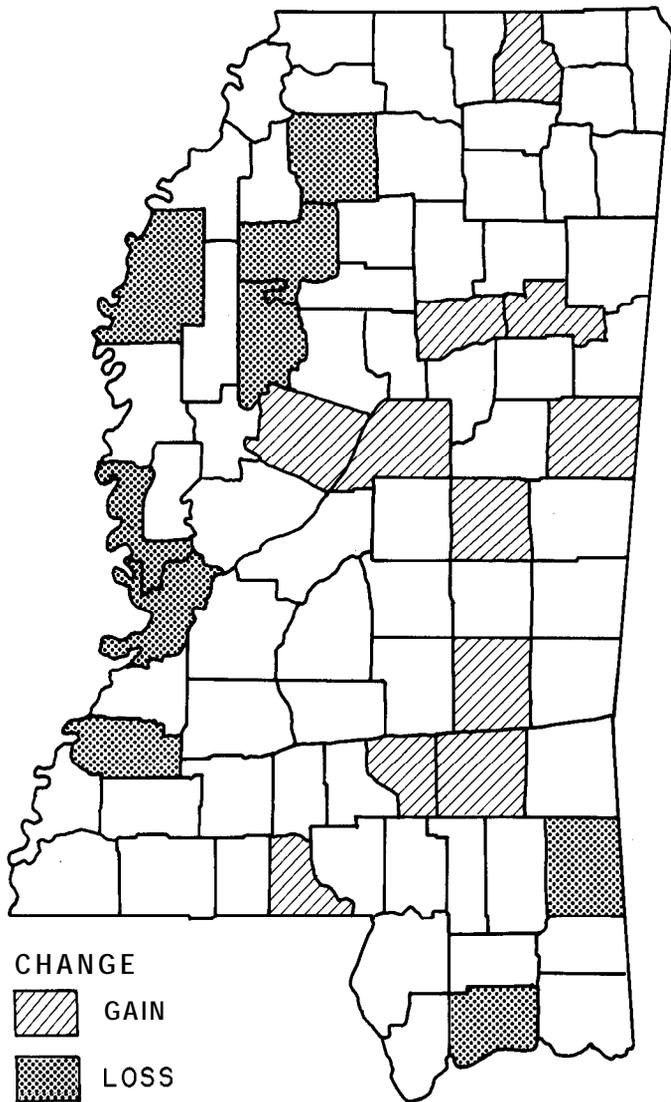


Figure 1-Change in timberland area for Mississippi counties; gain or loss of at least 20,000 acres, 1977 to 1987.

activities have not precluded the net decline in pine types, they have been a significant factor in pine types currently occupying 28 percent of the total timberland.

Ownership

Mississippi's timberland is dominated by private owners, with only 11 percent publicly owned (table IV, fig. 4). Of the private owners, forest industry holds 3.2 million acres (19 percent), and nonindustrial private owners hold the remaining 70 percent, giving the latter a dominant influence on the character of the forest resource. Nonindustrial private owners are a diverse group having many different land management objectives, as illustrated in one study

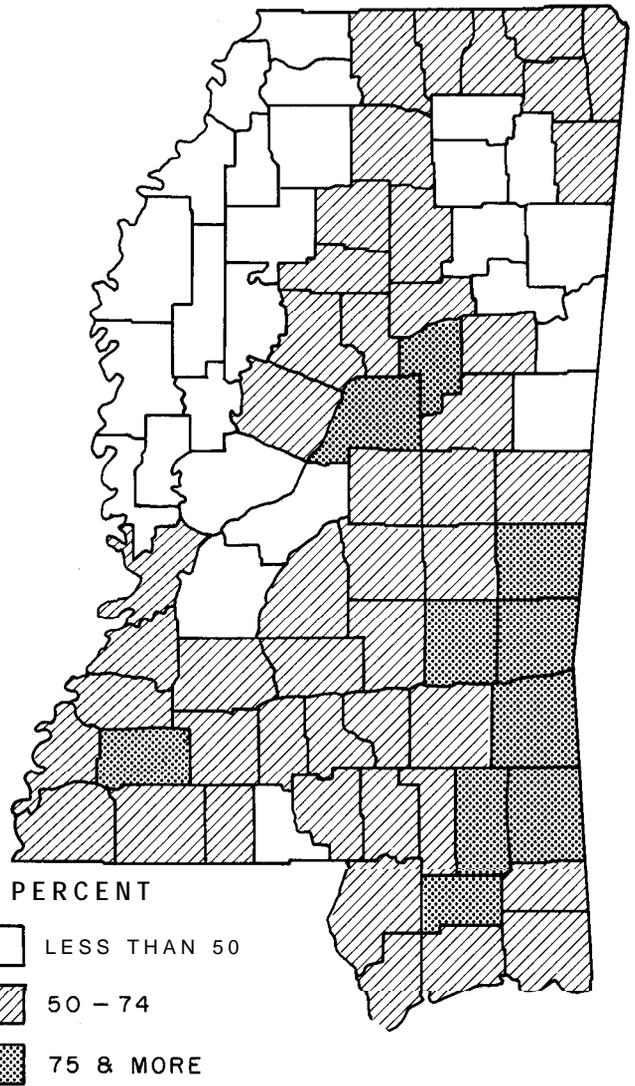


Figure 2-Proportion of timberland in Mississippi counties, 1987.

of a southern State (Holemo and Brown 1975). Forest industry owners, on the other hand, concentrate on timber production to supply raw material to their wood-processing facilities.

Forest industry owners emphasize pine management (table IV). Sixty-two percent of the timberland owned by forest industry is in pine or oak-pine forest types. Only 44 percent of nonindustrial private timberland is in pine or oak-pine types. In contrast, 37 percent of the nonindustrial private timberland is in oak-hickory, but only 23 percent of forest industry land is in this type.

Forest industry has increased its ownership 168,600 acres (6 percent) since 1977. Pine plantations have increased more than any other forest type on industry lands and now represent more than one-

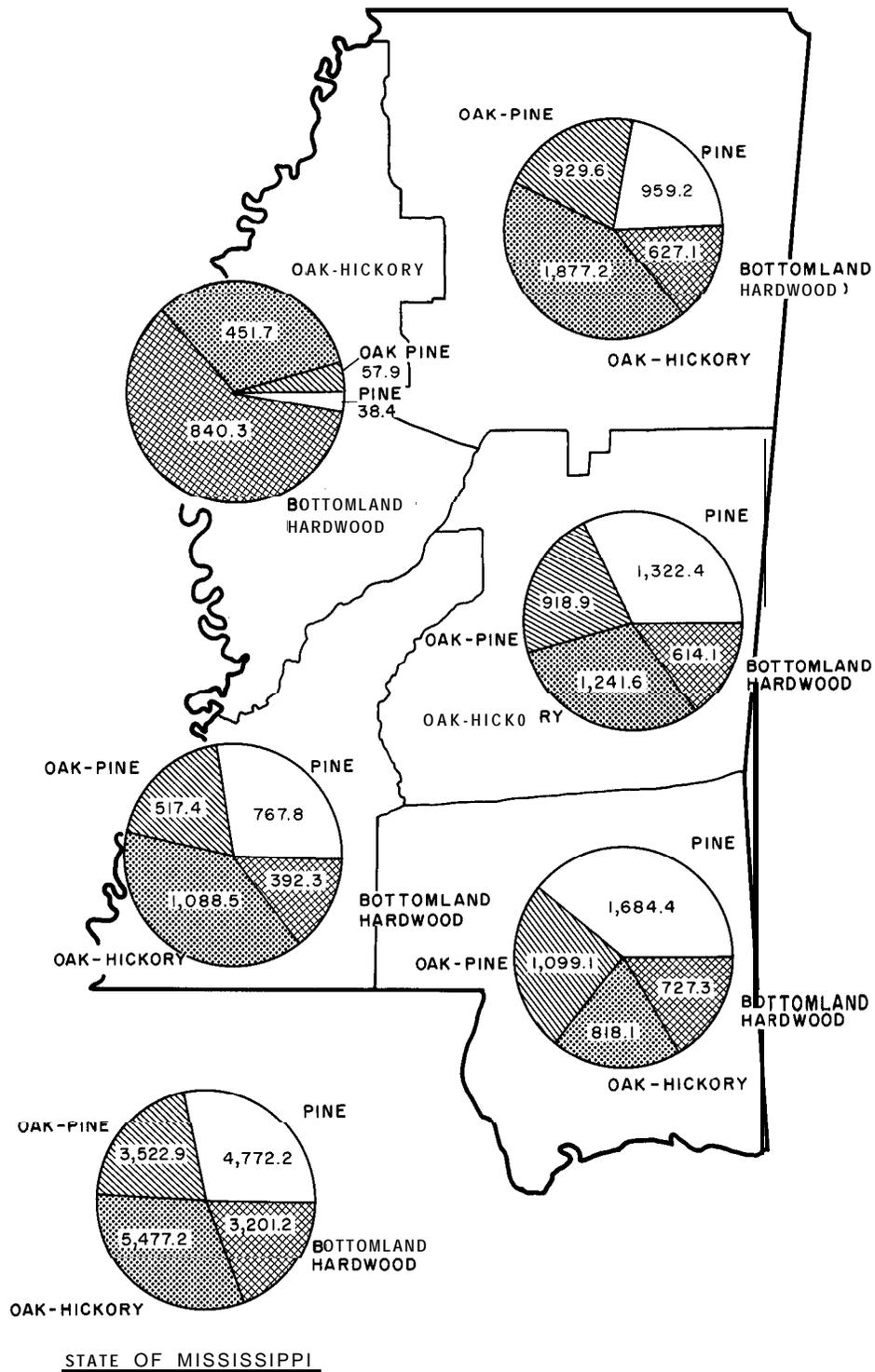


Figure 3.-Timberland area in thousand acres by forest type and survey region, Mississippi, 1987. Pine type includes longleaf-slash pine and loblolly-shortleaf pine types; bottomland hardwood type includes oak-gum-cypress and elm-ash-cottonwood types.

Table III.-Area of timberland and percent change since 1977 by forest type and survey region, Mississippi, 1987¹

Survey region	All types	Longleaf-slash pine		Loblolly-shortleaf pine		Oak-pine		Oak-hickory		Oak-gum-cypress		Elm-ash-cottonwood		Nontyped	
		Area	Change	Area	Change	Area	Change	Area	Change	Area	Change	Area	Change	Area	Change
	<i>Thousand acres</i>	<i>Thousand acres</i>	<i>Percent</i>	<i>Thousand acres</i>	<i>Percent</i>	<i>Thousand acres</i>	<i>Percent</i>	<i>Thousand acres</i>	<i>Percent</i>	<i>Thousand acres</i>	<i>Percent</i>	<i>Thousand acres</i>	<i>Percent</i>	<i>Thousand acres</i>	<i>Percent</i>
Delta	1,388.3	.....	.....	38.4	+121	57.9	-22	451.7	+5	762.3	-10	78.0	-20	.....	(²)
North	4,401.3	5.2	(²)	954.0	-14	929.6	+2	1,877.2	+20	593.9	-9	33.2	+131	8.1	(²)
Central	4,097.0	17.1	-51	1,305.3	-10	918.9	+12	1,241.6	+41	614.1	-11	.....	.....	.....	(²)
South	4,328.9	819.2	-19	865.3	+1	1,099.1	+5	818.1	+24	721.8	-4	5.5	(²)	.....	(²)
Southwest	2,766.0	.....	(²)	767.8	-3	517.4	-13	1,088.5	+32	359.5	-29	32.8	-8	.....	.....
All regions	16,981.5	841.5	-20	3,930.7	-7	3,522.9	+2	5,477.2	+26	3,051.7	-12	149.5	+1	8.1	-55

¹Rows and columns may not add due to rounding.

²Change is based on one plot only.

Table N.--Timberland area and percent change since 1977, by ownership and forest type, Mississippi, 1987¹

Ownership	All types		Pine plantations ¹		Natural pine ³		Oak-pine		Oak-hickory		Bottomland hardwoods		Nontyped	
	<i>Thousand acres</i>	<i>Percent change</i>	<i>Thousand acres</i>	<i>Percent change</i>	<i>Thousand acres</i>	<i>Percent change</i>	<i>Thousand acres</i>	<i>Percent change</i>	<i>Thousand acres</i>	<i>Percent change</i>	<i>Thousand acres</i>	<i>Percent change</i>	<i>Thousand acres</i>	<i>Percent change</i>
Public	1,919.3	+10	84.2	-26	581.6	-16	481.2	+27	387.6	+75	384.7	+16	.....	.....
Forest industry	3,197.3	+6	818.2	+80	496.9	-33	668.3	+4	730.8	+40	475.0	-28	8.1	(⁴)
Nonindustrial private ⁵	11,865.0	(⁶)	635.3	+10	2,156.1	-20	2,373.4	-2	4,358.7	+21	2,341.5	-10	.....	(⁴)
All owners	16,981.5	+2	1,537.7	+34	3,234.5	-21	3,522.9	+2	5,447.2	+26	3,201.2	-11	8.1	-55

¹Rows and columns may not add due to rounding.

²Includes longleaf-slash pine and loblolly-shortleaf pine forest types artificially regenerated.

³Includes longleaf-slash pine and loblolly-shortleaf pine forest types of natural origin.

⁴Change is based on one plot only.

⁵Includes 135.5 thousand acres of land leased by forest industry.

⁶Less than 1 percent change.

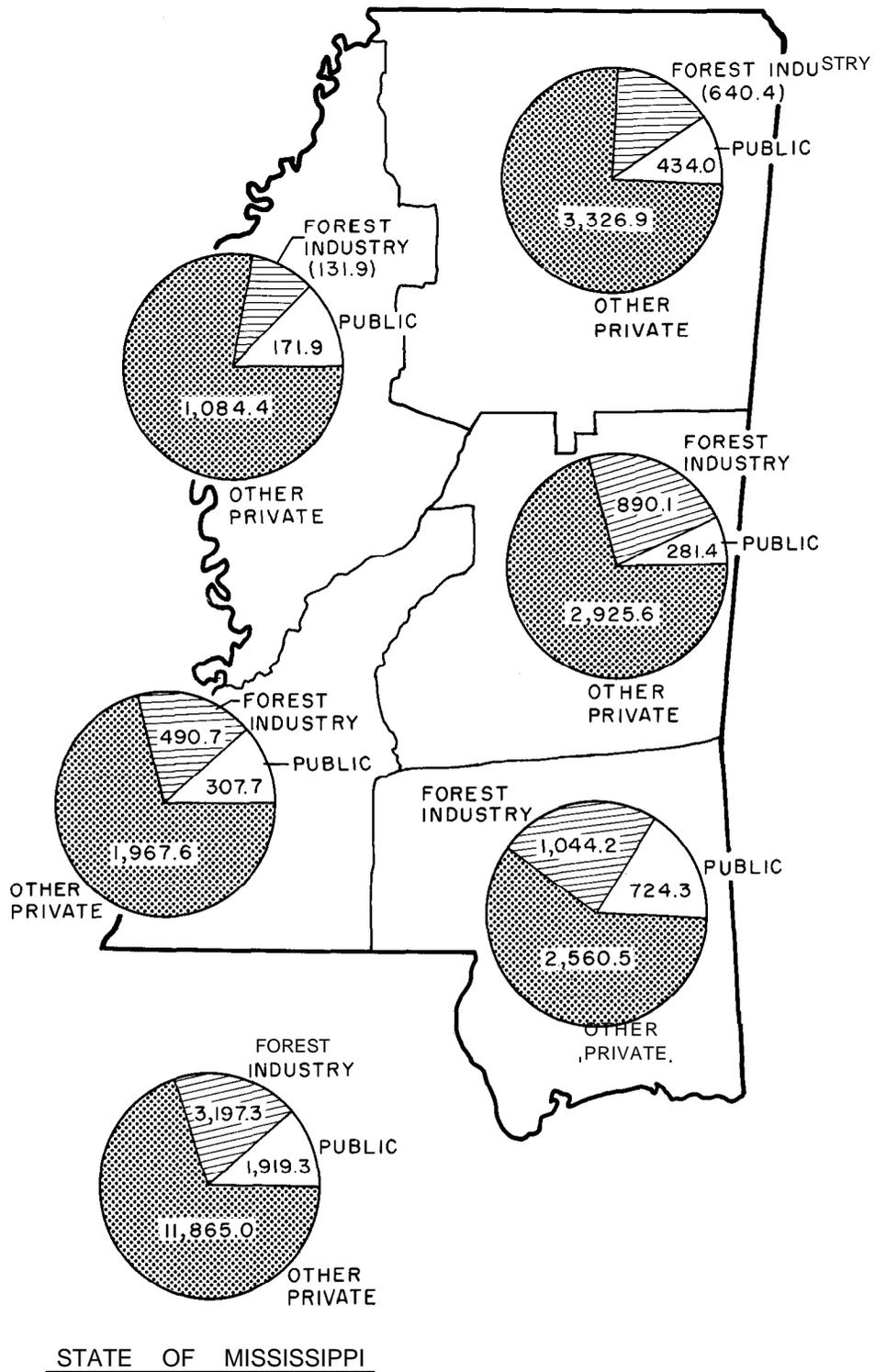


Figure 4.— *Timberland area in thousand acres by ownership and survey region, Mississippi, 1987.*

half the total pine plantations for all ownerships (table IV).

The 21-percent increase in the oak-hickory type was the largest change for nonindustrial private owners and was accompanied by a 20-percent decrease in natural pine acreage. Pine plantations increased a modest 10 percent on nonindustrial private lands.

For public lands, the largest relative change was the 75 percent increase in the oak-hickory type. Natural pine remains the largest forest type on public lands, despite a 15-percent decline since 1977.

Less than 1 percent of the total timberland, 135,500 acres, is under long-term lease by forest industry (table V). This land is in the North, Central, and South regions. For the balance of this analysis, leased lands will be included with nonindustrial private lands.

Plantations

The total area of plantations increased by 927,700 acres, or 50 percent, from 1977 to 1987 (table VI). The acreage occupied by plantations is greatest in the South survey region, as it was in the previous survey. In the South region, almost 1 in 4 acres of timberland is planted; in the North region, 1 in 5

acres is planted. Plantations are common throughout the State, except in the Delta (fig. 5).

Forest industry now owns more acres of plantations, surpassing nonindustrial private owners for the first time; industry also has the largest percentage of its timberland in plantations. Forty-four percent of forest industry timberland is in plantations, a far larger percentage than either public (11 percent), or nonindustrial private (10 percent) ownerships (table VI.>.

Most forest plantations in Mississippi were planted to pine, but the actual forest type, based on all live trees in the stand, is either oak-pine or oak-hickory for many. Forest types of plantations on upland sites are as follows: longleaf-slash pine, 334,000 acres; loblolly-shortleaf pine, 1,203,700 acres; oak-pine, 752,600 acres; and oak-hickory, 450,000 acres. Additionally, there are 30,000 acres of bottomland hardwood plantations.

Many of the young (even-aged) plantations classed as oak-pine and oak-hickory forest types will eventually become pine forest types, as pines compete favorably with young hardwoods during early stand development. (The majority of oak-pine and many oak-hickory plantations are less than 15 years old.) For example, over one-half of the planted plots classified as oak-pine and less than 15 years old in

Table V.- *Timberland area, growing-stock volume, and sawtimber volume on privately owned land leased to forest industry, by survey region, Mississippi, 1987'*

Survey region	Timberland area	Growing-stock volume			Sawtimber volume		
		All species	Softwood	Hardwood	All species	Softwood	Hardwood
	<i>Thousand acres</i>	<i>Million cubic feet</i>			<i>Million board feet²</i>		
Delta	.....	.....	.....	.....	.....	.....	.....
North	28.9	21.3	13.6	13.8	95.8	46.9	48.8
Central	87.6	123.1	52.3	71.4	442.8	213.1	229.1
South	19.1	22.1	17.7	5.0	70.0	65.2	4.8
Southwest	.....	.....	.....	.....	.....	.....	.....
All regions	135.5	173.7	83.6	90.1	608.5	325.2	283.3

¹Rows and columns may not add due to rounding.

²International 1/4-inch rule.

Table VI.-Area *offorestplantations by survey region and ownership, Mississippi, 1977 and 1987'*

Survey region	1987 ownership				1977 ownership			
	All owners	Public	Forest industry	Nonindustrial private*	All owners	Public	Forest industry	Nonindustrial private'
	<i>Thousand acres</i>							
Delta	31.5	—	18.3	19.2	100.1	—	19.2	80.9
North	899.0	67.6	389.5	441.9	671.1	88.7	125.6	456.9
Central	582.3	34.5	312.2	235.6	312.4	6.2	190.2	115.9
South	1,037.9	100.1	563.7	374.1	690.7	81.5	390.5	218.6
Southwest	213.7	16.7	112.1	84.8	68.4	7.0	18.0	43.4
All regions	2,770.3	219.0	1,395.7	1,155.7	1,842.6	183.4	743.5	915.7

¹Rows and columns may not add due to rounding.

²Includes 25.9 thousand acres of leased land (all regions).

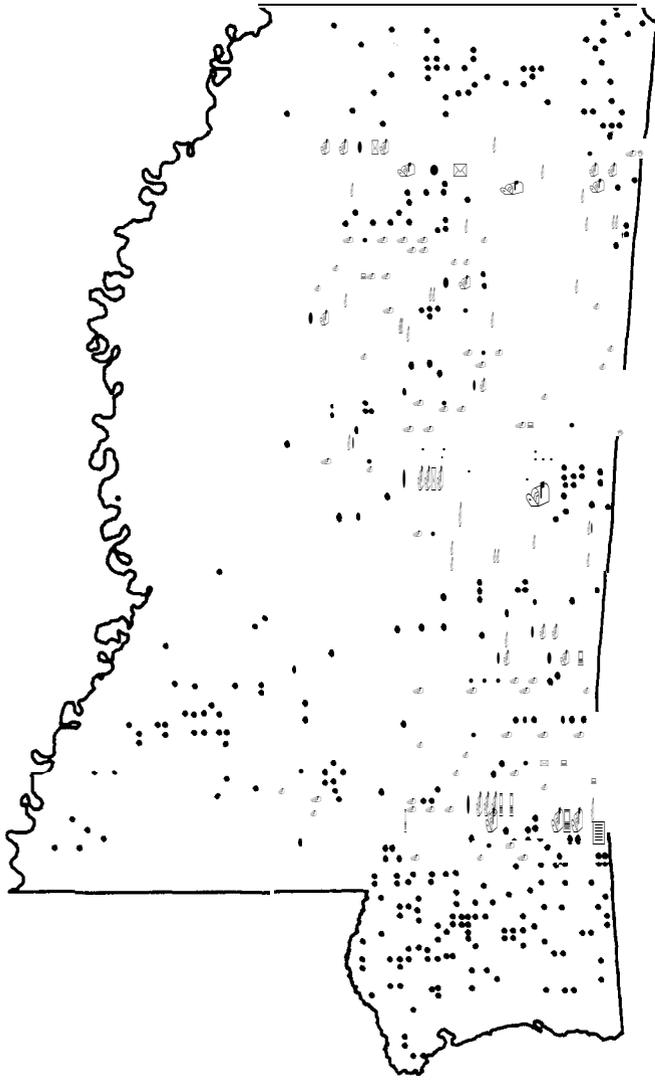


Figure 5.—Forest plots located on planted areas, Mississippi, 1987.

1977 are now classed as pine forest type. One-quarter of the planted oak-hickory plots that were less than 15 years of age in 1977 are now classed as pine, and about one-half of the plots moved into the oak-pine type.

Not all artificially regenerated stands are even-aged. This occurs because of stand components that are present at the time of planting or that develop afterward. Survey procedures assign stand ages based on all trees in the stand, rather than on any portion. Thus, where two or more distinct age classes are in a stand, a mixed-age category is assigned. Twenty percent (522,000 acres) of the artificially regenerated stands are uneven-aged.

Stand Size

More timberland is classed as sawtimber than either poletimber or sapling-seedling stands (table VII, fig. 6). The clear trend is toward more acreage

in sawtimber-size stands, which comprise 48 percent of the total timberland. Poletimber and sapling-seedling stands each account for about one-fourth of the total. Sawtimber stands have increased 9 percent from 1977 to 1987. Poletimber stands, on the other hand, have decreased 10 percent whereas sapling-seedling stands have remained about the same during the past 10 years.

The increase in sawtimber stands indicates the maturing of stands established over the past several decades. Many are moving from poletimber size into sawtimber size, thus accounting for the decrease of poletimber stands. Regeneration is helping to maintain the area of sapling-seedling stands.

Only forest industry land shows an increase in sapling-seedling stands (table VIII). Forty-one percent of these holdings are in the sapling-seedling class. Sawtimber stands are increasing on the forest land of public and nonindustrial private owners but decreasing on forest industry lands. The trends for forest industry result from the harvesting and regeneration of lands acquired during the late 1960's and the 1970's.

STAND STRUCTURE

Number of Trees

The trends in tree numbers are characteristic of maturing forests: (1) saplings and seedlings are decreasing, (2) larger trees and cull trees are increasing, (3) growing-stock trees, except in the larger size classes, are decreasing, and (4) hardwoods, many of which tolerate competition, are increasing compared with softwoods, which generally do not. The ratio of hardwoods to softwoods for each of the three principal tree sizes (saplings and seedlings, poletimber, and sawtimber) has increased since 1977.

Since 1977, the number of softwood saplings and seedling (trees less than 5 inches in d.b.h.) has declined 17 percent, while hardwoods have declined 12 percent. Live softwood trees 5 to 12.9 inches in d.b.h. have decreased 17 percent, while hardwoods have remained unchanged (figs. 7 and 8). Live softwood trees at least 13 inches in d.b.h. have increased 8 percent and hardwoods 12 percent.

The number of merchantable-size cull trees (≥ 5 -inch d.b.h.) has increased 19 percent for softwoods and 9 percent for hardwoods (fig. 9). Hardwood cull trees outnumber softwoods more than seven to one. Merchantable-size growing-stock trees have decreased — softwoods by 16 percent and hardwoods by only 1 percent (fig. 9).

Table VII.—*Timberland area by stand size class, survey region, and change since 1977, Mississippi, 1987*

Survey region	All classes area	Stand-size class							
		Sawtimber		Poletimber		Sapling-seedling		Nonstocked ²	
		Area	Change	Area	Change	Area	Change	Area	Change
	Thousand acres	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
Delta	1,388.3	968.4	+8	320.7	-13	79.3	-59	19.9	+24
North	4,401.2	1,934.0	+20	1,359.0	-10	1,014.6	-8	93.7	+175
Central	4,097.1	1,891.9	+4	918.0	-15	1,253.1	+29	34.1	+90
South	4,328.9	1,644.7	+6	1,098.9	+4	1,550.9	-5	34.5	-56
Southwest	2,766.0	1,677.8	+8	507.4	-19	561.0	+3	19.9	-29
All regions	16,981.6	8,116.8	+9	4,203.9	-10	4,458.8	(³)	202.0	+16

¹Rows and columns may not add due to rounding.

²Less than 16.7 percent stocked with live trees.

³Change is less than 1 percent.

Table VIII.—*Area of timberland by stand size, ownership, and change since 1977, Mississippi, 1987*

Ownership	All classes area	Stand-size class							
		Sawtimber		Poletimber		Sapling-seedling		Nonstocked ²	
		Area	Change	Area	Change	Area	Change	Area	Change
	Thousand acres	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent	Thousand acres	Percent
Public	1,919.3	1,260.5	+12	321.1	+31	298.2	-16	39.4	+82
Forest industry	3,197.3	1,104.2	-9	738.6	-1	1,304.5	+26	50.0	+62
Nonindustrial									
private	11,865.0	5,752.1	+13	3,144.2	-14	2,856.1	-7	112.6	-8
All regions	16,981.5	8,116.8	+9	4,203.9	-10	4,458.8	(³)	202.0	+16

¹Rows and columns may not add due to rounding.

²Less than 16.7 percent stocked with live trees.

³Change is less than 1 percent.

The decrease in growing-stock trees results from fewer smaller trees. Softwood growing-stock trees at least 13 inches in d.b.h. increased 7 percent, and hardwoods increased 38 percent (fig. 10).

Stocking

Trends in stocking indicate that stands are becoming increasingly occupied, another sign of maturity. The average acre is 109 percent stocked, based on all live trees, up slightly from 105 percent in 1977 (table IX). Stocking is a measure of the relative occupancy of a site; 100 percent represents full stocking. Cull tree stocking increased from 22 percent to 30 percent for the average stand. Average stocking for growing-stock trees, on the other hand, decreased slightly, from 83 percent in 1977 to 79 percent in 1987.

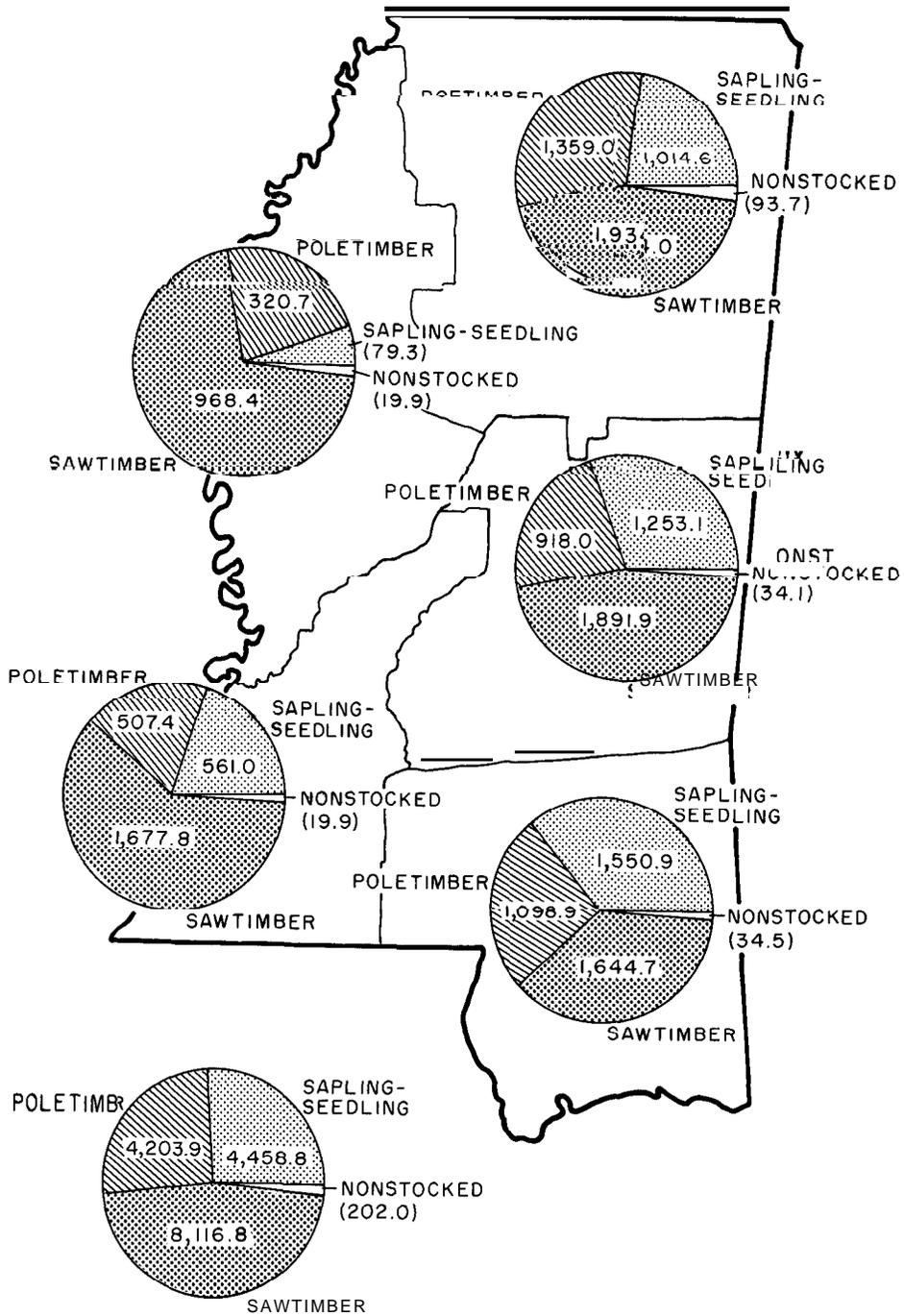
Overstocked stands (130 percent stocking and more for all live trees) increased by 728,200 acres, or 41 percent. Fully stocked stands (60-129 percent stocking) have remained constant; they occupy 83 percent of the timberland. Understocked stands have decreased somewhat and now occupy only 2 percent of the timberland area, down from 3 percent.

Basal Area

Average basal area declined from 82.7 square feet per acre in 1977 to 78.5 in 1987 (table Xa). The reduction occurred because of the change in growing stock (fig. 11), which probably resulted from timber harvesting and mortality. Cull tree basal area, on the other hand, increased an average of 14 percent, from 18.0 square feet per acre in 1977 to 20.6 square feet in 1987. The increase in cull is another indicator of increasing maturity and is a potential treatment opportunity.

The breakdown of average basal area in square feet per acre is as follows: softwood cull, 2.0; softwood growing stock, 24.9; hardwood cull, 18.7; and hardwood growing stock, 33.0. Hardwood growing stock is the largest component on the average statewide and in every survey region except the South, where softwood growing stock is largest (fig. 12).

The apparently divergent trends for average basal area and average stocking are actually the result of stocking calculations and particular resource changes. On the one hand, to represent the dominance of larger trees appropriately, saplings are dis-



STATE OF MISSISSIPPI

Figure 6.— Timberland area in thousand acres by stand size and survey region, Mississippi, 1987.

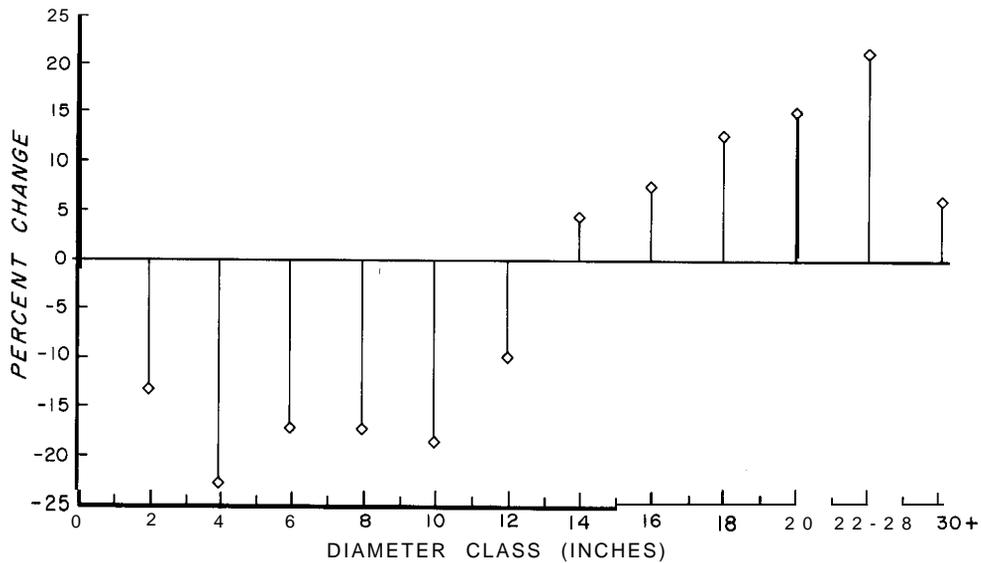


Figure 7.-Change in number of live softwood trees by diameter class, Mississippi, 1977 to 1987.

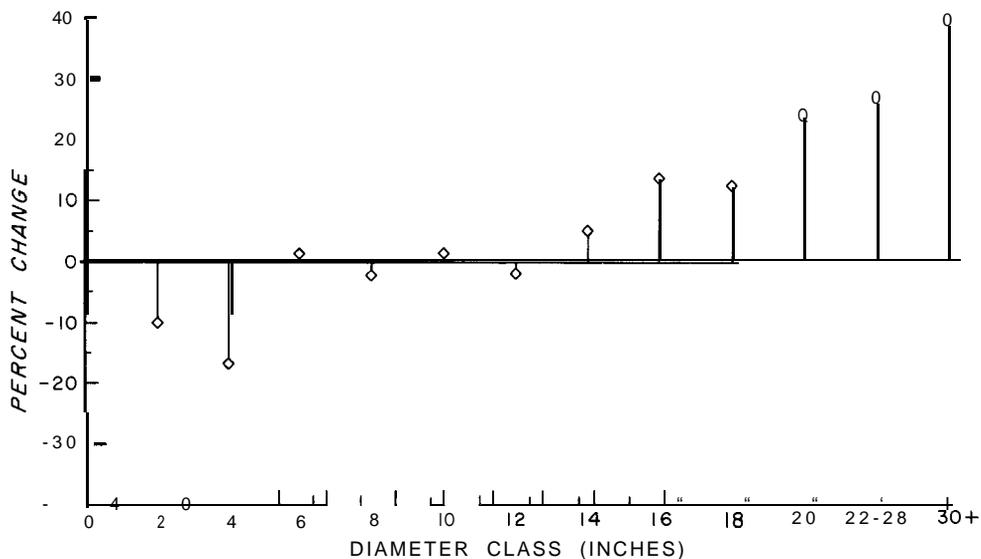


Figure 8.-Change in number of live hardwood trees by diameter class, Mississippi, 1977 to 1987.

counted on survey points that have one or more trees 5 inches in d.b.h. or larger. On the other hand, basal area is relatively more concentrated in larger trees than in the previous survey. Thus, even with the small decrease in total basal area, stocking is higher because there is less discounting of small trees for stocking calculations.

The reduction in average basal area is occurring for both softwoods and hardwoods on all forest types, with minor exceptions. Softwood basal area for the longleaf-slash pine forest type increased slightly during the past 10 years, as did hardwood basal area on bottomland hardwood types. Across the State, average basal area decreased in all survey regions except the Delta (tables Xb-Xf), where a 7-percent

increase occurred in average hardwood basal area.

Comment On Stand Structure Trends

In the aggregate, Mississippi's forests appear to be maturing. Fewer small trees and more large ones suggest that harvesting and regeneration have failed to keep pace with the aging process. Similarly, increased cull and mortality point toward mature forests. Data on stand age, collected during the survey, is useful primarily in even-aged stands. Other stands are simply classed as mixed and provide little evidence of an aging forest. The other symptoms, however, leave little doubt.

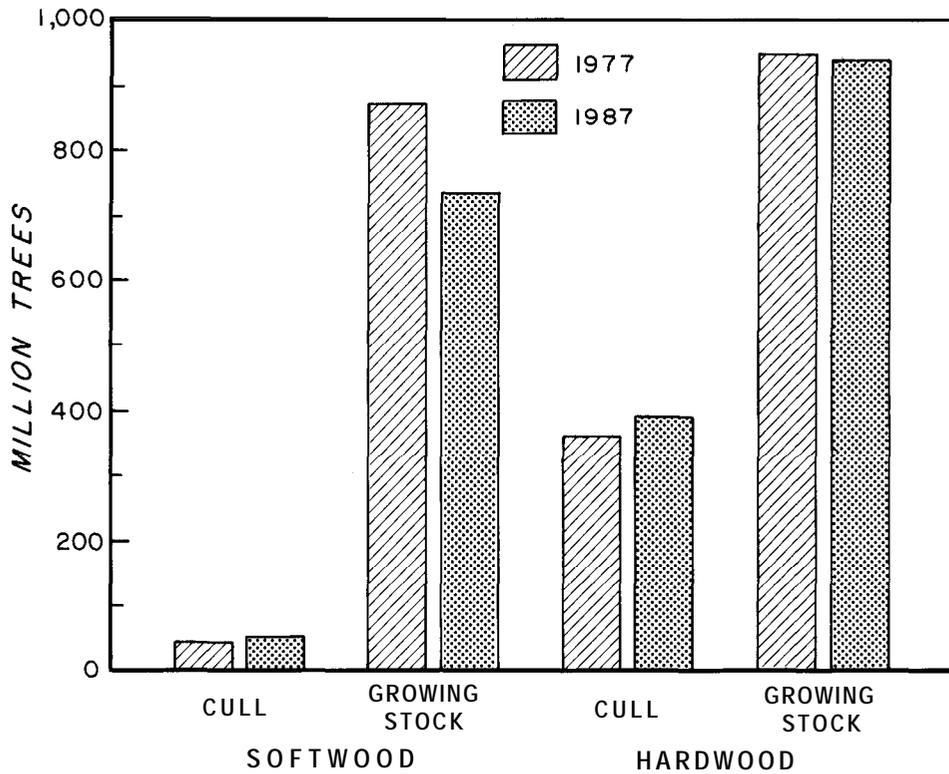


Figure 9.—Number of merchantable-size (≥ 5.0 inches d.b.h.) cull trees and growing-stock trees by softwood and hardwood groups, Mississippi, 1977 and 1987.

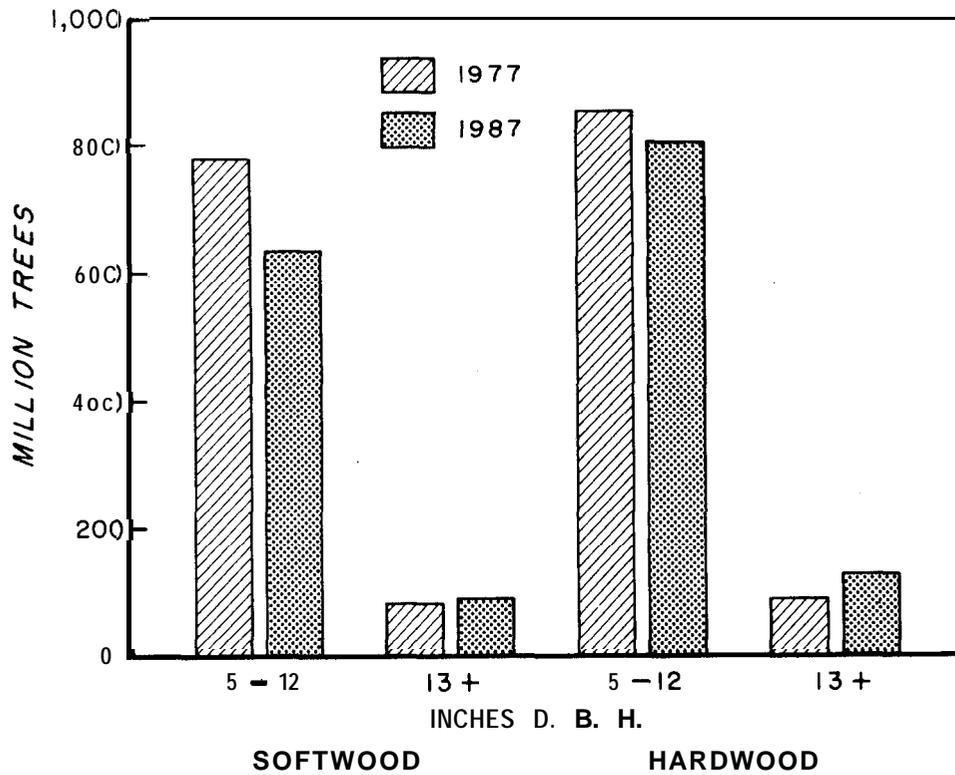


Figure 10.—Number of small and large growing-stock trees by softwood and hardwood groups, Mississippi, 1977 and 1987.

Table XX-Average percent stocking for all live trees on timberland by tree class and survey region, Mississippi, 1977 and 1987'

Survey region	Tree class					
	All tree classes		Growing stock		Cull	
	1987	1977	1987	1977	1987	1977
	----- percent -----					
Delta	101	98	67	69	34	30
North	111	107	78	84	32	23
Central	112	109	84	90	28	20
South	108	100	79	81	29	19
Southwest	106	105	78	82	29	22
All regions	109	105	79	83	30	22

Totals for all tree classes may not add due to rounding.

TIMBER VOLUME

The volume of live timber in Mississippi forests totals 22.3 billion cubic feet, a 13-percent increase since 1977. Timber volume includes the merchantable sound-wood volume of all live growing-stock trees, rough trees, rotten trees, and noncommercial species. Fifty-eight percent of the volume is in hardwood species; eighty-seven percent of all live timber volume is in growing stock and the remainder is in rough cull trees (10 percent), rotten cull trees (2 percent), and noncommercial species (1 percent).

Softwood live timber volume has increased only 2 percent; hardwood volume has increased 23 percent.

Trends for growing-stock volume are similar to those for all live timber, although the small increase in total softwood volume is due mainly to the increase in the cull component. Sawtimber volume has increased for softwoods and hardwoods but not for the best quality trees.

Growing Stock

Total growing-stock volume increased 11 percent between 1977 and 1987, all in hardwood species (table XI). Currently 19.4 billion cubic feet of growing stock are contained in 74 different species; most of the volume is in 12 species variously distributed across the State (fig. 13). Hardwoods account for 10.3 billion cubic feet.

Softwood volume declined in the Central and Southwest regions and increased modestly elsewhere, resulting in a statistically insignificant increase of 73.7 million cubic feet. All d.b.h. classes below 14 inches decreased in volume while 14-inch and larger classes increased (fig. 14). The reduced poletimber and small-sawtimber volume may diminish the availability of pulpwood and some sawtimber. The major changes among softwood species have been a decrease in the volume of shortleaf pine and an increase in loblolly pine (fig. 15).

The 23-percent increase in hardwood growing-stock volume resulted from increases in all d.b.h. classes except the 5- to 6.9-inch class (fig. 16). The increase in hardwood volume over the past 10 years

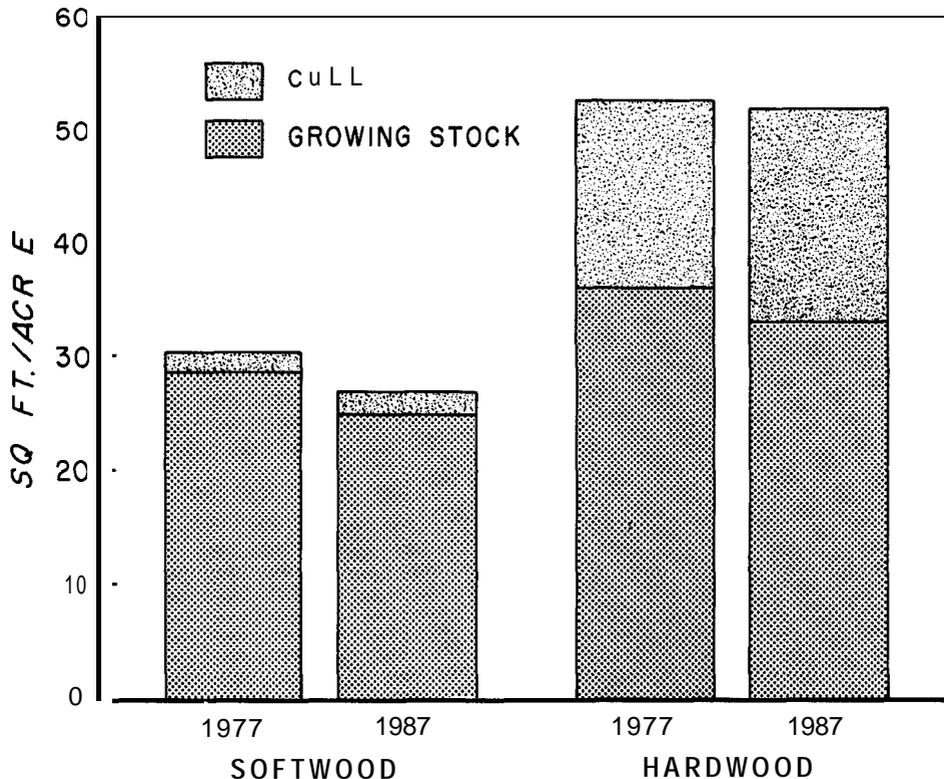


Figure II-Average basal area on timberland by species group and component, Mississippi, 1977 and 1987.

Table Xa.— Average basal area per acre of live trees by forest type, and tree class, Mississippi, 1977 and 1987

Species group and forest type	Tree class 1987			Tree class 1977		
	All trees	Growing stock	Cull	All trees	Growing stock	Cull
----- Square feet per acre -----						
Softwoods:						
Longleaf-slash pine	54.3	51.0	3.3	50.7	48.7	2.1
Loblolly-shortleaf pine	64.0	59.4	4.7	69.7	65.9	3.8
Oak-pine	30.6	28.5	2.2	31.3	29.6	1.7
Oak-hickory	6.7	6.2	0.6	6.9	6.4	0.5
Bottomland hardwoods ¹	4.2	3.7	0.4	5.6	5.0	0.5
All softwoods	26.8	24.9	2.0	30.3	28.6	1.7
Hardwoods:						
Longleaf-slash pine	11.5	5.8	5.6	11.7	7.8	3.9
Loblolly-shortleaf pine	24.5	13.7	10.8	26.1	17.7	8.4
Oak-pine	44.4	27.3	17.1	47.1	32.5	14.6
Oak-hickory	60.8	39.6	21.1	64.9	45.7	19.2
Bottomland hardwoods ¹	88.3	59.1	29.2	85.3	57.6	27.7
All hardwoods	51.7	33.0	18.7	52.4	36.0	16.4
All types	78.5	57.9	20.6	82.7	64.6	18.0

¹Includes oak-gum-cypress and elm-ash-cottonwood forest types.

continues a trend that has been evident since the third forest survey in 1957. Most major hardwood species increased in volume during the decade (fig. 17). The largest increases were in the other red oaks group and sweetgum.

Trends in growing-stock volume are similar for the major owner categories except for forest industry (table XII). Softwood and hardwood species slightly declined in volume on industry lands; this change for hardwood contrasts with the large increases on other ownerships.

Thus, while total growing-stock volume increased, as it has for 30 years, softwood volume has changed little in the past 10 years. Softwood volume remains at a level not surpassed before 1977, at least since the first forest survey. In 1934 softwood growing-stock volume was approximately 4.6 billion cubic feet¹. By 1948 softwood inventory had fallen to 3.3 billion cubic feet and remained at that level in 1957. By 1967, softwood growing-stock volume was 6.6 billion cubic feet; in 1977, 9.0 billion; and currently, 9.1 billion (fig. 18).

Growing-stock volume averages 1,144 cubic feet per acre, up 10 percent from 1977. Softwood volume averages 535 cubic feet per acre, and hardwood 609.

¹Because survey standards have changed over the years, it is impossible to provide a completely compatible estimate of inventory volume for the first survey; this estimate is based on available data appropriately converted.

Sawtimber

Sawtimber volume has increased since 1977 for softwoods and hardwoods; with minor exceptions the increases have occurred in all survey regions and for all d.b.h. classes (table XIII, figs. 19, 20). Sawtimber inventory for 1987 was 73.2 billion board feet, with 54 percent in softwoods.

Softwood sawtimber volume has increased 11 percent statewide. The increase varies by region, from 2 percent in the Southwest to 50 percent for the Delta. The Delta, however, supports only 1 percent of the total softwood sawtimber volume. Volume in the North region increased 27 percent. For 2-inch d.b.h. classes, only the smallest class, 9.0 to 10.9 inches, decreased. Most softwood sawtimber continues to occur in natural pine types, despite a 4-percent decrease in these stands (table XIV).

Hardwood sawtimber volume increased 31 percent. The increase was across all survey regions, all d.b.h. classes, and all forest types.

Increases in sawtimber volume occurred on all ownerships, except for forest industry, where small decreases have occurred over the past 10 years.

Tree Grade Trends

Table XV indicates recent trends by tree grade. In the forest survey, tree grade is determined by the grade of the butt log. Grade 1 sawtimber volume has

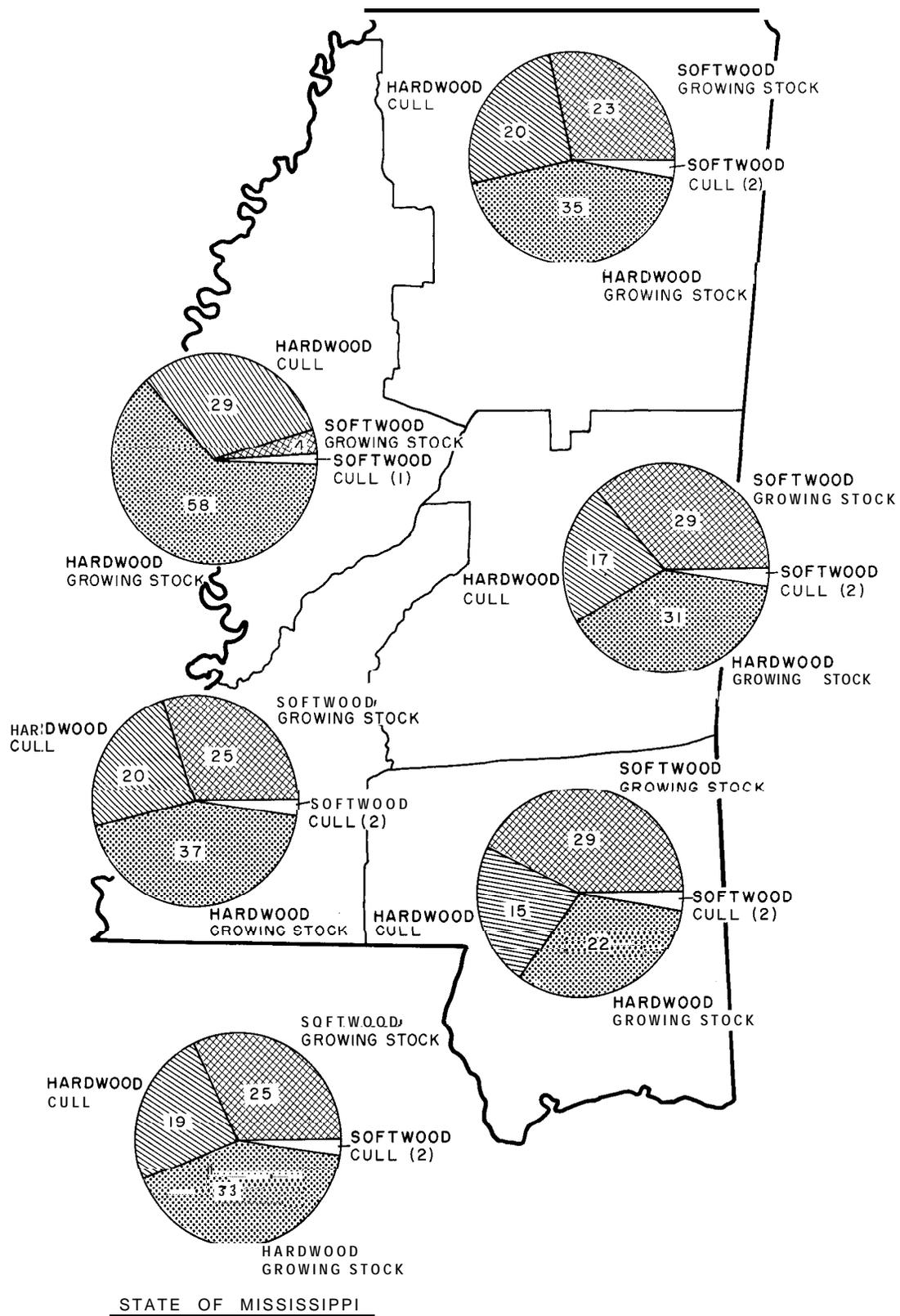


Figure 12.—Average basal area in square feet per acre on timberland by component and survey region, Mississippi, 1987.

Table Xb.- *Average basal area per acre of live trees by forest type, and tree class, Delta region, 1977 and 1987*

Species group and forest type	Tree class 1987			Tree class 1977		
	All trees	Growing stock	Cull	All trees	Growing stock	Cull
----- <i>Square feet per acre</i> -----						
Softwoods:						
Longleaf-slash pine	.....	.....	.....	.....	.....	.....
Loblolly-shortleaf pine	38.4	36.1	2.2	78.8	77.6	1.2
Oak-pine	31.8	30.6	1.3	29.8	27.9	1.9
Oak-hickory	2.5	2.0	0.5	2.8	2.4	0.4
Bottomland hardwoods ¹	3.0	2.3	0.8	2.9	2.3	0.6
All softwoods	5.1	4.3	0.8	5.1	4.5	0.6
Hardwoods:						
Longleaf-slash pine	.....	.....	.....	.....	.....	.....
Loblolly-shortleaf pine	26.9	13.9	13.0	30.7	24.4	6.3
Oak-pine	52.9	31.5	21.4	50.3	36.7	13.6
Oak-hickory	83.6	54.9	28.7	76.3	50.7	25.6
Bottomland hardwoods ¹	95.1	64.0	31.1	88.8	61.5	27.2
All hardwoods	87.7	58.3	29.4	82.1	56.4	25.7
All types	92.7	62.6	30.2	87.2	60.9	26.3

¹Includes oak-gum-cypress and elm-ash-cottonwood forest types.

Table Xc.- *Average basal area per acre of live trees by forest type, and tree class, North region, 1977 and 1987*

Species group and forest type	Tree class 1987			Tree class 1977		
	All trees	Growing stock	Cull	All trees	Growing stock	Cull
----- <i>Square feet per acre</i> -----						
Softwoods:						
Longleaf-slash pine	84.9	80.6	4.3	45.8	42.0	3.8
Loblolly-shortleaf pine	72.0	66.2	5.7	72.2	67.7	4.5
Oak-pine	28.9	26.7	2.2	32.4	31.1	1.2
Oak-hickory	6.2	5.6	0.6	6.8	6.2	0.5
Bottomland hardwoods ¹	3.0	2.6	0.4	3.4	3.0	0.4
All softwoods	24.9	22.9	2.0	28.8	27.1	1.7
Hardwoods:						
Longleaf-slash pine	.....	.....	.....	.....	.....	.....
Loblolly-shortleaf pine	28.3	14.8	13.5	27.2	17.6	9.6
Oak-pine	45.0	26.8	18.2	54.0	38.0	16.0
Oak-hickory	65.9	43.8	22.1	72.0	51.3	20.7
Bottomland hardwoods ¹	80.3	54.4	25.9	80.1	55.1	25.0
All hardwoods	55.2	35.3	19.9	57.7	40.2	17.5
All types	80.0	58.2	21.9	86.5	67.3	19.2

¹Includes oak-gum-cypress and elm-ash-cottonwood forest types.

Table Xd.— *Average basal area per acre of live trees by forest type, and tree class, Central region, 1977 and 1987*

Species group and forest type	Tree class 1987			Tree class 1977		
	All trees	Growing stock	Cull	All trees	Growing stock	Cull
----- <i>Square feet per acre</i> -----						
Softwoods:						
Longleaf-slash pine	78.4	78.4	.....	69.0	68.3	0.7
Loblolly-shortleaf pine	66.2	61.6	4.6	72.3	68.5	3.8
Oak-pine	32.6	30.2	2.4	33.9	31.7	2.1
Oak-hickory	7.5	6.9	0.6	9.0	8.5	0.5
Bottomland hardwoods ¹	3.8	3.6	0.2	5.6	5.3	0.3
All softwoods	31.6	29.3	2.2	37.8	35.7	2.1
Hardwoods:						
Longleaf-slash pine	18.4	15.7	2.7	17.2	15.2	2.0
Loblolly-shortleaf pine	24.7	14.5	10.2	26.9	18.9	8.0
Oak-pine	48.0	30.3	17.6	52.2	36.6	15.6
Oak-hickory	52.7	34.6	18.1	58.1	41.5	16.5
Bottomland hardwoods ¹	83.5	57.3	26.2	83.4	58.1	25.4
All hardwoods	47.2	30.6	16.6	49.3	34.7	14.6
All types	78.8	59.9	18.9	87.1	70.4	16.6

Includes oak-gum-cypress and elm-ash-cottonwood forest types.

Table Xe.— *Average basal area per acre of live trees by forest type, and tree class, South region, 1977 and 1987*

Species group and forest type	Tree class 1987			Tree class 1977		
	All trees	Growing stock	Cull	All trees	Growing stock	Cull
----- <i>Square feet per acre</i> -----						
Softwoods:						
Longleaf-slash pine	53.6	50.3	3.3	50.0	47.9	2.1
Loblolly-shortleaf pine	54.8	50.3	4.5	58.9	55.6	3.2
Oak-pine	29.0	26.9	2.1	26.6	25.3	1.3
Oak-hickory	8.6	8.2	0.4	8.2	7.4	0.7
Bottomland hardwoods ¹	7.1	6.7	0.4	9.3	8.8	0.5
All softwoods	31.3	29.1	2.2	32.6	30.9	1.6
Hardwoods:						
Longleaf-slash pine	11.4	5.7	5.7	11.5	7.5	4.0
Loblolly-shortleaf pine	18.9	9.8	9.2	21.5	13.5	8.0
Oak-pine	35.9	20.6	15.3	34.6	21.3	13.3
Oak-hickory	38.6	22.8	15.8	45.5	33.1	12.4
Bottomland hardwoods ¹	91.0	57.9	33.1	85.4	55.0	30.4
All hardwoods	37.6	22.3	15.3	37.1	24.2	12.9
All types	68.9	51.4	17.5	69.6	55.1	14.5

¹Includes oak-gum-cypress and elm-ash-cottonwood forest types.

Table Xf.— *Average basal area per acre of live trees by forest type, and tree class, Southwest region, 1977 and 1987*

Species group and forest type	Tree class 1987			Tree class 1977		
	All trees	Growing stock	Cull	All trees	Growing stock	Cull
----- <i>Square feet per acre</i> -----						
Softwoods:						
Longleaf-slash pine				71.9	67.5	4.4
Loblolly-shortleaf pine 62.2	58.5	3.7	73.0	69.7	3.2	
Oak-pine 33.6	31.7	1.9	34.3	31.9	2.4	
Oak-hickory 7.0	6.5	0.5	6.0	5.6	0.4	
Bottomland hardwoods ¹ 3.4	3.2	0.2	7.7	6.8	0.9	
All softwoods 26.8	25.2	1.6	31.8	30.0	1.8	
Hardwoods:						
Longleaf-slash pine				17.3	13.5	3.8
Loblolly-shortleaf pine 25.4	15.3	10.2	27.7	20.0	7.7	
Oak-pine 54.3	36.4	17.9	51.3	37.7	13.6	
Oak-hickory 68.4	44.6	23.8	68.3	47.1	21.2	
Bottomland hardwoods ¹ 89.0	60.9	28.1	88.0	56.9	31.1	
All hardwoods 56.7	37.2	19.5	56.8	39.2	17.6	
All types 83.5	62.4	21.1	88.5	69.2	19.3	

¹Includes oak-gum-cypress and elm-ash-cottonwood forest types.

Table XI.— *Growing-stock volume by survey region, species group, and change since 1977, Mississippi, 1987*

Survey region	All species		Softwood		Hardwood	
	Volume	Change	Volume	Change	Volume	Change
	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>
Delta	1,916.3	+23	132.8	+24	1,783.6	+23
North	4,674.7	+16	1,955.7	+9	2,718.9	+21
Central	4,984.6	+7	2,782.6	-2	2,202.0	+20
south	4,042.8	+11	2,442.1	+2	1,600.2	+26
Southwest	3,807.1	+8	1,773.0	-7	2,034.0	+25
All regions	19,425.5	+11	9,086.8	()	10,338.7	+23

¹Rows and columns may not add due to rounding.

() Change is less than 1 percent.

decreased since 1977 for both softwoods and hardwoods. Due mainly to the grading specifications regarding tree size for hardwoods, there is no volume in tree grade 1 for trees less than 15 inches in d.b.h. Hardwood grade 1 sawtimber volume has decreased 24 percent for larger trees. Softwood sawtimber volume has decreased 8 percent for all grade 1 trees. Sawtimber volume for small trees (<15 inches in d.b.h.) also decreased for grade 2 (16 percent). Large-tree volume for grade 2, all grade 3 trees, and tie and timber volumes have increased over the past 10 years. Statewide distribution of sawtimber volume for tree grade 1 varies considerably for some species (fig. 21).

These trends are to be expected of maturing timber stands: more volume is in large trees, but quality is deteriorating as defect caused by rot and other degrade sets in. The harvesting of high-quality sawtimber and the inattention given to replacing harvested trees has also contributed to overall lowering of grades.

Saw-log Lengths and Saw-log Top Inside-bark Diameters

For saw logs, the minimum diameter outside bark is 7 inches for softwoods and 9 inches for hardwoods. Often, the small end diameter is larger if the main bole terminates because of branching or defect. Inside bark diameter at the saw-log top is calculated as a linear function of d.b.h., bark thickness at d.b.h., and saw-log top outside bark diameter measured by a Wheeler pentaprism. The butt end of saw-log length is generally a stump 1-foot high, but sometime& higher if the tree is swellbuted or defective in some other way.

Softwood saw logs in trees less than 15 inches in d.b.h. average 38 feet in length to an average top inside-bark diameter of 6.8 inches; larger softwoods average 54 feet and 9.4 inches (table XVI). The average measurements for all softwood sawtimber trees are 41 feet for saw-log length and 7.3 inches for saw-log top inside-bark diameter.

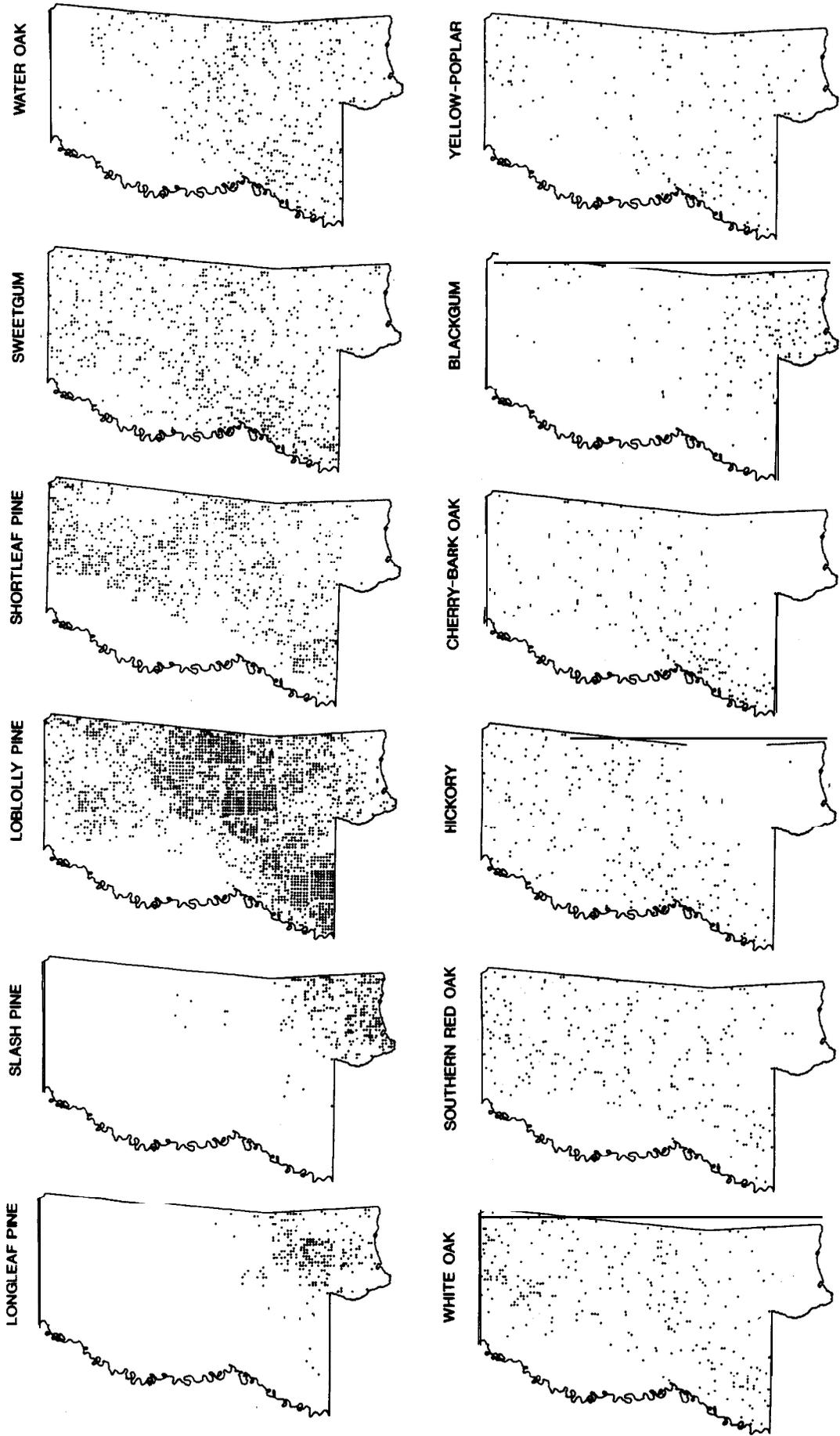


Figure 13.—Distribution of growing-stock volume, Mi. 1987. Each dot represents 2.5 million cubic feet.

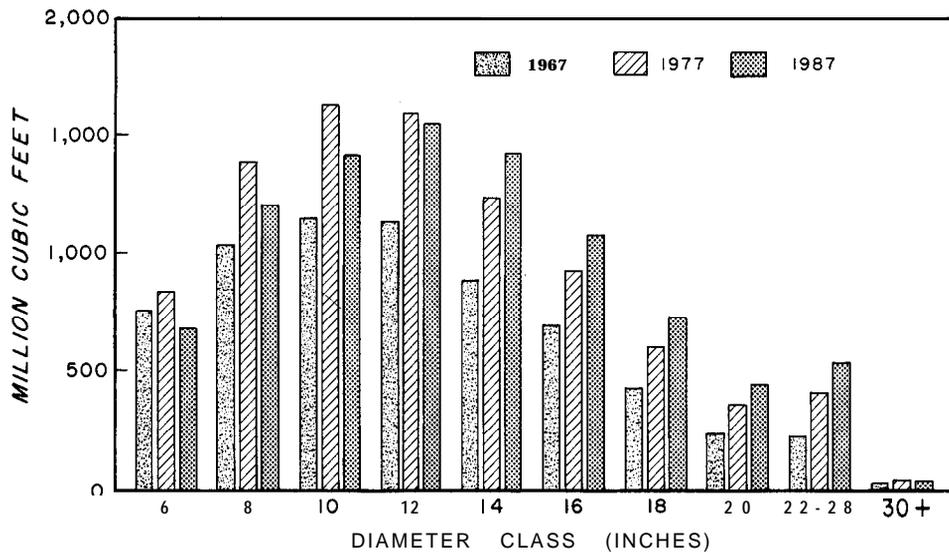


Figure 14.— Softwood growing-stock volume by diameter class, Mississippi, 1967 to 1987.

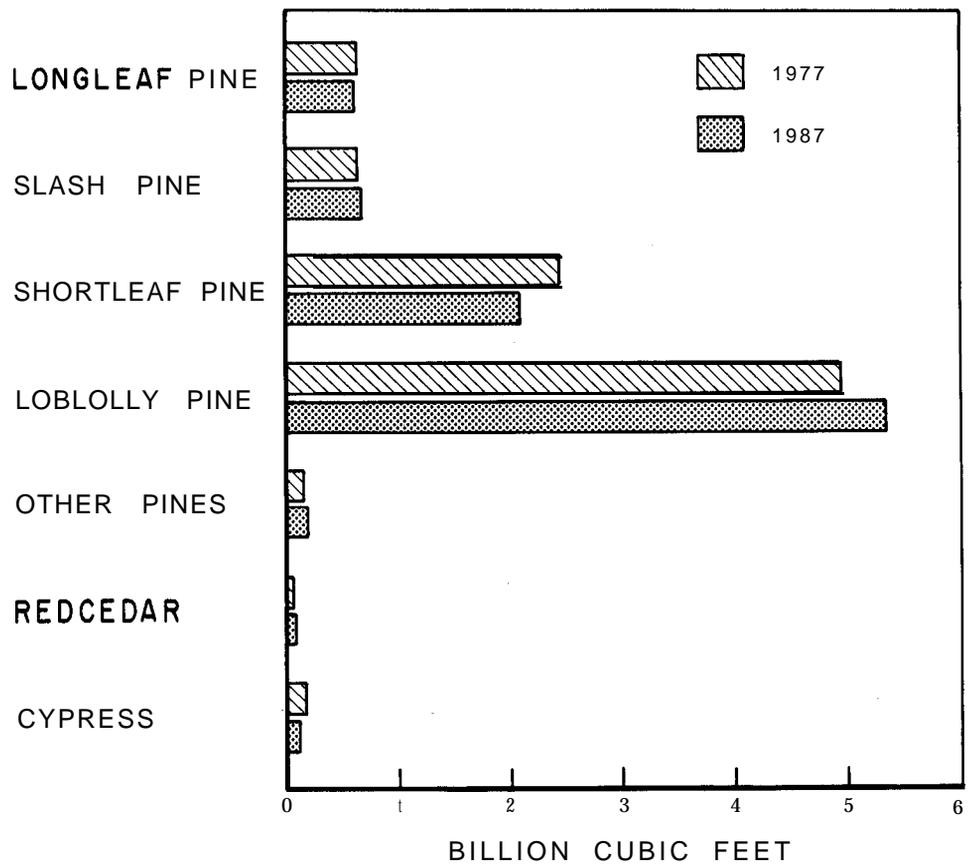


Figure 15.— Growing-stock volume for softwood species, Mississippi, 1977 and 1987.

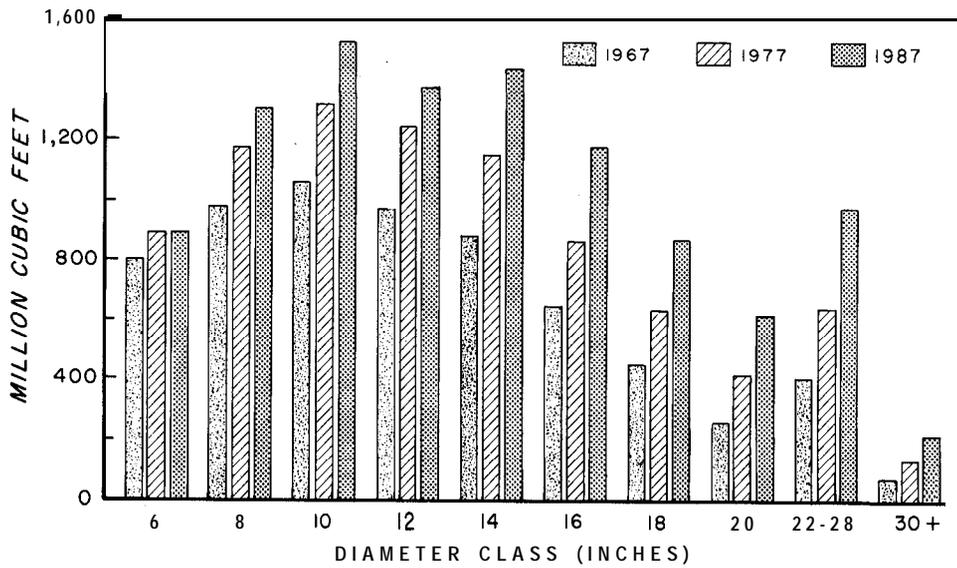


Figure 16.—Hardwood growing-stock volume by diameter class, Mississippi, 1967 to 1987.

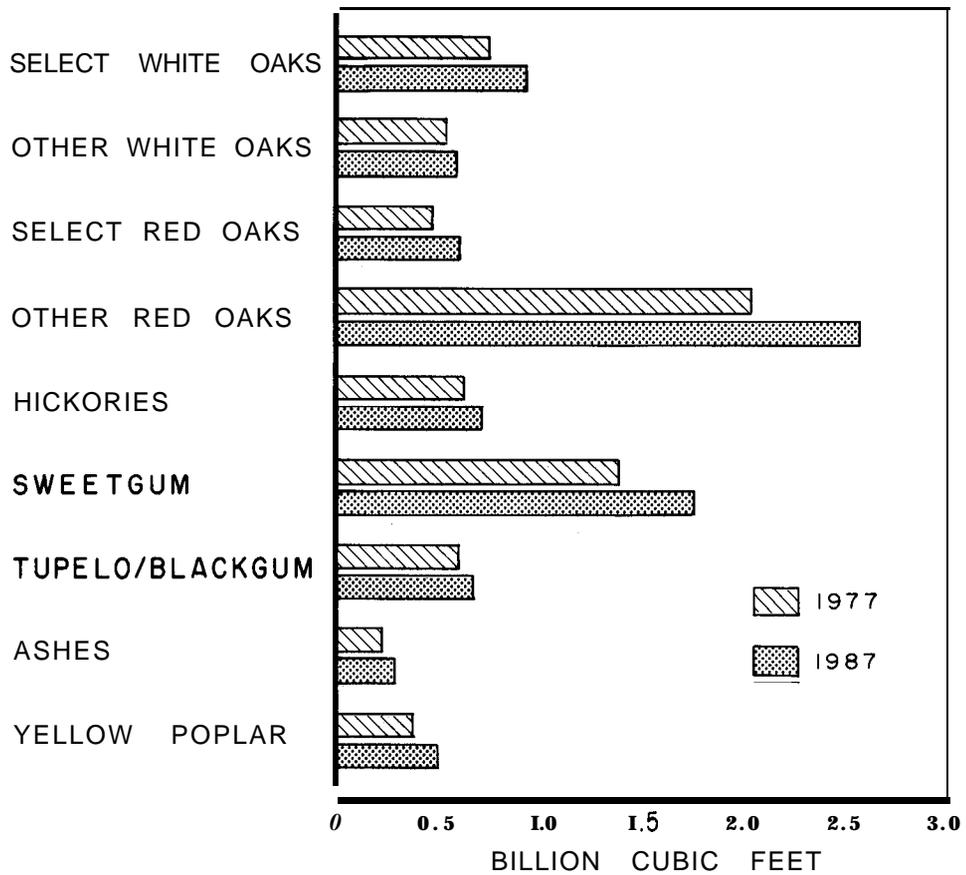


Figure 17.—Growing-stock volume for major hardwood species, Mississippi, 1977 and 1987.

Table XII.—*Growing-stock volume by ownership, forest type, species group, and change since 1977, Mississippi, 1987*¹

Ownership	Species group	All types		Pine plantations ²		Natural pine ³		Oak-pine		Oak-hickory		Bottomland hardwoods ⁴	
		Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change
		<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>	<i>Million cubic feet</i>	<i>Percent</i>
Public	softwood	1,744.7	+7	121.5	+41	1,022.4	-14	463.3	+69	95.7	+70	41.7	+51
	Hardwood	1,319.6	+47	9.4	+54	154.1	+3	274.6	+54	370.6	+112	511.0	+31
	Total	3,064.4	+21	130.9	+42	1,176.5	-12	737.9	+63	466.3	+102	552.7	+32
Forest industry	Softwood	1,671.2	-4	495.4	+65	111.5	-20	310.6	-16	91.5	+61	50.2	-58
	Hardwood	1,281.1	-1	34.4	+98	76.8	-9	183.1	-11	389.7	+33	597.2	-15
	Total	2,952.3	-3	529.8	+67	794.2	-19	493.7	-15	487.2	+38	647.4	-21
Nonindustrial private	Softwood	5,670.9	(⁵)	530.3	+8	2,834.0	-10	1,506.1	+14	583.8	+42	216.7	-17
	Hardwood	7,738.0	+25	46.5	+10	416.6	+11	1,049.6	+13	3,296.1	+41	2,928.7	+16
	Total	13,408.9	+13	576.8	+8	3,250.6	-8	2,555.6	+14	3,880.5	+41	3,145.4	+13
All owners	Softwood	9,086.8	(⁵)	1,147.2	+31	4,573.9	-13	2,280.0	+16	171.0	+47	308.6	-25
	Hardwood	10,338.7	+23	90.3	+38	647.4	+6	1,507.2	+14	4,056.9	+45	4,036.8	+12
	Total	19,425.5	+11	1,237.6	+31	5,221.3	-11	3,787.3	+15	4,833.9	+45	4,345.4	+8

¹Rows and columns may not add due to rounding.

²Planted stands of either longleaf-slash pine or loblolly-shortleaf pine forest types.

³Longleaf-slash pine and loblolly-shortleaf pine forest types of natural origin.

⁴Oak-gum-cypress and elm-ash-cottonwood forest types.

⁵Change is less than 1 percent.

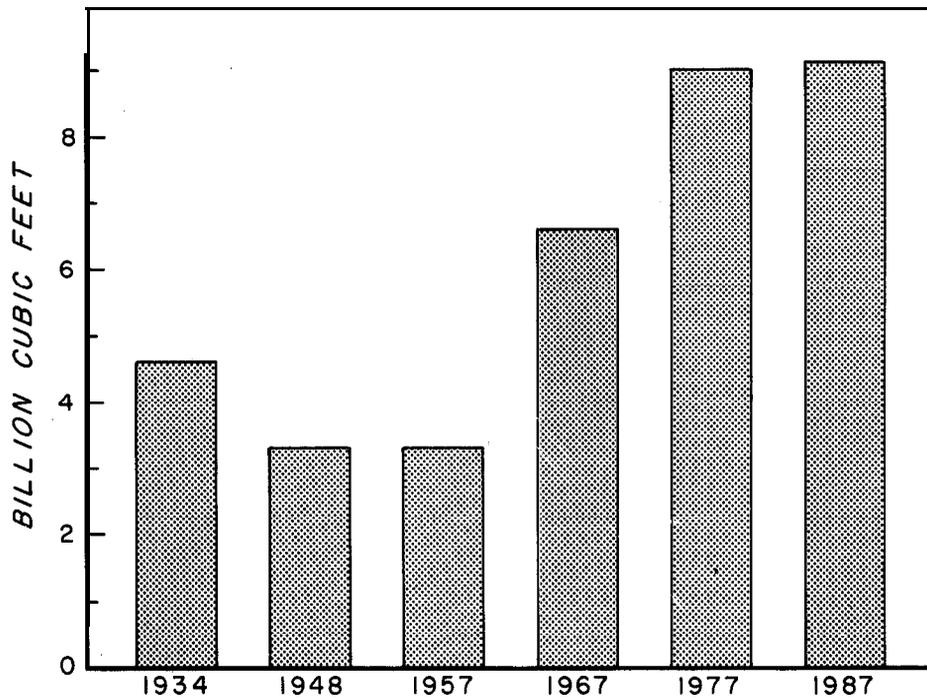


Figure 18.— Volume of softwood growing stock by survey year, Mississippi.

Table XIII.— Sawtimber volume by survey region, species group, and change since 1977, Mississippi, 1987*

Survey	All species		Softwood		Hardwood	
	Volume	Change	Volume	Change	Volume	Change
	Million board feet ²	Percent	Million board feet ²	Percent	Million board feet ²	Percent
Delta	7,501.4	+28	526.4	+50	6,975.0	+26
North	15,833.1	+32	7,474.9	+27	8,358.2	+36
Central	19,501.7	+17	12,953.5	+12	6,548.2	+29
South	14,177.0	+12	9,679.0	+6	4,498.1	+27
Southwest	16,196.7	+14	8,963.4	+2	7,233.4	+35
All regions	73,209.9	+19	39,597.1	+11	33,612.8	+31

*Rows and columns may not add due to rounding.

*International 1/4-inch rule.

Table XIV.—Sawtimber volume by ownership, forest type, species group, and change since 1977, Mississippi, 1987¹

Ownership	Species group	All types		Pine plantations*		Natural pine ³		Oak-pine		Oak-hickory		Bottomland hardwoods ⁴	
		Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change
		Million board feet^{5}	Percent	Million board feet^{5}	Percent	Million board feet^{5}	Percent	Million board feet^{5}	Percent	Million board feet^{5}	Percent	<i>Million board feet⁵</i>	<i>Percent</i>
Public	Softwood	9,029.9	+11	550.6	+96	5,305.0	-12	2,428.4	+77	531.6	+84	208.3	+36
	Hardwood	4,686.3	+53	14.8	+138	376.5	+9	817.0	+72	1,427.9	+126	2,050.1	+28
	Total	13,716.3	+23	565.3	+97	5,681.5	-11	3,245.4	+75	1,965.5	+113	2,258.5	+29
Forest industry	Softwood	6,379.6	-2	1,222.3	+97	2,997.3	-13	1,427.6	-12	463.8	+83	268.1	-55
	Hardwood	4,197.0	4	54.4	+82	143.0	-22	516.1	()	1,265.3	+36	2,218.1	-18
	Total	10,576.5	-3	1,276.6	+96	3,140.3	-13	1,943.7	-9	1,729.1	+46	2,486.8	-25
Nonindustrial private	softwood	24,187.6	+14	1,638.3	+45	12,408.7	+3	6,495.1	+27	2,541.8	+59	1,103.7	-14
	Hardwood	24,729.5	+36	141.5	+36	872.0	+19	2,671.8	+12	10,502.5	+55	10,541.7	+29
	Total	48,917.1	+24	1,779.8	+44	13,280.7	+4	9,166.9	+22	13,044.4	+55	11,645.4	+23
All owners	Softwood	39,597.2	+11	3,411.1	+68	20,710.9	-4	10,351.1	+28	3,543.2	+65	1,580.8	-22
	Hardwood	33,612.8	+31	210.6	+51	1,391.6	+10	4,004.9	+18	13,195.8	+58	14,809.9	+19
	Total	73,209.9	+19	3,621.7	+67	22,102.5	-3	14,356.0	+25	16,739.0	+59	16,390.7	+13

¹Rows and columns may not add due to rounding.

*Planted stands of longleaf-slash and loblolly-shortleaf pine forest types.

³Longleaf-slash and loblolly-shortleaf pine forest types of natural origin.

⁴Oak-gum-cypress and elm-ash-cottonwood forest types.

⁵International 1/4-inch rule

⁶Change of less than 1 percent.

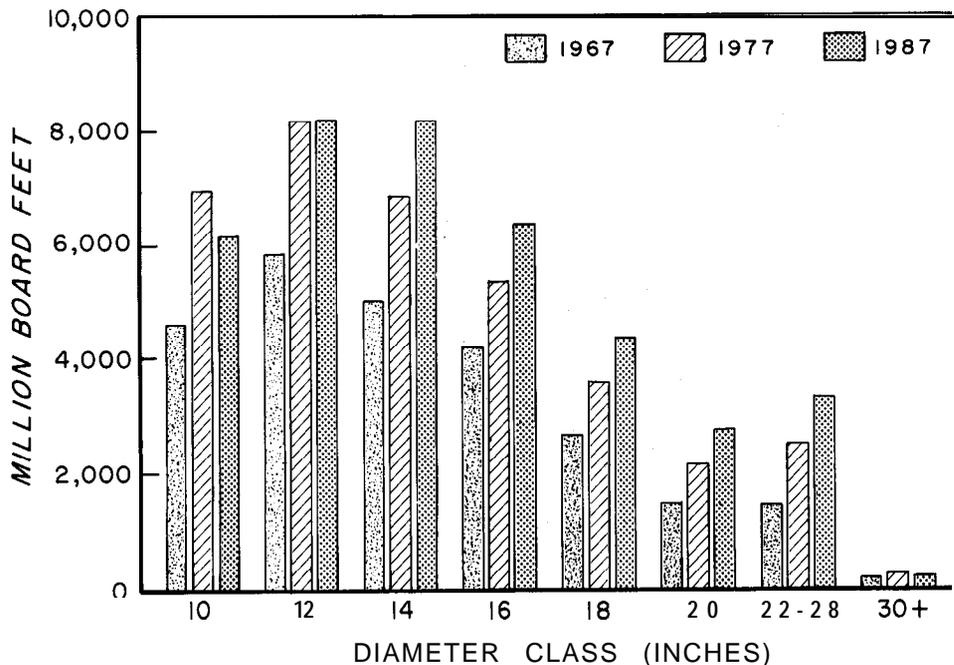


Figure 19.—Softwood sawtimber volume by diameter class, Mississippi, 1967 to 1987.

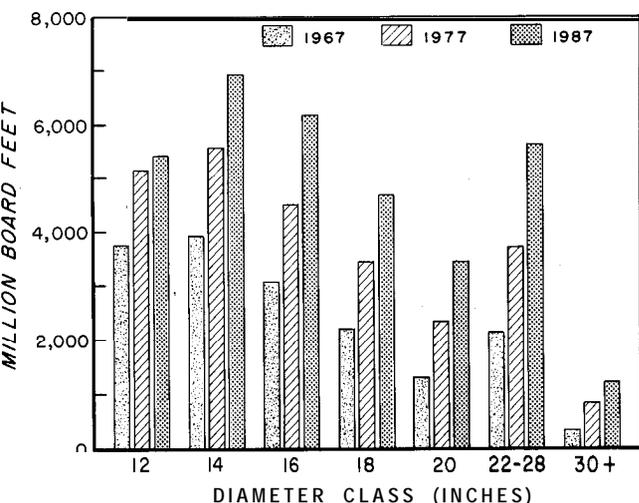


Figure 20.—Hardwood sawtimber volume by diameter class, Mississippi, 1967 to 1987.

Similar measurements for small hardwoods are 26 feet for saw-log length and 9.0 inches for small end diameter inside bark; large hardwoods average 37 feet and 12.0 inches. Hardwood grade 1 trees average 44 feet and 13.3 inches. The average for all hardwood sawtimber is 30 feet and 10.1 inches.

Saw-log length and small end inside-bark diameter vary considerably for individual species. Many oaks, for example, have saw-log lengths shorter than average and top inside-bark diameters larger than average; sweetgum has a longer saw-log length and a smaller than average diameter.

Cull-tree Volume

Cull-tree timber is useful where bole quality is unimportant, such as for pulpwood. In Mississippi, cull volume totals 2.9 billion cubic feet (table XVII), or 15 percent of the growing-stock volume (fig. 22). Most of the cull volume is in hardwood trees, where it is 25 percent of growing-stock volume. Softwood cull has increased 43 percent since 1977 and hardwood cull, 22 percent. All survey regions had increased cull volume over the past 10 years, a trend commensurate with the increase in the number, basal area, and stocking of cull trees.

BIOMASS WEIGHTS AND SPECIES DISTRIBUTION

A total of 734.3 million dry-weight tons of woody biomass is on timberland in Mississippi (table XVIII). Most, 56 percent, is merchantable dry weight (the main stem of growing-stock trees); the rest is contained in nonmerchantable, residual portions of trees. Hardwood biomass is 69 percent of the total.

The hardwood forest types, oak-hickory and bottomlands, contain more biomass than other types (table XIX). Nonindustrial private owners hold most of the biomass.

A total of 101 different species was sampled, including 10 softwood species and 91 hardwood species. Loblolly pine (*Pinus taeda*) is the species with the most total dry-weight biomass statewide and in all regions except the Delta (tables XXa-XXf).

Table XV.—Sawtimber volume by tree grade,¹ tree size, and species group, Mississippi, 1977 and 1987²

Tree grade	1987				1977			
	Softwood		Hardwood		Softwood		Hardwood	
	Tree size (d.b.h. in inches)							
	9.0-14.9	15.0+	11.0-14.9	15.0+	9.0-14.9	15.0+	11.0-14.9	15.0+
	-----Million board feet ³ -----							
1	2,032.2	4,068.3		2,890.8	2,467.8	4,194.4		3,790.6
2	3,179.1	3,636.5	955.3	5,828.9	3,669.7	3,594.1	1,252.0	4,334.7
3	17,384.3	9,296.8	7,412.8	8,013.7	15,864.8	6,003.1	6,510.0	4,432.6
Tie and timber			4,020.8	4,490.6			2,994.0	2,322.7
Total	22,595.6	17,001.6	12,388.8	21,224.0	22,002.3	13,791.5	10,755.9	14,880.8

¹Tree grade determined by grade of the butt log.

²Columns may not add due to rounding.

³International 1/4-inch rule.

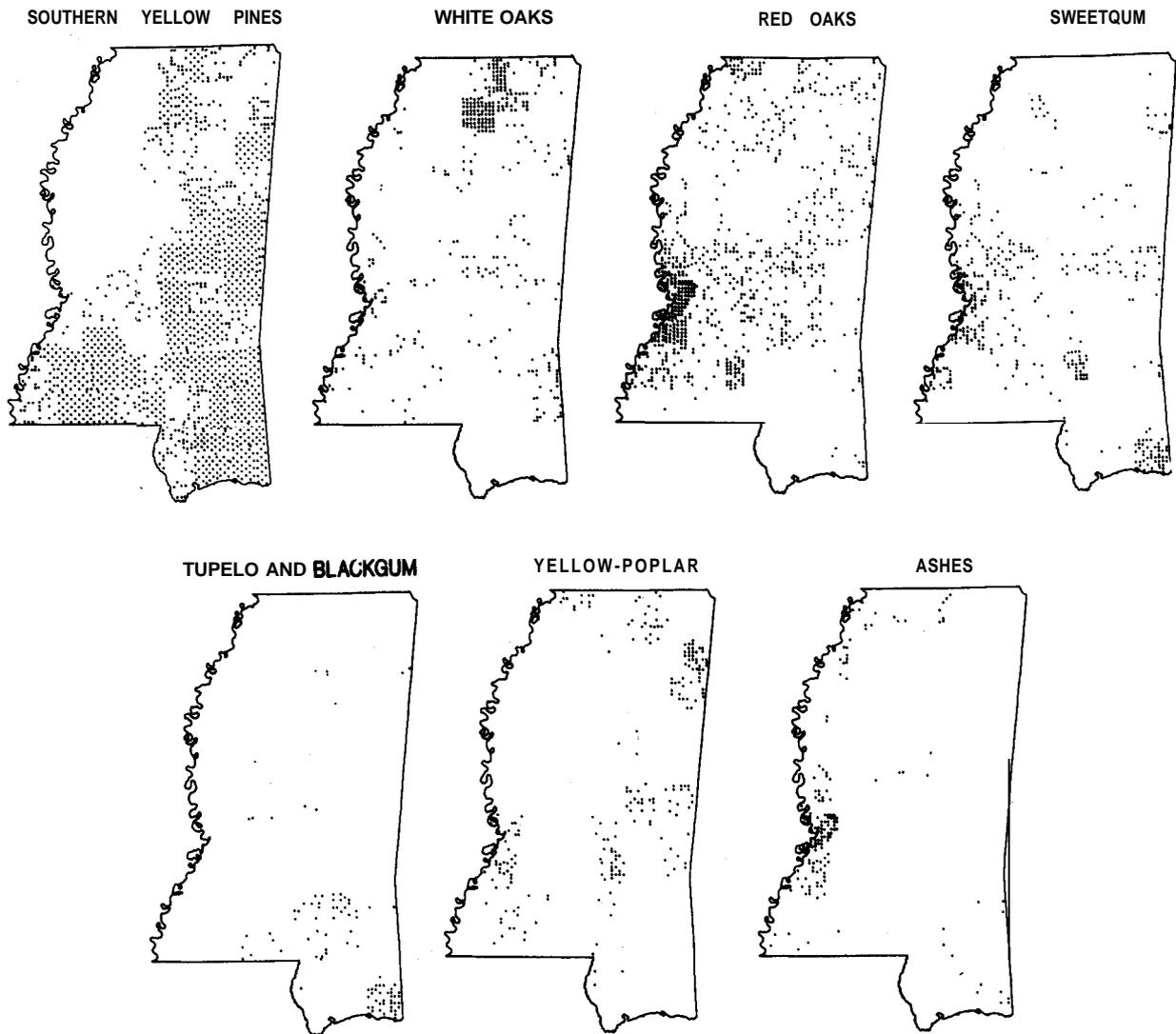


Figure 21.—Distribution of sawtimber volume in tree grade 1, Mississippi, 1987. Each dot represents 1 million board feet.

Table XVI.- *Average saw-log length and saw-top inside bark diameter of sawtimber by tree grade, species group, and size class, Mississippi, 1987*

Tree grade	Softwood				Hardwood			
	Tree size (d.b.h. in inches)							
	9-14.9		15.0+		11-14.9		15.0+	
	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet
Saw-top diameter	Saw-log length	Saw-top diameter	Saw-log length	Saw-top diameter	Saw-log length	Saw-top diameter	Saw-log length	
1	7.0	38	9.1	60	.....	.	13.3	44
2	6.9	45	9.4	57	9.4	36	12.1	39
3	6.8	40	9.3	50	8.9	27	11.8	35
Tie and timber	.....	.....	.....	.....	9.0	25	11.9	34
All grades	6.8	38	9.4	54	9.0	26	12.0	37

*Tree grade determined by grade of butt log.

Table XVII.- *Volume of cull trees by survey region, species group, and change since 1977, Mississippi, 1987*

Survey region	All species		Softwood		Hardwood	
	Volume	Change	Volume	Change	Volume	Change
	Million cubic feet	Percent	Million cubic feet	Percent	Million cubic feet	Percent
Delta	473.8	37	13.8	5	460.0	38
North	132.0	18	70.4	76	661.6	14
Central	576.8	23	102.9	45	473.8	19
South	565.4	33	78.4	61	487.1	29
Southwest	523.7	14	58.6	7	465.2	15
All regions	2,871.1	24	324.1	43	2,547.6	22

*Rows and columns may not add due to rounding.

Table XVIII.- *Dry weight of forest biomass on timberland by biomass category and survey region, Mississippi, 1987*

Survey region	Total dry weight			Merchantable dry weight			Residual dry weight		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood	All species	Softwood	Hardwood
----- Million tons -----									
Delta	82.6	3.1	79.5	42.9	2.3	40.6	39.7	0.8	38.9
North	192.2	49.6	142.6	105.3	37.1	68.2	86.9	12.5	74.3
Central	175.6	66.4	109.3	103.2	50.3	52.9	72.5	16.1	56.4
South	147.9	65.9	81.9	82.7	47.0	35.7	65.2	18.9	46.2
Southwest	136.0	41.2	94.8	78.1	31.8	46.3	57.9	9.4	48.5
All regions	734.3	226.2	508.1	412.2	168.5	243.1	322.1	57.1	264.4

*Rows and columns may not add due to rounding.

Table XIX-Total dry weight of woody biomass on timberland by forest type, ownership, and species group, Mississippi, 1987¹

Ownership	Species group	All types	Pine plantations*	Natural pine ¹	Oak-pine	Oak-hickory	Bottomland hardwoods ⁴
----- Million tons -----							
Public	Softwood	40.8	3.1	23.9	10.6	2.1	1.0
	Hardwood	62.5	0.6	8.8	13.6	17.2	22.2
	Total	103.3	3.8	32.7	24.2	19.3	23.2
Forest industry	Softwood	44.6	15.9	17.0	8.2	2.3	1.2
	Hardwood	65.7	3.6	5.9	10.7	19.2	26.3
	Total	110.3	19.5	22.9	18.9	21.5	27.5
Nonindustrial private	Softwood	140.8	15.0	70.3	36.3	14.0	5.1
	Hardwood	379.9	4.1	26.3	58.4	161.3	129.8
	Total	520.7	19.2	96.6	94.7	175.4	134.9
All owners	Softwood	226.2	34.0	111.3	55.1	18.5	7.3
	Hardwood	508.1	8.4	40.9	82.6	197.7	178.4
	Total	734.3	42.4	152.2	137.8	216.2	185.6

¹Rows and columns may not add due to rounding.

*Plantation stands of longleaf-slash pine and loblolly-shortleaf pine forest types.

¹Longleaf-slash pine and loblolly-shortleaf pine forest types of natural origin.

⁴Oak-gum-cypress and elm-ash-cottonwood forest types.

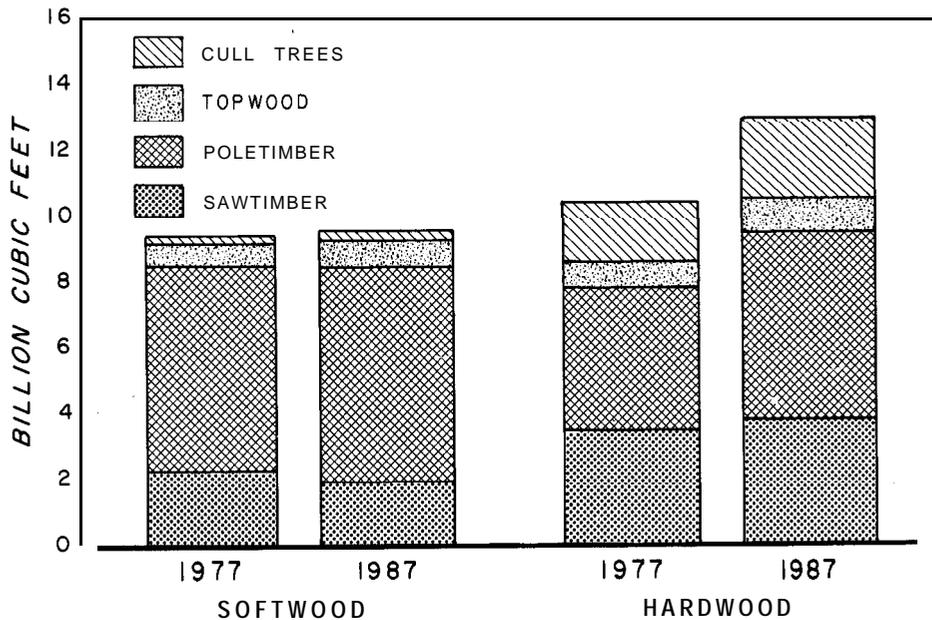


Figure 22.-Volume of timber by species group and class of timber, Mississippi, 1977 and 1987.

Table XXa.—*Total dry weight of all woody biomass, ranked by species, Mississippi, 1987*

Species	Dry weight
	<i>Million tons</i>
Loblolly pine	134.62
Sweetgum	63.67
Water oak	53.97
Shortleaf pine	46.60
White oak	38.64
Southernredoak	35.87
Hickory	30.12
Cherrybark oak	24.25
Post oak	23.94
Blackgum	19.21
Slash pine	19.02
Willow oak	16.88
Longleaf pine	15.99
Yellow-poplar	14.24
Sugarberry	13.32
Red maple	13.25
Green ash	11.25
Flowering dogwood	10.74
American beech	9.11
Sweetbay	8.63
Overcup oak	8.43
Black oak	6.61
American hornbeam	6.23
Winged elm	6.01
Black cherry	5.32
Swamp tupelo	5.22
Swamp chestnut oak	5.08
American elm	5.07
Nuttall oak	4.87
Laurel oak	4.84
Spruce pine	4.71
Water hickory	4.23
Shumard oak	4.08
Sycamore	3.97
Cottonwood	3.64
Sourwood	3.49
White ash	3.46
Common persimmon	3.14
Boxelder	3.05
Willow	3.02
Eastern hophornbeam	2.85
Pecan	2.82
Scarlet oak	2.80
Water tupelo	2.57
Eastern redcedar	2.52
Baldcypress	2.46
Blackjack oak	2.43
River birch	2.01
Sassafras	1.76
Southern magnolia	1.04
51 other species	<u>13.21</u>
All species	734.25

Totals may not add due to rounding.

Table XXb.—*Total dry weight of all woody biomass, ranked by species, Delta region, 1987*

Species	Dry weight
	<i>Million tons</i>
Sweetgum	9.24
Sugarberry	8.61
Green ash	5.05
Overcup oak	4.36
Nuttall oak	4.24
Water oak	3.93
Willow oak	3.79
Water hickory	3.61
Hickory	3.11
Cherrybark oak	2.71
Cottonwood	2.35
American elm	1.78
White oak	1.77
Pecan	1.76
Boxelder	1.73
Southern red oak	1.72
American beech	1.72
Willow	1.71
Sycamore	1.46
Water tupelo	1.36
Yellow-poplar	1.23
Baldcypress	1.05
Shortleaf pine	1.03
Shumard oak	0.97
White ash	0.92
Common persimmon	0.89
Eastern hophornbeam	0.82
American hornbeam	0.81
Loblolly pine	0.70
Sassafras	0.70
Flowering dogwood	0.69
Winged elm	0.49
Red maple	0.48
Black oak	0.46
Post oak	0.40
Swamp chestnut oak	0.36
Cedar elm	0.35
Black cherry	0.33
Slippery elm	0.32
Sugar maple	0.31
Honey locust	0.29
Eastern redcedar	0.28
Blackgum	0.27
Silver maple	0.26
Chinkapin oak	0.24
Water-elm	0.23
Red mulberry	0.20
White basswood	0.19
Chestnut oak	0.19
Black walnut	0.11
27 other species	<u>0.94</u>
All species	82.58

Totals may not add due to rounding.

Table XXc.—*Total dry weight of all woody biomass, ranked by species, North region, 1987*

Species	Dry weight
	Million tons
Loblolly pine	27.43
Shortleaf pine	20.30
Sweetgum	17.89
White oak	16.75
Southern red oak	15.56
Hickory	12.04
Post oak	10.76
Water oak	8.24
Cherrybark oak	6.98
Black oak	4.64
Willow oak	4.46
Red maple	4.14
Yellow-poplar	3.98
Flowering dogwood	3.49
Blackgum	3.14
Winged elm	2.57
Green ash	2.24
Scarlet oak	2.19
Overcup oak	1.88
River birch	1.66
Shumard oak	1.44
American beech	1.43
Eastern redcedar	1.42
Blackjack oak	1.31
White ash	1.26
Black cherry	1.16
Sugarberry	1.16
American elm	1.11
Common persimmon	1.08
Sour-wood	1.03
Sycamore	1.03
American hornbeam	0.72
Northern red oak	0.64
Swamp chestnut oak	0.59
Willow	0.47
Black locust	0.43
Eastern hophornbeam	0.42
Boxelder	0.41
Water tupelo	0.39
Sweetbay	0.36
Laurel oak	0.34
Chestnut oak	0.34
Baldcypress	0.33
Sassafras	0.30
Slippery elm	0.29
Red mulberry	0.26
Nuttall oak	0.26
Black walnut	0.23
Osage-orange	0.21
Water hickory	0.18
31 other species	<u>0.127</u> 127
All species	192.16

*Totals may not add due to rounding.

Table XXd.—*Total dry weight of all woody biomass, ranked by species, Central region, 1987¹*

Species	Dry weight
	Million tons
Loblolly pine	48.35
Sweetgum	16.03
Water oak	15.48
Shortleaf pine	13.08
White oak	9.83
Southern red oak	8.70
Hickory	8.28
Post oak	6.58
Willow oak	5.30
Cherrybark oak	4.77
Red maple	3.90
Blackgum	3.22
Yellow-poplar	2.96
Spruce pine	2.65
Flowering dogwood	1.91
American beech	1.79
Swamp chestnut oak	1.59
American hornbeam	1.53
Green ash	1.40
Overcup oak	1.30
Longleaf pine	1.28
Winged elm	1.24
Laurel oak	1.19
Sourwood	1.13
Black cherry	1.01
Shumard oak	0.96
Sweetbay	0.95
Black oak	0.87
Sugarberry	0.83
Swamp tupelo	0.80
Common persimmon	0.63
American elm	0.62
Blackjack oak	0.49
Slash pine	0.48
Eastern redcedar	0.42
White ash	0.36
Eastern hophornbeam	0.33
Sycamore	0.33
Sassafras	0.31
Willow	0.29
Water tupelo	0.23
American holly	0.20
Boxelder	0.17
Red mulberry	0.17
Durand oak	0.17
Baldcypress	0.14
Swamp white oak	0.14
Scarlet oak	0.13
Northern red oak	0.10
River birch	0.09
33 other species	<u>0.96</u>
All species	175.64

*Totals may not add due to rounding.

Table XXe.—*Total dry weight of all woody biomass, ranked by species, South region, 1987'*

Species	Dry weight
	<i>Million tons</i>
Loblolly pine	26.06
Slash pine	18.21
Longleaf pine	14.33
Water oak	12.45
Blackgum	10.67
Sweetbay	7.05
Sweetgum	6.32
Shortleaf pine	5.01
Southern red oak	4.54
Swamp tupelo	3.89
Red maple	3.72
Post oak	3.60
Yellow-poplar	3.46
White oak	3.20
Laurel oak	2.95
Flowering dogwood	2.62
Hickory	1.96
Willow oak	1.72
Spruce pine	1.26
Blackcherry	1.22
Swamp chestnut oak	1.22
American hornbeam	1.16
Cherrybark oak	1.09
American beech	0.97
Greenash	0.92
Baldcypress	0.76
Overcup oak	0.63
American holly	0.53
Blackjack oak	0.51
Sourwood	0.47
Southern magnolia	0.40
American elm	0.31
Sparkleberry	0.29
Water tupelo	0.29
Pondcypress	0.27
Sugarberry	0.25
Common persimmon	0.25
Redbay	0.24
River birch	0.22
Scarlet oak	0.20
Water hickory	0.19
Winged elm	0.19
Shumard oak	0.18
Live oak	0.18
Sassafras	0.15
Black oak	0.12
Pecan	0.12
Turkey oak	0.12
Hawthorn	0.11
Sycamore	0.10
25 other species	1.20
All species	147.88

Totals may not add due to rounding.

Table XXf.—*Total dry weight of all woody biomass, ranked by species, Southwest region, 1987'*

Species	Dry weight
	<i>Million tons</i>
Loblolly pine	32.09
Sweetgum	14.19
Water oak	13.87
Cherrybark oak	8.68
Shortleaf pine	7.18
White oak	7.08
Southern red oak	5.35
Hickory	4.74
American beech	3.20
Yellow-poplar	2.62
Post oak	2.59
Sugarberry	2.47
Flowering dogwood	2.03
American hornbeam	2.01
Blackgum	1.91
Greenash	1.64
Willow oak	1.62
Blackcherry	1.61
Winged elm	1.51
Swamp chestnut oak	1.32
American elm	1.27
Eastern hophornbeam	1.19
Cottonwood	1.18
Sycamore	1.05
Red maple	1.01
Pecan	0.87
Sourwood	0.85
White ash	0.82
Spruce pine	0.80
Boxelder	0.73
Southern magnolia	0.60
Shumard oak	0.53
Black oak	0.52
Willow	0.44
Swamp tupelo	0.43
Longleaf pine	0.38
Eastern red cedar	0.37
Laurel oak	0.33
Water tupelo	0.30
Honeylocust	0.30
Common persimmon	0.30
Sassafras	0.29
Sweetbay	0.27
Nuttall oak	0.27
Overcup oak	0.23
American holly	0.23
Slash pine	0.21
Water hickory	0.21
White basswood	0.20
Red mulberry	0.19
31 other species	1.90
All species	136.00

Totals may not add due to rounding.

Sweetgum (*Liquidambar styraciflua*), the most common hardwood, is second in importance statewide. Water oak (*Quercus nigra*) is the most common oak species².

GROWTH, REMOVALS, AND MORTALITY

Components of Change

Components of change are gross growth, mortality, and removals. Gross growth is defined as the sum of survivor growth, ingrowth, growth on removals, and growth on mortality, minus cull increment. Net growth is defined as gross growth minus mortality; net change is net growth minus removals. Procedures for calculating inventory change are presented in Van Deusen and others (1986); the method used for the Mississippi survey emphasizes additivity between the initial (1977) and final (1987) surveys; the initial inventory plus gross growth minus mortality and removals approximately equals the final inventory estimate. May (1988a) uses the North region of Mississippi as an example in presenting the operational considerations for calculating change.

All species are increasing a net 184.2 million cubic feet annually, but softwoods may be slightly declining (table XXI). The 11.3 million cubic-foot net decrease for softwoods is too small to indicate a definite decline; the small increase in softwood growing-stock volume is within the margin of error that would indicate no definite increase, and is thus not contradictory³. Hardwoods, on the other hand, are clearly increasing — by an estimated 195.5 million cubic feet annually.

The net change in growing stock for softwoods and hardwoods is dominated by survivor growth and removals. Survivor growth accounts for 71 percent of gross growth for all species. Softwood removals are larger than net growth, causing the net decrease. Hardwood removals, on the other hand, are smaller than net growth, allowing for the annual increase of 195.5 million cubic feet.

Timber removals come from two sources: timberland and land clearing (table XXI). Timberland removals include growing-stock trees harvested for industrial uses and those killed during logging and related activities and by cultural treatments. Ninety-three percent of the timberland removal was

²These are not all taxonomically distinct species; see list in the appendix.

³The small increase of 73.7 million cubic feet is less than 1 percent of softwood growing-stock volume. Sampling errors for net change and inventory estimates indicate no statistical difference between the 1977 and 1987 softwood inventories. See May (1988a) for a discussion of potential additivity problems that could affect estimates of change.

used, with most of the remainder in trees killed by logging and related activities. Only a small amount, about 1 percent of timberland removals, was in trees killed by cultural treatments. Much of the timber from land clearing is cut and used, but exactly how much is difficult to assess.

Cull increment, the change in growing-stock volume due to tree class change, contributed a small but distinctly negative factor for softwood net growth, due to trees changing from growing stock to cull class. Survey procedures allow tree class changes from cull to growing stock, as well as from growing stock to cull. Cull increment for hardwoods is dominated by trees moving to growing stock from the cull class, resulting in a negative cull increment (thereby being an *addition* to net growth).

Of the five survey regions in Mississippi, the volume of softwood growing stock declined in the Central and Southwest. The South region is essentially unchanged since the previous survey. The North region gained a modest net 12.5 million cubic feet annually, and although the Delta region showed an increase, little softwood grows in this region (table XXI).

Survivor growth is a dominant factor for sawtimber change, accounting for 58 percent of gross growth (table XXII). Removals are the other major factor in sawtimber change, as they are for growing stock. Softwood sawtimber removals are almost three times as large as hardwood sawtimber removals. Growth outweighs removals and mortality, as there is a net increase for both species groups.

Trends in Growth, Removals, and Mortality

The net change in softwood growing stock has gone from a large annual increase to an annual decrease (table XXIII). This change for softwoods has occurred because of a 15-percent reduction in growth and 35-percent increase in removals from the 1967 to 1977 period to the 1977 to 1987 period (fig. 23). Alternately, the net growth of hardwood growing stock increased 25 percent, while removals increased only 22 percent. The net annual change for hardwoods has thus increased 28 percent between the two periods.

Sawtimber growth and removals have both increased, but softwood sawtimber growth increased only 2 percent, as average annual removals increased 45 percent between the two periods (table XXIV). The net growth of softwood sawtimber exceeds removals by 18 percent, a considerable decline from its previous 67 percent. For hardwood sawtimber, net annual growth increased 40 percent; removals increased 32 percent.

An important factor in net growth trends is the increased mortality. Total growing-stock mortality has increased 28 percent, primarily because soft-

Table XXI.—Components of average annual change in the volume of growing stock by species group and forest survey region, Mississippi, 1977-1987¹

Forest survey region	Species group	Survivor growth*	Ingrowth ³	Growth on removals	Growth on mortality	Cull increment	Mortality	Timberland removals	Land-clearing removals	Net change
-----Million cubic feet-----										
Delta	Softwood	5.2	0.5	1.4	0.4	-0.03	1.0	5.1	0.1	1.4
	Hardwood	2.6	5.2	3.9	2.4	1.0	14.9	21.7	5.9	40.5
	Total	77.8	5.6	5.3	2.8	1.0	15.8	26.8	6.0	41.9
North	Softwood	91.9	14.4	28.9	9.2	1.2	21.0	102.5	7.1	12.5
	Hardwood	102.1	13.4	11.9	3.8	-2.6	18.7	61.3	11.2	42.7
	Total	194.0	27.8	40.8	13.1	-1.5	39.8	163.8	18.3	55.2
Central	Softwood	120.8	13.3	39.8	8.7	3.4	25.8	167.4	7.9	-21.9
	Hardwood	82.5	13.0	12.6	3.5	-0.5	15.3	63.2	3.7	29.9
	Total	203.3	26.4	52.4	12.2	2.9	41.1	230.5	11.6	8.1
South	Softwood	106.1	21.5	35.7	7.2	1.5	25.9	137.3	5.4	0.5
	Hardwood	57.2	11.4	7.0	2.5	-0.7	15.0	33.8	1.3	28.7
	Total	163.3	33.0	42.7	9.7	0.9	40.9	171.1	6.7	29.2
Southwest	Softwood	74.3	6.0	18.8	5.3	1.2	19.4	85.9	1.8	-3.8
	Hardwood	82.6	9.6	7.3	2.6	-3.1	12.8	37.5	1.2	53.7
	Total	156.9	15.7	26.2	7.9	-1.9	32.2	123.4	3.0	49.9
All regions	Softwood	398.3	55.7	124.7	30.8	7.3	93.1	498.1	22.2	-11.3
	Hardwood	396.9	52.6	42.7	14.9	-5.9	76.8	217.5	23.3	195.5
	Total	795.2	108.3	167.5	45.7	1.5	169.8	715.6	45.6	184.2

¹Rows and columns may not add due to rounding.

*Includes nongrowth trees.

³Includes ongrowth trees.

Table XXII.—Components of average annual change in the volume of growing stock by species group and forest survey region, Mississippi, 1977-1987¹

Forest survey region	Species group	Survivor growth ¹	Ingrowth ³	Growth on removals	Growth on mortality	Cull increment	Mortality	Timberland removals	Land-clearing removals	Net change
-----Million board feet ⁴ -----										
Delta	Softwood	14.4	9.2	4.7	0.8	0.6	1.6	15.7	0.3	10.9
	Hardwood	250.3	85.9	16.8	8.2	10.5	57.8	105.9	16.8	170.3
	Total	264.7	95.1	21.5	9.0	11.0	59.4	121.6	17.1	181.2
North	Softwood	302.2	169.0	115.1	14.2	-0.3	41.6	372.3	26.0	160.8
	Hardwood	284.3	157.7	36.9	7.0	-14.9	44.9	202.8	28.6	224.6
	Total	586.5	326.7	152.0	21.1	-15.2	86.5	575.1	54.6	385.4
Central	Softwood	526.6	192.8	181.7	23.7	8.0	72.0	733.6	22.9	88.3
	Hardwood	211.4	119.2	35.0	7.3	-10.0	40.3	197.4	7.2	138.1
	Total	738.0	312.0	216.8	31.0	-2.1	112.3	931.0	30.1	226.4
South	Softwood	364.9	170.7	127.7	16.4	3.2	84.9	527.2	19.4	45.1
	Hardwood	131.1	72.1	19.0	5.5	-1.9	42.8	106.1	2.6	78.2
	Total	496.1	242.8	146.7	21.9	1.3	127.7	633.3	21.9	123.3
Southwest	Softwood	362.5	95.9	101.1	19.3	5.1	73.7	425.2	4.1	70.9
	Hardwood	268.5	94.8	28.3	7.5	-22.5	33.7	142.8	3.2	241.9
	Total	631.0	190.7	129.4	26.9	-17.4	107.4	567.9	7.2	312.9
All regions	Softwood	1,570.7	637.6	530.3	74.5	16.5	273.9	2,073.9	72.7	376.1
	Hardwood	1,145.7	529.7	136.1	35.5	-38.9	219.5	755.0	58.3	853.0
	Total	2,716.4	1,167.3	666.4	109.9	-22.4	493.4	2,828.9	131.0	1,229.1

¹Rows and columns may not add due to rounding.

*Includes nongrowth trees.

³Includes ongrowth trees.

⁴International 1/4-inch rule.

Table XXIII.—Average annual change of growing-stock volume by change class, species group, and survey period, Mississippi¹

Survey period	Species group	Change class			
		Gross growth	Net growth	Removals	Net change
<i>Million cubic feet</i> -----					
1967-77	Softwood	664.4	600.7	385.6	215.1
	Hardwood	436.0	349.9	197.1	152.9
	Total	1,100.4	950.7	582.7	368.0
1977-87	Softwood	609.5	509.1	520.4	-11.3
	Hardwood	507.2	436.3	240.8	195.5
	Total	1,116.7	945.4	761.2	184.2

¹Totals may not add due to rounding.

Table XXIV.—Average annual change of sawtimber volume by change class, species group, and survey period, Mississippi¹

Survey period	Species group	Change class			
		Gross growth	Net growth	Removals	Net change
<i>Million board feet</i> -----					
1967-77	Softwood	2,653.4	2,474.3	1,480.6	993.6
	Hardwood	1,437.7	1,194.0	618.3	575.8
	Total	4,091.1	3,668.3	2,098.9	1,569.4
1977-87	Softwood	2,813.0	2,522.7	2,146.6	376.1
	Hardwood	1,846.9	1,666.3	813.3	853.0
	Total	4,660.0	4,189.0	2,959.9	1,229.1

¹Totals may not add due to rounding.

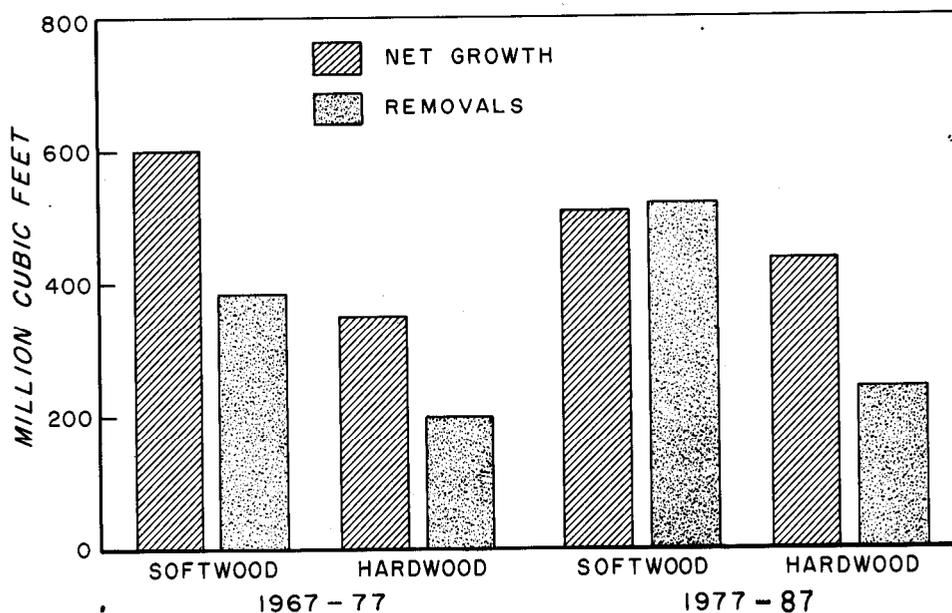


Figure 23.—Average net annual growth and average annual removals of growing stock for softwoods and hardwoods, Mississippi, 1967 to 1976 and 1977 to 1986.

wood mortality has increased 55 percent (to 93.1 million cubic feet annually) since the previous survey period. Hardwood growing-stock mortality increased only 5 percent (to 76.7 million cubic feet annually). Softwood mortality now exceeds hardwood, reversing the situation from the previous survey. Thus, the gross growth of softwood growing stock declined only 8 percent, but subtracting mortality to obtain net growth results in a E-percent decline. Softwood sawtimber mortality has increased 61 percent, while hardwood has increased 7 percent.

Over the past two surveys Mississippi's forests have matured, concentrating growth in larger trees and diminishing the importance of ingrowth from smaller trees. Survivor growth accounts for 71 percent of gross growth for all species; ingrowth accounts for only 10 percent. In the 1967 to 1977 period survivor growth accounted for only 20 percent of gross growth, and ingrowth accounted for 65 percent. Yet, 1.7 million acres of plantations and 2.0 million acres of natural stands are 15 years of age or less. These stands will contribute a large volume of ingrowth as their trees enter merchantable size.

Growth and Removal Trends by Ownership

The decreasing net annual change for softwood growing stock is principally the result of growth and removals on land owned by forest industry (table XXV). Softwood removals exceed net growth on publicly owned timberland, but only by 0.5 million cubic feet. For industry-owned timberland, however, softwoods removals exceed net growth by 31.8 million cubic feet. Although industry owners control only 19 percent of the total timberland, 29 percent of all

Table XXV.-Average annual change of growing-stock volume by ownership, species group, and change class, Mississippi, 1977-87¹

Ownership	Species group	Gross growth	Net growth	Net Removals	Net change
----- Million cubic feet -----					
Public	Softwood	76.9	57.2	57.7	-0.5
	Hardwood	50.2	38.6	14.0	24.7
	Total	127.2	95.8	71.7	24.2
Forest industry	Softwood	141.0	124.1	156.0	-31.8
	Hardwood	70.8	59.8	67.2	-7.4
	Total	211.8	183.9	223.2	-39.3
Nonindustrial private	Softwood	391.5	327.8	306.7	21.1
	Hardwood	386.2	337.9	159.7	178.2
	Total	777.7	665.7	466.4	199.3
All owners	Softwood	609.5	509.1	520.4	-11.3
	Hardwood	507.2	436.3	240.8	195.5
	Total	1,116.7	945.4	761.2	184.2

¹Totals may not add due to rounding.

growing-stock removals are from their lands. Softwood growing stock on nonindustrial private ownerships is increasing at an average annual rate of 21.1 million cubic feet.

Average net growth per acre of growing stock by ownership is as follows: forest industry, 58 cubic feet per acre per year; nonindustrial private, 56; and public, 50. Future ingrowth from classes that now are submerchantable should increase the figure for industry lands considerably. Industry owns 34 percent of all stands 15 years old and younger and 58 percent of all plantations less than 15 years old.

Sawtimber volume is increasing on all ownerships except forest industry, where softwoods and hardwoods are decreasing (table XXVI). The decline of sawtimber on industry land is the result of harvesting; 28 percent of sawtimber removals is from industry land.

Average per-acre growth rates of sawtimber by ownership are as follows: public, 251 board feet per acre per year; nonindustrial private, 250; and forest industry, 23. Thus, while growing-stock growth rates are highest on industry timberland, little of the growth is in sawtimber volume.

Growth and Removals of All Live Timber

As with growing stock, all live volume is declining slightly for softwoods and increasing for hardwoods (table XXVII). All live trees includes both growing stock and cull trees. The calculation of growth for all live trees is similar to that for growing stock, except cull increment is not applicable because any change in tree class is not relevant. The net annual increase in live volume for all species is 229.9 million cubic

Table XXVI.-Average annual change of sawtimber volume by ownership, species group, and change class, Mississippi, 1977-87¹

Ownership	Species group	Gross growth	Net growth	Net Removals	Net change
----- Million board feet ² -----					
Public	Softwood	414.6	330.8	289.2	41.6
	Hardwood	188.3	151.6	46.7	104.9
	Total	602.9	482.4	335.9	146.5
Forest industry	Softwood	560.6	525.8	605.1	-79.2
	Hardwood	247.7	214.3	231.7	-17.4
	Total	808.3	740.1	836.8	-96.6
Nonindustrial private	Softwood	1,837.9	1,666.0	1,252.3	413.7
	Hardwood	1,410.9	1,300.4	534.8	765.6
	Total	3,248.8	2,966.5	1,787.2	1,179.3
All owners	Softwood	2,813.0	2,522.7	2,146.6	376.1
	Hardwood	1,846.9	1,666.3	813.3	853.0
	Total	4,660.0	4,189.0	2,959.9	1,229.1

¹Totals may not add due to rounding.

²International 1/4-inch rule.

feet, about 25 percent greater than the net change for growing stock. The additional volume provided by cull trees offers opportunity for timber utilization.

Net growth for all live trees is greater than growing-stock growth by 5 percent for softwoods, 21 percent for hardwoods, and 12 percent for all species. Removals of all live trees exceeds removals for growing stock as follows: 3 percent for softwoods, 23 percent for hardwoods, and 9 percent for all species. Because hardwoods are more commonly classed as culls, the increase in hardwood growth and removals is greater than for softwoods.

MANAGEMENT TREATMENTS

No management treatments were noted on 9.2 million acres, or 54 percent of Mississippi's timberland, during the 1977 to 1987 period (table XXVIII). Some type of timber harvest (which involves the cutting of crop trees and excludes single-tree selection) occurred on 6.2 million acres, or 37 percent of the timberland. Most of the harvesting, 5.7 million acres, was on privately owned timberland (McWilliams 1988). Sixty-two percent of industry land was treated compared with 45 percent of public and 43 percent of nonindustrial private land. Man-

agement treatments include commercial thinning of poletimber trees on 220,700 acres; other treatments (including precommercial thinnings and stand improvement measures) were on 1.4 million acres.

Sixty-five percent of the timber harvesting was by partial cutting, which includes all selection cuts (except single-tree selection), diameter-limit cuts, salvage cuts, and any other sawtimber cutting practice leaving a residual stand of crop trees or potential crop trees and cull trees. Clearcuts accounted for most of the remaining area harvested. Seed tree and shelterwood cuts accounted for only 1 percent of the harvested area.

Clearcuts are far more prevalent on industry ownerships than elsewhere (McWilliams 1988). Clearcuts account for 61 percent of all timberland harvested on forest industry land, while public and nonindustrial private owners used clearcutting on about 25 percent of the area harvested.

MANAGEMENT OPPORTUNITIES

The average growth of Mississippi's forests is far below its potential. The potential growth of fully stocked natural stands was calculated by use of site class midpoints and by summing for all acres by site class. The average potential growth for fully stocked natural stands is 122 cubic feet per acre per year. This average potential is not a maximum; effective management techniques such as planting genetically improved seedlings could result in even higher growth rates. The average annual growth rate for Mississippi's timberland during the 1977 to 1987 period was 56 cubic feet per acre per year, or less than one-half the potential growth for fully stocked natural stands.

The presence of cull or damaged trees and the relatively sparse stocking of desirable trees indicate an opportunity for regeneration, salvage cuts, and other stocking control in Mississippi's forests. Other opportunities include thinning, stand conversion, and regeneration cuts. The criteria for determining treatment opportunities did not include converting well-stocked upland hardwood stands to pine, but some landowners will wish to consider this alternative.

Forty-seven percent of the existing timberlands need no treatment to improve growth (table XXIX). The majority of timberland, however, could benefit from treatment. These estimates do not account for the economic feasibility of treatment but consider stand characteristics that contribute to reducing the growth rates of desirable trees.

Economic feasibility will depend greatly on the size of forest tracts. The per-acre cost of treatment can be lower for larger areas; the per-acre cost for

Table XXVII.—Average annual change of all live volume by change class, survey region, and species group, Mississippi, 1977-1987¹

Survey region	Species group	Gross growth	Net growth	Removals	Net change
-----Million cubic feet-----					
Delta	Softwood	8.1	1.0	5.5	1.4
	Hardwood	110.0	85.7	33.3	52.4
	Total	118.1	92.7	38.8	53.9
North	Softwood	150.7	127.1	112.8	14.9
	Hardwood	167.4	138.1	92.9	45.2
	Total	318.1	265.8	205.6	60.2
Central	Softwood	190.9	162.5	181.7	-19.2
	Hardwood	139.7	114.5	79.9	34.9
	Total	330.7	227.3	261.6	15.7
South	Softwood	179.1	150.4	146.9	3.4
	Hardwood	105.9	80.7	42.6	38.1
	Total	285.0	231.2	189.6	41.6
Southwest	Softwood	110.1	88.1	90.9	-2.9
	Hardwood	129.4	108.2	46.7	61.5
	Total	239.5	196.3	137.7	58.6
All regions	Softwood	638.9	535.7	537.9	-2.2
	Hardwood	652.5	527.5	295.4	232.1
	Total	1,291.4	1,063.2	833.3	229.9

Totals may not add due to rounding.

Table XXVIII.—Area of timberland by type of harvest or management category, Mississippi, 1977–1987¹

All ownerships	All categories	Timber harvest ²					
		No treatment	Clearcut	Partial cut ³	Seed tree-shelter-wood cut	Commercial thinning	Other treatment ⁴
-----Thousand acres-----							
Public	1,919.3	1,051.9	124.3	350.2	10.2	57.8	325.0
Forest industry	3,197.3	1,222.9	893.1	566.4	6.1	68.7	440.1
Nonindustrial private	11,865.0	6,925.1	1,081.0	3,134.1	41.3	94.1	589.4
All ownerships	16,981.6	9,200.0	2,098.4	4,050.6	57.6	220.7	1,354.4

Totals may not add due to rounding.

²Harvest of crop trees only (does not include poletimber thinnings).

³Includes pine selection, diameter-limit, and salvage cuts; some heavy thinnings of dominant trees in sawtimber stands are included.

⁴Includes precommercial thinnings and stand improvement measures.

small areas may be prohibitive. Although a plurality of timberland is in the 501 to 2,500 acre tract size, 14 percent is in tracts 100 acres or less, and 2 percent is in tracts of 10 acres or less (table XXX).

Pine Stands

About two-thirds of the pine stands need no treatment (fig. 24) because they are well stocked with growing-stock trees, not overstocked, and have a low proportion of cull or damaged trees. One-third of the pine timberland needs stand establishment, intermediate treatment, or final harvest.

Stand establishment is needed on 338,400 acres, or 7 percent of all pine timberland. Most are stands that need to be regenerated as they have excessive cull-tree stocking or less than 50-percent stocking in growing-stock trees. In other stands the pines are poorly distributed for optimum growth, and hardwoods or cull trees present a problem. Regeneration of these acres will require site preparation in almost all cases. Conversion of poor-quality stands is needed on an additional 37,700 acres.

Intermediate treatments, mainly poletimber thinning and other stocking control, are needed on 607,800 acres of pine stands. Poletimber (commercial) thinning is indicated for 228,100 overcrowded acres to enable residual crop trees to grow vigorously. Other stocking control is a treatment opportunity on 369,900 acres of fully stocked sawtimber stands that have too many cull trees.

There are 649,100 acres of pine stands in need of final harvest. Most are over-stocked sawtimber stands that have more than 5,000 board feet per acre and would benefit from a regeneration cut. Salvage cuts are needed on 139,400 acres, where many salvable dead or damaged trees are present.

Mixed Stands

Of the 3.5 million acres of oak-pine forests in the State, almost one-half would benefit from intermedi-

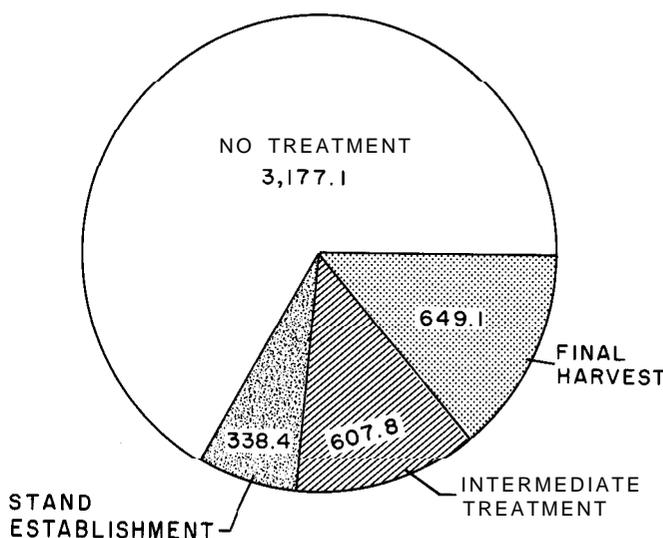


Figure 24.—Pine stands in thousand acres by treatment opportunity, Mississippi, 1987.

ate treatments, stand establishment, or final harvest (fig. 25).

Intermediate treatment is a management option on 741,600 acres of oak-pine stands, of which 682,800 acres support seedling-sapling and poletimber stands that have adequate growing-stock stocking but an excessive amount of cull trees. Cutting or deadening of the cull trees (other stocking control) will provide better conditions for timber growing in these stands.

About 573,700 acres, or 16 percent of the entire oak-pine area, need stand establishment. Regeneration would benefit these acres because there is an excessive amount of cull-tree stocking and a small amount of growing stock.

For oak-pine stands, final harvest is a management option on 320,100 acres, and includes regeneration cuts on 117,200 acres and salvage cuts on 202,900 acres. Salvage cuts are needed mainly in sawtimber stands where trees are damaged to the extent that bole form has been affected.

Table XXIX.-Area of timberland by forest type, ownership, and treatment opportunity class, Mississippi, 1987¹

Forest type. and ownership	Total	No treatment	Stand establishment		Intermediate treatments			Final harvest	
			Regenerate	Stand conversion*	Thin seedlings and saplings	Thin poletimber	Other stocking control ¹	Regeneration cut	Salvage cut
<i>Thousand acres</i> -----									
Pine plantation ²									
Public	84.2	65.1	5.1	.	.	13.3	.....	.....	.....
Forest industry	818.2	514.6	55.6	13.8	5.5	68.7	93.5	41.3	25.2
Nonindustrial private	635.3	413.3	29.1	5.9	4.3	48.9	91.4	36.8	5.0
Total	1,537.7	993.0	91.1	19.7	9.8	131.0	185.0	78.2	30.1
Natural pine ³									
Public	581.2	423.0	32.2	.	.	13.1	10.9	15.4	27.0
Forest industry	496.9	331.7	17.6	.	.	24.9	37.2	67.8	17.6
Nonindustrial private	2,156.1	1,429.4	159.8	18.0	.....	59.2	136.1	288.3	64.7
Total	3,234.5	2,184.1	209.6	18.0	.....	97.1	184.9	431.5	109.3
Oak-pine									
Public	481.2	307.4	49.1	—	...	4.9	51.9	41.8	26.1
Forest industry	668.3	356.1	63.9	18.2	5.4	.	191.1	5.7	21.9
Nonindustrial private	2,373.4	1,224.0	425.4	17.2	—	48.5	439.8	69.7	148.9
Total	3,522.9	1,887.5	538.3	35.4	5.4	53.4	682.8	117.2	202.9
Upland hardwood									
Public	387.6	164.9	56.0	7.3	..	..	44.7	6.1	108.6
Forest industry	738.9	250.2	206.5	11.6	22.3	...	174.7	6.3	67.4
Nonindustrial private	4,358.7	1,588.7	1,154.1	98.2	5.5	36.3	129.3	31.8	714.8
Total	5,485.2	2,003.9	1,416.6	117.0	27.8	36.3	948.7	44.1	890.8
Bottomland hardwood									
Public	384.7	102.7	92.5	.	.	.....	42.6	5.5	141.5
Forest industry	475.0	152.7	114.6	17.1	.....	5.7	23.2	7.0	154.8
Nonindustrial private	2,341.5	720.9	482.3	32.2	.....	17.3	226.9	49.6	812.3
Total	3,201.2	916.4	689.3	49.3	.....	23.0	292.7	62.0	1,108.6
All types									
Public	1,919.3	1,063.3	235.5	1.3	.	31.3	150.2	128.7	303.1
Forest industry	3,197.3	1,605.2	458.2	60.6	33.3	99.3	519.7	128.1	292.8
Nonindustrial private	11,865.0	5,376.3	2,251.3	171.5	9.8	210.1	1,624.1	476.2	1,745.7
Total	16,981.6	8,044.8	2,944.9	239.4	43.0	340.8	2,294.1	733.1	2,341.6

¹Totals may not add due to rounding.

²Stands containing considerable stocking of damaged or diseased trees but with insufficient merchantable volume to warrant a salvage cut.

³Clean, release, or cull-tree removal.

⁴Includes longleaf-slash pine and loblolly-shortleaf pine stands of artificial origin.

⁵Includes longleaf-slash pine and loblolly-shortleaf pine stands having no evidence of artificial origin.

Table XXX—Area of timberland by forest type and size of forest tract, Mississippi, 1987¹

Forest type	Size of forest tract (acres)*							
	All classes	1-10	11-50	51-100	101-500	501-2,500	2,501-5,000	More than 5,000
	-----Thousand acres-----							
Longleaf-slash	841.5	5.1	37.1	38.3	191.4	464.2	88.5	16.2
Loblolly-shortleaf	3,930.7	61.8	213.7	196.1	1,169.8	1,648.7	282.6	358.2
Oak-pine	3,522.0	55.5	151.7	239.6	1,005.3	1,408.8	393.6	269.4
Oak-hickory	5,477.2	132.3	259.3	497.5	1,595.7	1,954.6	619.1	418.6
Oak-gum-cypress	3,051.7	34.1	122.1	278.5	682.2	1,114.4	454.0	366.3
Elm-ash-cottonwood	149.5	5.8	6.6	---	30.6	62.3	22.2	21.9
All types ³	16,973.5	295.3	790.4	1,249.1	4,675.0	6,653.0	1,859.9	1,450.7

¹Rows and columns may not add due to rounding.

*Tract size indicates contiguous forest land and does not indicate size of ownership.

³Does not include 8.1 thousand acres of nontyped timberland.

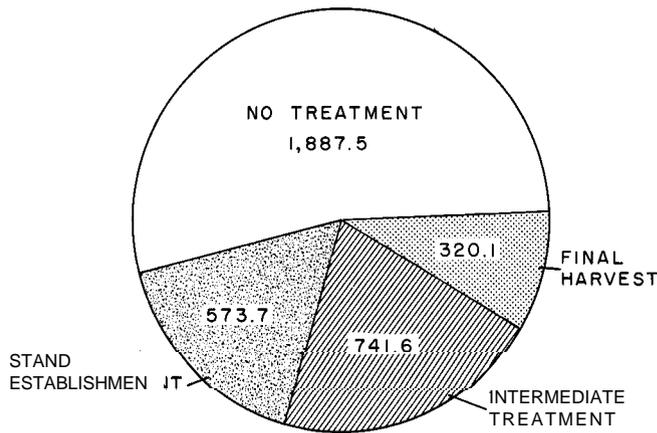


Figure 25.—Oak-pine stands in thousand acres by treatment opportunity, Mississippi, 1987.

TIMBER OUTLOOK

The current resource conditions will essentially determine the character of Mississippi's forests for the next decade or so. Beyond that, harvesting and the management practices currently being applied will be the major determinants. The large forest industry in the State will certainly continue to be a dominant factor in shaping the resource.

Over the next decade or so, Mississippi's forests can be expected to continue aging as cull-tree stocking increases, the number of large trees increases, and the hardwood-softwood ratio increases. Average tree sizes will continue to increase, but the amount of high-quality (grade 1) timber will probably decline. As softwood growth continues to decrease, removals may be expected to exceed growth by an increasing margin over the next several years (USDA FS 1988).

Hardwood Stands

Hardwood stands are generally in poor condition: 63 percent of upland hardwood stands and 69 percent of bottomland hardwood stands—or 66 percent of all hardwood stands—need treatment for increased timber productivity (fig. 26).

Stand establishment is an option on 26 percent of hardwood stands. For most, growing-stock stocking is low, and/or cull stocking is high enough to warrant regeneration. Even where growing stock is adequate, cull-tree stocking is often excessive. Intermediate treatment is an option on 15 percent of the hardwood area, mainly through cutting or deadening of cull trees. Final harvest and regeneration is an option on 2.1 million acres, almost all of which have trees damaged to the extent that salvage cuts are needed.

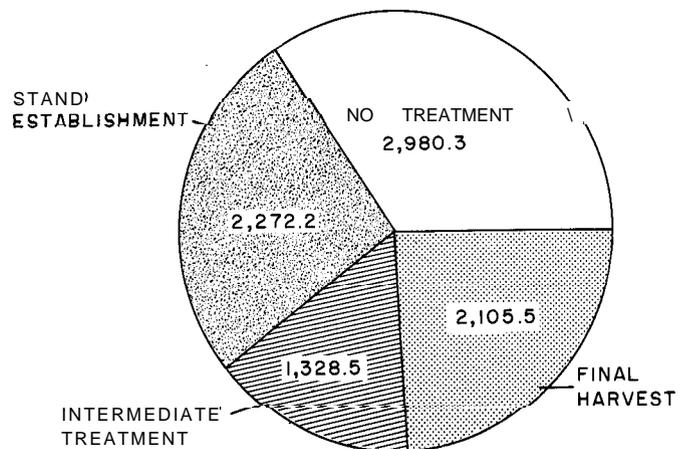


Figure 26.—Hardwood stands in thousand acres by treatment opportunity, Mississippi, 1987.

TIMBER PRODUCTS OUTPUT

Increased management of pine stands, especially plantations, will be a major factor in future softwood trends. The young pine stands already established will contribute significantly to growth in the next few years, while additional plantations being established by industry and nonindustrial private owners (including those planted through the Conservation Reserve Program) will continue adding to softwood growth over the next several decades. The Southern timber supply study has estimated that softwood growth will begin rising and approximately equal removals in the year 2000. The balance between growth and removals is expected to be maintained for several decades thereafter (USDA FS 1988).

Changes in timber demands will affect the resource. Beginning in the early 1980's the increasing usage of hardwood pulpwood became evident. The harvest of this resource component is likely to increase, especially in regions where pulpwood harvest has traditionally been low, further reducing the presence of poletimber-size hardwoods in maturing stands.

Pulpwood harvest will be a major factor, along with aging stands, for prospective hardwood trends. Hardwood growth is likely to begin decreasing as mortality reaches sufficiently high levels. The Southern timber supply study has estimated that removals will surpass growth for hardwoods by the year 2000 (USDA FS 1988). The increasing stumpage prices that will likely be associated with increasing removals may be expected to boost interest in hardwood management, perhaps eventually stimulating additional growth.

Due to the current high levels of both softwood and hardwood inventories, the outlook for timber inventories in the near future is good, even if large declines occur for a few years because of removals exceeding growth. In spite of this generally favorable outlook there are potential inventory problems: These include the decline of best-quality timber, the decline of trees in poletimber and small-sawtimber size classes, and the diminishing of some species such as longleaf pine. Potential problems may also be evident for some regions, but not statewide.

Mississippi's forests provided more than 950 million cubic feet of timber products in 1986 (table XXXI). Information on timber product output is derived from severance-tax collection data (Mississippi Cooperative Extension Service 1977-1987) and annual pulpwood reports (May 1988b). The use of industrial wood, excluding fuelwood, was 32 percent higher than at the end of the previous survey period in 1976 (Bertelson 1978). Forty-two percent of the timber harvested in 1986 was used for pulpwood and 40 percent for saw logs. The remainder was used for veneer logs (10 percent), fuelwood (6 percent), and other products (2 percent).

Softwoods are the most important source for saw logs, as they have been historically (fig. 27). Beginning in 1983, hardwoods have become more important for pulpwood, but softwoods still dominate (fig. 28).

Saw Logs

Saw-log production in Mississippi has averaged 282 million cubic feet over the past 10 years (Mississippi Cooperative Extension Service 1977-1987). Softwoods have accounted for the vast majority of saw-log production—76 percent of the total over the past 10 years. This proportion of softwood to hardwood saw-log volume has remained relatively constant throughout recent years. Softwood saw-log production hit a 10-year peak in 1979, while hardwood saw-log production peaked in 1978. The low point for saw-log production in the past decade was reached in 1982.

The production of saw logs in 1986 was 31 percent higher than at the end of the previous survey period in 1976 (Bertelson 1978). Softwood saw-log production increased 39 percent, while hardwoods increased 14 percent.

Pulpwood

Pulpwood production in Mississippi over the past 10 years has averaged just under 6 million cords

Table XXXI.—*Volume of roundwood timber harvested by source of material, product, and species group, Mississippi, 1986*

Product	All sources			Growing stock		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	<i>Million cubic feet</i>					
Saw logs	378.1	279.3	98.9	372.0	275.4	96.6
Pulpwood	397.8	241.3	156.5	364.4	226.7	137.7
Veneer logs	98.5	94.6	3.8	96.5	92.7	3.8
Fuelwood	59.4	1.5	57.9	19.6	0.6	19.0
Other products	23.1	20.5	2.6	22.1	19.9	2.2
All products	956.9	637.2	319.7	874.6	615.4	259.2

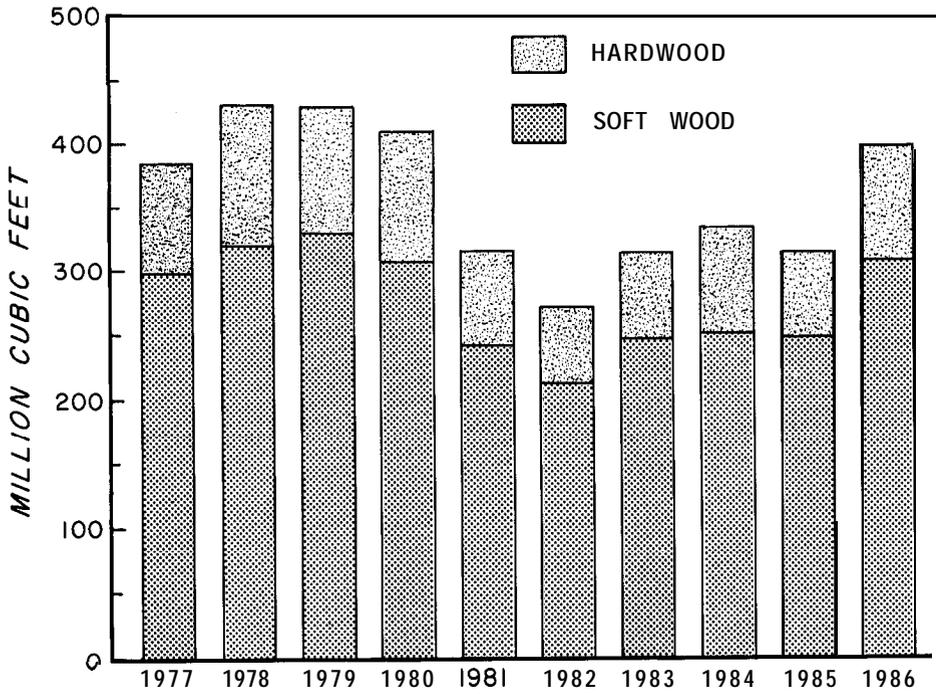


Figure 27.—Saw logs and other timber products, except pulpwood, produced in Mississippi, 1977 to 1986.

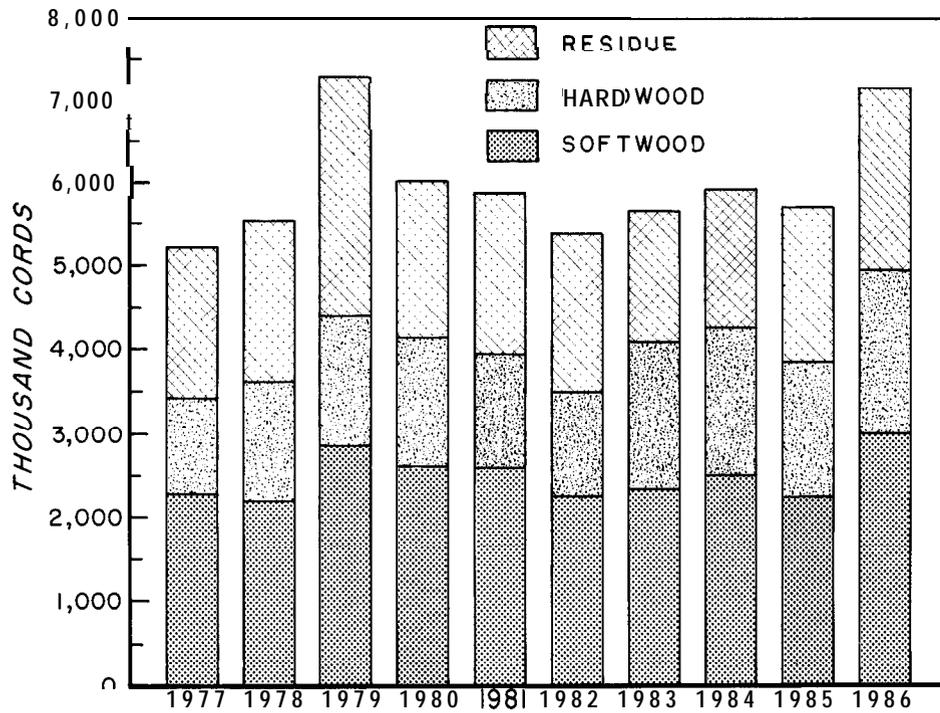


Figure 28.—Pulpwood production in Mississippi, 1977 to 1986.

Table XXXII.-Pulpwood production by source and year, Mississippi, 1977-1986¹

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	-----Thousand cords-----									
Roundwood										
Softwood	2,276.7	2,198.2	2,855.6	2,606.1	2,584.3	2,236.8	2,313.3	2,475.6	2,236.4	2,979.4
Hardwood	1,134.7	1,422.0	1,542.3	1,523.4	1,348.4	1,249.0	1,767.9	1,764.0	1,602.6	1,956.2
Total	3,411.4	3,620.2	4,397.9	4,129.5	3,932.7	3,485.9	4,081.2	4,239.6	3,839.0	4,935.6
Residues										
Softwood	1,429.9	1,518.3	2,333.5	1,504.0	1,496.1	1,442.2	1,268.6	1,307.9	1,359.0	1,522.7
Hardwood	370.6	391.4	555.6	380.2	444.5	434.1	284.6	362.5	476.2	670.7
Total	1,800.5	1,909.7	2,889.1	1,884.2	1,940.6	1,876.3	1,553.1	1,670.4	1,835.2	2,193.4
All sources										
Softwood	3,706.6	3,716.5	5,189.1	4,110.1	4,080.4	3,679.0	3,581.9	3,783.5	3,595.4	4,502.1
Hardwood	1,505.3	1,813.4	2,097.9	380.2	1,792.9	1,683.1	2,052.5	2,126.5	2,078.8	2,626.9
Total	5,211.9	5,529.9	7,287.0	6,013.7	5,873.3	5,362.2	5,634.3	5,910.0	5,674.2	7,129.0

¹Totals may not add due to rounding.

annually (table XXXII, May 1988b), two-thirds of which is roundwood, with the remainder residues. In 1977, 33 percent of the roundwood pulpwood produced was hardwood; by 1986, 40 percent was hardwood. The use of hardwood residues has similarly increased.

During the past decade total pulpwood production peaked in 1979 at 7.3 million cords and was lowest in 1982 with 5.4 million cords.

Seven pulpmills are located in Mississippi, having a total pulping capacity of 9,250 tons per 24 hours. Seven other mills draw on the State's timberland for pulpwood.

Other Products and Fuelwood

Production of veneer logs is another important use of timber in Mississippi. In 1986, veneer log volume was about 26 percent of saw-log volume (Mississippi Cooperative Extension Service 1977-1987). Almost all veneer logs in the State are softwood, used for producing southern pine plywood. A small amount of hardwood veneer is produced.

Other products include posts, poles, and piling. Total volume for all other products amounted to 23.1 million cubic feet in 1986, or 2 percent of the total volume of timber produced in the State.

Fuelwood usage in 1986 was 59.4 million cubic feet, or 6 percent of total timber volume.

LITERATURE CITED

- Bertelson, Daniel F. 1978. Mississippi forest industries, 1976. Resour. Bull. SO-68. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 25 p.
- Forest Economics Staff. 1946. Basic data on forest area and timber volumes from the Southern forest survey, 1932-36. Forest Survey Release 54. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 26 p.
- Holemo, Fred J.; Brown, E.E. 1975. A profile of the private non-industrial forest landowner in Georgia's coastal plain. Research Paper 82. Georgia Forest Research Council. 17 p.
- James, Lee M. 1951. Mississippi's forest resources and industries. Forest Resource Rep. No. 4. Washington, DC: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 92 p.
- Kelly, John F.; Hines, F. Dee. 1987a. Forest statistics for north Mississippi counties-1987. Resour. Bull. SO-122. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 39 p.
- Kelly, John F.; Hines, F. Dee. 1987b. Forest statistics for south Mississippi counties-1987. Resour. Bull. SO-124. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 34 p.
- Kelly, John F.; Hines, F. Dee. 1987c. Forest statistics for Mississippi Delta counties-1987. Resour. Bull. SO-126. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 34 p.
- Kelly, John F.; Hines, F. Dee. 1987d. Forest statistics for central Mississippi counties-1987. Resour. Bull. SO-127. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 34 p.
- Kelly, John F.; Hines, F. Dee. 1987e. Forest statistics for southwest Mississippi counties-1987. Resour. Bull. SO-128. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 33 p.

- May, Dennis M. 1988a. Forest growth of Mississippi's North unit-a case study of the Southern Forest Survey's growth estimation procedures. Resour. Bull. SO-134. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 9 p.
- May, Dennis M. 1988b. Southern pulpwood production, 1986. Resour. Bull. SO-138. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 40 p.
- McWilliams, William H. 1988. Status of privately owned harvested timberland in Mississippi, 1977-1987. Res. Note SO-346, New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 6 p.
- Mississippi Cooperative Extension Service. 1977-1987. Unpublished annual newsletter reporting harvest of forest products. Mississippi State, MS: Mississippi State University. [not paged]
- Murphy, Paul A. 1978. Mississippi's forest trends and outlook. Resour. Bull. SO-67. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 32 p.
- Porter-field, Richard L.; Terfehr, Thomas R.; Moak, James E. 1978. Forestry and the Mississippi economy. Bulletin 869. Mississippi State, MS: Mississippi Agricultural and Forestry Experiment Station. 51 p.
- Schallau, Con H.; Maki, Wilbur R.; Foster, Bennett B.; Redmond, Clair H. 1988. Mississippi's forest products industry: performance and contribution to the State's economy, 1970 to 1980. Res. Paper PNW-398. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 22 p.
- U.S. Department of Agriculture, Forest Service. 1949. Forest statistics for Mississippi. Forest Survey Release 59. New Orleans, LA: Southern Forest Experiment Station. 67 p.
- U.S. Department of Agriculture. 1958. Mississippi's forests. Forest Survey Release 81. New Orleans, LA: Southern Forest Experiment Station. 52 p.
- U.S. Department of Agriculture, Forest Service. 1988. The South's fourth forest: alternatives for the future. For. Resour. Rep. 24. Washington, DC: U.S. Department of Agriculture 512 p.
- Van Deusen, Paul C.; Dell, Tom R.; Thomas, Charles E. 1986. Volume growth estimation from permanent horizontal points. Forest Science. 32(2):415-422.
- Van Sickle, Charles C.; Van Hooser, Dwane D. 1969. Forest resources of Mississippi. Resour. Bull. SO-17. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 33 p.

APPENDIX

Survey Methods

Forest resource statistics were obtained by a systematic sampling method involving forest-nonforest classification on aerial photographs, ground checks of land use, and on-the-ground measurements of trees at selected locations. Inventory volume and area statistics are required to give precise answers at the State level to one standard deviation of the total, equal to 1 percent per million acres of forest land and to 5 percent per billion cubic feet.

The estimate of timberland area is based on the forest-nonforest photo interpretation of recent aerial photography for points representing approximately 230 acres. The photo interpretation of these points was checked in the field at sample locations representing approximately 3,840 acres. These field checks are used to correct photo interpretation errors and adjust the proportion of forest to nonforest area for each county. The proportion of forest area is combined with U.S. Census land area data to develop county-level forest statistics.

Volume estimates come entirely from permanent sample locations at the intersection of a 3- by 3-mile grid. This grid gives each sample plot an expansion factor representing, on the average, 5,760 acres. The plots established by the prior survey were remeasured to determine the elements of change. In Mississippi, 3,003 plots were measured — 2,899 of these are currently forested; 10 points were measured at each plot location. Trees 5.0 inches in d.b.h. and larger were selected with a 37.5-factor prism, thus each tree selected with the prism represented 3.75 square feet of basal area per acre. Trees smaller than 5.0 inches in d.b.h. were tallied on a 1/275-acre circular plot fixed around the first 3 points of the 10-point cluster. Pine seedlings are tallied on a 1/1000-acre plot established at each of the 10 points.

A satellite point system is combined with a large-factor prism to get a representative sample of stand conditions at each plot location. This eliminates the effect that vegetation clumping and open gaps would induce if only one point or one fixed plot were used at each location.

Volumes in Mississippi were derived from deterministic measurements of trees on all sample locations. These deterministic measurements include d.b.h., bark thickness, total height, bole length, log length, and four upper-stem diameters. Volumes for these trees were computed by means of Smalian's formula. Volume equations were developed for seven species groups, and these equations were used to estimate volumes at time of removal or death for trees that did not survive the remeasurement period and to estimate the past volume for nongrowth trees (see definitions). Procedures for estimating growth are documented elsewhere (May 1988a).

Measurements at each forested location also included collection of data on site productivity, stand origin, stand age, size of forest tract, distance from road, slope, aspect, disturbance, management, evidence of use, and nontimber resources. Ownership information was obtained for each plot from county tax assessors' records and contact with owners in the field. Personnel from public agencies and other contacts were consulted when classifying absentee owners as farmers, individuals, corporations, or lessors.

Field work was started in April 1986 and completed in March 1987.

Reliability of the Data

Reliability of the Forest Inventory and Analysis (FIA) estimates may be affected by two sources of error. The first source, termed estimating error, arises from mistakes in measurement, judgment, recording, or compiling and from limitations of the equipment. Estimating error is minimized by FIA through comprehensive training, supervision, quality control programs, and emphasis on careful work.

The second type of error, "sampling error," is the error associated with natural and expected deviation of the sample mean from the true population mean. Thus, the deviation is susceptible to a mathematical evaluation of the probability of error. Sampling errors for State totals are based on one standard deviation (table XXXIII). That is, the chances are two out of three that if the results of a 100-percent census were known, the sample results would be within the limits indicated.

Estimates smaller than State totals will have larger sampling errors. The smaller the area examined, the larger the sampling error. Furthermore, as area or volume totals are stratified by forest type, species, diameter class, ownership, or other subunits, the sampling error increases and is greatest for the smallest divisions. The magnitude of this increase is depicted in table XXXIV and shows the sampling error to which the estimates are liable, two chances out of three.

Definition of Terms

Forest Land Classes

Forest Land-Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest uses. Minimum area considered for classification is 1 acre. Forest land is divided into commercial categories: timberland and deferred timberland; and

Table XXXIII.—*Sampling errors for estimates of total timberland area, volume, net annual growth (1977–1987), and annual removals (1977–1987), Mississippi, 1987*

Item	Total	Units	Percent sampling error
Timberland area	16,981.6	Thousand acres	0.3
Growing stock			
Volume	19,425.5	Million cubic feet	1.8
Periodic net annual growth	945.4	Million cubic feet	1.5
Periodic annual removals	761.2	Million cubic feet	2.7
Sawtimber			
Volume	73,209.9	Million board feet ¹	2.2
Periodic net annual growth	4,189.0	Million board feet ¹	1.8
Periodic annual removals	2,959.9	Million board feet ¹	3.1

¹International 1/4-inch rule.

Table XXXIV.—*Sampling error to which estimates are liable, two chances out of three, Mississippi, 1987¹*

Sampling error	Timberland area	Volume	Periodic net annual growth	Periodic annual removals	Volume	Periodic net annual growth	Periodic annual removals
Percent	Thousand acres	Million cubic feet	Million cubic feet	Million cubic feet	Million board feet ²	Million board feet ²	Million board feet ²
1.0	1,528.3	.....	—	.....	.....	.....	.....
2.0	382.1	15,734.7	531.8	.....	.....	3,393.1	.....
3.0	169.8	6,993.2	236.4	616.6	39,370.7	1,508.0	.....
4.0	95.5	3,933.1	132.9	346.8	22,146.0	848.3	1,777.8
5.0	61.1	2,517.5	85.1	222.0	14,173.4	542.9	1,137.8
10.0	15.3	629.4	21.3	55.5	3,543.4	135.7	284.4
15.0	6.8	219.1	9.5	24.7	1,574.8	60.3	126.4
20.0	3.8	151.3	5.3	13.9	885.8	33.9	71.1
25.0	2.4	100.7	3.4	8.9	566.9	21.7	45.5

¹By random sampling formula.

²International 1/4 -inch rule.

noncommercial categories: productive-reserved forest land and unproductive forest land.

Timberland-Forest land that is producing, or is capable of producing, crops of industrial wood and not withdrawn from timber utilization. Timberland is synonymous with “commercial forest land” in prior reports.

Deferred Timberland—National forest land that meets productivity standards for timberland but is under study for possible inclusion in the wilderness system.

Productive-Reserved Forest Land—Productive public forest land withdrawn from timber utilization through statute or administrative regulations.

Unproductive Forest Land—Forest land incapable of yielding crops of industrial wood because of adverse site conditions.

Tree Classes

Commercial Species-Tree species currently or prospectively suitable for industrial wood products. Excluded are noncommercial species. See Species List.

Noncommercial Species-Tree species of typical small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products. See Species List.

Growing-Stock Trees—Live trees of commercial species classified as sawtimber, poletimber, sapling, and seedlings. Trees must have a 12-foot butt log now or prospectively to be classed as growing stock.

Rough Trees—Live trees of commercial species that are unmerchantable for saw logs currently or potentially because of roughness or poor form in the

butt log. Also included are all live trees of noncommercial species.

Rotten Trees—Live trees of commercial species that are unmerchantable for saw logs currently or potentially because of rot deduction in the butt log.

Cull Pees-Rough or rotten trees.

Hardwoods-Dicotyledonous trees, usually broad-leaved and deciduous.

Softwoods-Coniferous trees, usually evergreen, having needles or scalelike leaves.

Live Trees—All trees that are alive. Included are all size classes and all tree classes.

Salvable Dead Trees-Standing or down dead trees that were formerly growing stock and are considered merchantable.

Forest Types

Longleaf-Slash Pine-Forests in which longleaf or slash pine, singly or in combination, comprise a plurality of the stocking. Common associates include oak, hickory, and gum.

Loblolly-Shortleaf Pine-Forests in which pine and eastern redcedar (except longleaf or slash pine), singly or in combination, comprise a plurality of the stocking. Common association include oak, hickory, and gum.

Oak-Pine-Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking, but in which softwoods, except cypress, comprise 25-49 percent of the stocking. Common associates include gum, hickory, and yellow-poplar.

Oak-Hickory-Forests in which upland oaks or hickory, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-49 percent, in which case the stand would be classified oak-pine. Common associates include yellow-poplar, elm, maple, and black walnut.

Oak-Gum-Cypress-Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or cypress, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-49 percent, in which case the stand would be classified oak-pine. Common associates include cottonwood, willow, ash, elm, hackberry, and maple.

Elm-Ash-Cottonwood-Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the live tree stocking. Common associates include willow, sycamore, beech, and maple.

Nontyped-Timberland currently unoccupied with any live trees or seedlings; e.g., very recent clear-cut areas.

Dimension Classes of Trees

Sawtimber Trees—Trees 9.0 inches and larger in d.b.h. for softwoods and 11.0 inches and larger for hardwoods.

Poletimber Trees—Trees 5.0 to 8.9 inches in d.b.h. for softwoods and 5.0 to 10.9 inches for hardwoods.

Saplings-Trees 1.0 inch to 4.9 inches in d.b.h.

Seedlings-Trees less than 1.0 inch in d.b.h.

Rough, Rotten, and Salvable Dead Trees- See "tree classes."

Stand Size Classes

Sawtimber Stands-Stands at least 16.7 percent stocked with growing-stock trees, half or more of this stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber Stands-Stands at least 16.7 percent stocked with growing-stock trees, half or more of this stocking in sawtimber or poletimber trees, and with poletimber stocking exceeding that of sawtimber stocking.

Sapling-Seedling Stands-Stands at least 16.7 percent stocked with growing-stock trees, more than half of this stocking in saplings or seedlings.

Nonstocked Stands-Stands less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is a measure of the extent to which the growth potential of the site is utilized by trees or preempted by vegetative cover. Stocking is determined by comparing the stand density in terms of number of trees or basal area with a specified standard. Therefore, full stocking is 100 percent of the stocking standard.

Defined below are arbitrarily defined stocking categories.

Understocked- Stands 0 to 60 percent stocked. These stands will take a very long time to reach full stocking. Meanwhile, poor bole form will result and much of the productivity will be placed on heavy limbs instead of the bole.

Optimally stocked- Stands 61 to 100 percent stocked. These stands are growing toward a fully stocked condition (ideal space required for each tree increases with age). Optimum growth and bole form occur in this range.

Overstocked- Stands greater than 100 percent stocked. These stands will become stagnant with mortality of individuals increasing as stocking increases over 100 percent.

The tabulation below shows the density standard in terms of trees per acre by size class required for full stocking.

D.b.h. (inches)	Number of trees	D.b.h. (inches)	Number of trees
Seedlings	600	16	72
2	560	18	60
4	460	20	51
6	340	22	42
8	240	24	36
10	155	26	31
12	115	28	27
14	90	30	24

Volume

Volume of Cull—The volume of sound wood in the bole of rough and rotten trees.

Volume of Growing Stock—Net volume of sound wood in the bole of sawtimber and poletimber trees from a 1-foot stump to a minimum 4.0-inch top outside bark or to the point where the central stem breaks into limbs. Rough, rotten, and noncommercial trees are excluded.

Volume of Sawtimber—Net volume of the saw-log portion of live sawtimber trees in board feet of the International rule (1/4-inch kerf). Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber to the point where the central stem breaks into limbs. Rough, rotten, and noncommercial trees are excluded.

Volume of Timber—The volume of sound wood in the bole of growing stock, rough, rotten, and salvable dead trees 5.0 inches and larger in d.b.h. from stump to a minimum 4.0-inch top outside bark or to the point where the central stem breaks into limbs.

Biomass

Merchantable Dry Weight—Dry weight of woody biomass of all growing-stock trees greater than 5.0-inches in d.b.h. from a 1-foot stump to a 4.0-inch top d.o.b. or to a point prior to 4.0-inch d.o.b. because of branching, forking, or other factors.

Residual Dry Weight—Dry weight of woody biomass of the nonmerchantable portion of all growing-stock trees greater than or equal to 5.0-inches in d.b.h., all saplings, all noncommercial trees, all rough trees, and all rotten trees.

Total Dry Weight—Dry weight of woody biomass for all live woody vegetation greater than 1.0 inch in d.b.h. Included are growing-stock, commercial, noncommercial, rough, and rotten (sound portion) trees.

Woody Biomass—The amount of live organic material in woody vegetation. Included are bark and wood; excluded are fruits, leaves, stump, and roots.

Growth Classes

Gross Growth—Total increase in stand volume computed on growing-stock trees. Gross growth equals survivor growth plus ingrowth plus growth on removals plus growth on mortality plus cull increment.

Net Growth—Increase in stand volume, computed on growing-stock trees. Net growth is equal to gross growth minus mortality.

Net Change—Increase or decrease in stand volume, computed on growing-stock trees. Net change is equal to net growth minus removals.

Classes of Trees Used in Growth Computations

Survivor Trees—Merchantable-and-in at time 1 (previous inventory) and time 2 (current inventory).

Ingrowth Trees—Submerchantable-and-in at time 1 and merchantable-and-in at time 2.

Ongrowth Trees—Submerchantable-and-out at time 1 and merchantable-and-in at time 2; included with ingrowth component for growth computation.

Nongrowth Trees—Merchantable-and-out at time 1 and merchantable-and-in at time 2; included with survivor growth for growth computation.

Removal Trees—Merchantable-and-in at time 1 and removed prior to time 2.

Mortality Trees—Merchantable-and-in at time 1 and dead prior to time 2.

Ownership Classes

National Forest Land—Federal lands that have been legally designated as national forests or purchase units and other lands under the administration of the USDA Forest Service, including experimental areas.

Other Federal Land—Federal lands other than national forests; lands administered by the Bureau of Land Management and Indian Lands.

State, County, and Municipal Lands—Lands owned by States, counties, and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

Forest Industry Land—Lands owned by companies or individuals operating wood-using plants (either primary or secondary).

Farmer Owned Land—Lands operated as a unit of 10 acres or more from which the sale of agricultural products totals \$1,000 or more annually.

Nonindustrial Private Land (Individual)—Lands privately owned by individuals other than forest industry, farmer owned, or miscellaneous private corporation.

Nonindustrial Private Land (Corporate)—Lands privately owned by private corporations other than forest industry and incorporated farms.

Miscellaneous Definitions

Average Net Annual Growth-Average net annual volume increase for the intersurvey period.

Average Annual Mortality-Average annual sound-wood volume of growing-stock trees dying from natural causes.

Average Annual Removals-Average net annual volume of growing-stock trees removed from the inventory by harvesting, cultural operations (such as timber-stand improvement), land clearing, or changes in land use.

Basal Area-The area in square feet of the cross section at breast height of a single tree or of all the trees in a stand, usually expressed in square feet per acre.

Cull Increment-The change in growing-stock volume due to growing-stock, rough, or rotten trees changing tree class between time 1 and time 2.

D.b.h. (Diameter at Breast Height)-Tree diameter in inches, outside bark, usually measured at 4 1/2 feet above ground.

Diameter Classes-The 2-inch diameter classes extend from 1.0 inch below to 0.9 inches above the stated midpoint. Thus, the 12-inch class includes trees 11.0 inches through 12.9 inches in d.b.h.

Log Grades-A classification of logs based on external characteristics as indicators of quality or value.

Mortality-Number or sound-wood volume of live trees dying from natural causes during a specified period.

Natural Stands-Stands with no evidence of artificial regeneration. This includes those stands established by seed tree regeneration methods.

Plantations-Stands evidenced by regeneration from planting or seeding. Forest Inventory and Analysis categorizes plantations by forest type based upon plot tally.

Saw-Log Portion-The point on the bole of a saw-timber tree between a 1-foot stump and the saw-log top.

Saw-Log Top-The portion of the bole of a saw-timber tree above which a saw log cannot be produced. The minimum saw-log top is 7.0 inches in diameter outside bark (d.o.b.) for softwoods and 9.0 inches in d.o.b. for hardwoods.

Select Red Oaks-a group of select species in the red oak (*Erythrobalanus*) subgenus; may include one or more of the following species: cherrybark oak (*Quercus falcata* var. *pagodaefolia*), northern red oak (*Q. rubra*), or shumard oak (*Q. shumardii*). Other red oak species are included in the "other red oaks" group.

Select White Oaks-A group of select species in the white oak (*Leucobalanus*) subgenus; may include one or more of the following species: white oak (*Quercus alba*), swamp white oak (*Q. bicolor*),

durand oak (*Q. durandii*), bur oak (*Q. macrocarpa*), swamp chestnut oak (*Q. michauxii*), or chinkapin oak (*Q. muehlenbergii*). Other white oak species are included in the "other white oaks" group.

Site Class-A classification of forest land in terms of potential capacity to grow crops of industrial wood.

Timber Removals-The net volume of growing-stock trees removed from the inventory by harvesting or cultural operations such as timber-stand improvement, land clearing, or change in land use.

Tree Grade-A log grade, assigned to the entire log portion of sawtimber trees, but based on the grade of the butt-log portion only. In past surveys, a log grade was assigned to each upper log based on log grade standards.

Upper-Stem Portion-That part of the main stem or fork of a sawtimber tree above the saw-log top to a diameter outside bark of 4.0 inches or to the point where the main stem or fork breaks into limbs.

Species List

Scientific and common names of tree species sampled in Mississippi⁴

Commercial Species

Scientific Name	Common Name
-----------------	-------------

Softwoods

<i>Chamaecyparis thyoides</i>	Atlantic white-cedar
<i>Juniperus silicicola</i>	southern redcedar
<i>J. virginiana</i>	eastern redcedar
<i>Pinus echinata</i>	shortleaf pine
<i>P. elliotii</i>	slash pine
<i>? glabra</i>	spruce pine
<i>P. palustris</i>	longleaf pine
<i>? taeda</i>	loblolly pine
<i>Taxodium distichum</i> var. <i>distichum</i>	baldcypress
<i>T. distichum</i> var. <i>nutans</i>	pondcypress

Hardwoods

<i>Acer barbatum</i>	Florida maple
<i>A. negundo</i>	boxelder
<i>A. rubrum</i> var. <i>rubrum</i>	red maple
<i>A. saccharinum</i>	silver maple
<i>A. saccharum</i>	sugar maple
<i>Aesculus glabra</i>	Ohio buckeye
<i>A. octandra</i>	yellow buckeye
<i>Betula nigra</i>	river birch
<i>Carya</i> sp.	hickory
<i>C. aquatica</i>	water hickory

Standard Tables

	Page
1. — Area by land classes	54
2. — Area of timberland by ownership classes	54
3. — Area of timberland by stand size and ownership classes	54
4. — Area of timberland by stand volume and ownership classes	54
5. — Area of timberland by percent growing-stock trees and cull trees	55
6. — Average basal area of live trees on timberland by ownership and timber classes	55
7. — Area of timberland by site and ownership classes	56
8. — Area of timberland by forest types and ownership classes	56
9. — Area of noncommercial forest land by forest types	56
10. — Number of growing-stock trees on timberland by species and diameter classes	57
11. — Volume of timber on timberland by classes of timber and by softwoods and hardwoods	58
12. — Volume of growing stock and sawtimber on timberland by ownership classes and by softwoods and hardwoods ..	58
13. — Volume of growing stock on timberland by species and diameter classes	59
14. — Volume of sawtimber on timberland by species and diameter classes	60
15. — Volume of sawtimber on timberland by species and tree grades	61
16. — Average net annual growth and average annual removals of growing stock on timberland by species	61
17. — Average net annual growth and average annual removals of growing stock on timberland by ownership classes and by softwoods and hardwoods ..	62
18. — Average net annual growth and average annual removals of sawtimber on timberland by species	62
19. — Average net annual growth and average annual removals of sawtimber on timberland by ownership classes and by softwoods and hardwoods	62
20. — Average annual mortality of growing stock and sawtimber on timberland by species	63
21. — Average annual mortality of growing stock and sawtimber on timberland by ownership classes and by softwoods and hardwoods	63
22. — Average annual mortality of growing stock and sawtimber on timberland by causes of death and by softwoods and hardwoods	63

Table 1—Area by land classes, Mississippi, 1987

Land class	Area
	Thousand acres
Forest	
Commercial	
Timberland	16,981.6
Deferred timberland	.....
Noncommercial	
Productive-reserved	8.6
Unproductive	.....
Total forest	<u>16,990.1</u>
Nonforest	
Cropland ¹	7,745.1
Other	<u>5,493.7</u>
Total nonforest	<u>13,238.8</u>
All land ¹	<u>30,228.9</u>

¹U.S. Department of Commerce, Bureau of the Census, 1982 Census of Agriculture, Volume 1: State and County data, issued 1984.

²Bureau of Census, 1981.

Table 2—Area of timberland by ownership classes, Mississippi, 1987¹

Ownership class	Area
	Thousand acres
Public:	
National forest	1,212.1
Other federal	342.0
State	252.7
County	<u>112.5</u>
Total public	<u>1,919.3</u>
Private:	
Forest industry	3,197.3
Farmer	4,171.5
Miscellaneous private	
Individual	7,086.2
Corporate	<u>607.2</u>
Total private	<u>15,062.3</u>
All ownerships	<u>16,981.6</u>

Columns may not sum to total due to rounding.

Table 3—Area of timberland by stand size and ownership classes, Mississippi, 1987¹

Stand size class	All ownerships	National forest	Other public	Forest industry	Miscellaneous Farmer	private	p
	Thousand acres						
Sawtimber	8,116.8	785.5	475.0	1,104.2	2,078.4	3,673.6	
Poletimber stands	4,203.9	224.4	96.7	738.6	1,154.2	1,990.1	
Sapling and seedling	4,458.8	189.4	108.8	1,304.5	880.8	1,975.2	
Nonstocked areas	202.0	12.8	26.6	50.0	58.1	54.5	
All classes	<u>16,981.6</u>	<u>1,212.1</u>	<u>707.1</u>	<u>3,197.3</u>	<u>4,171.5</u>	<u>7,693.4</u>	

¹Rows and columns may not sum to totals due to rounding.

Table 4—Area of timberland by stand volume and ownership classes, Mississippi, 1987¹

Stand volume per acre	All ownerships	National forest	Other public	Forest industry	Miscellaneous Farmer	private
	Thousand acres					
Board feet						
Less than 1,500	6,005.7	189.5	149.0	1,616.8	1,441.6	2,608.7
1,500 to 5,000	5,206.7	281.3	176.7	789.1	1,317.4	2,642.2
More than 5,000	5,769.1	741.3	381.4	791.4	1,412.5	2,442.5
All classes	<u>16,981.6</u>	<u>1,212.1</u>	<u>707.1</u>	<u>3,197.3</u>	<u>4,171.5</u>	<u>7,693.4</u>

¹Rows and columns may not sum to totals due to rounding.

²International 1/4-inch rule.

Table 5—Area of timberland by percent growing-stock trees and cull trees, Mississippi, 1987

Growing-stock trees	Cull trees percent stocking							
	Total	0-10	10-20	20-30	30-40	40-50	50-60	60+
Percent stocking	-----Thousand acres-----							
0-10	94.6	27.9	5.5	...	...	12.0	5.9	43.2
10-20	128.8	22.7	7.8	15.8	15.9	11.7	6.1	48.9
20-30	346.3	7.0	32.5	24.1	34.1	21.0	80.9	146.1
30-40	569.1	51.6	44.2	60.3	62.4	62.5	91.6	196.4
40-50	1,069.1	45.3	51.9	102.5	136.4	235.6	211.9	285.5
50-60	1,741.6	73.3	138.8	210.6	389.2	413.3	298.4	218.1
60-70	2,219.4	99.7	224.9	548.9	604.1	379.3	231.6	131.0
70-80	2,560.1	124.4	429.9	686.2	669.1	385.0	192.6	73.0
80-90	2,655.6	285.5	603.0	798.5	514.2	258.4	91.7	44.3
90-100	2,116.0	304.6	579.9	124.9	386.4	103.5	10.4	6.3
100-110	1,508.5	344.8	508.6	411.0	171.4	66.8	5.9	.....
110-120	1,067.2	351.0	418.6	232.9	42.6	22.1	.....	.....
120-130	426.7	184.1	151.8	51.7	39.2	.....	.....	.....
130-140	216.9	157.4	89.5	30.0	.....	.....	.....	.....
140-150	150.4	103.9	34.4	12.2	.....	.....	.....	.....
150-160	37.6	32.2	5.4	.....	.....	.....	.....	.....
160+	13.5	13.5	.....	.....	.....	.....	.....	.....
Total	16,981.6	2,228.9	3,326.6	3,910.2	3,124.9	1,971.4	1,226.9	1,192.7

*Rows and columns may not sum to totals due to rounding.

Table 6—Average basal area of live trees on timberland by ownership and timber classes, Mississippi, 1987

Owner and timber classes	All species	Softwood			Hardwood		
		Sapling & seedling	Poletimber	Sawtimber	Sapling & seedling	Poletimber	Sawtimber
-----Square feet per acre-----							
National forest:							
Growing stock	70.8	3.9	7.0	29.0	3.8	12.5	14.7
Rough and rotten	18.7	0.7	0.3	0.7	8.1	4.2	4.7
Total	89.5	4.5	1.3	29.7	11.9	16.7	19.3
Other public:							
Growing stock	61.5	1.7	4.3	18.5	4.2	13.4	25.3
Rough and rotten	22.8	0.4	0.4	0.7	6.9	6.3	8.1
Total	90.3	2.2	4.7	19.2	11.1	19.7	33.4
Forest industry:							
Growing stock	51.0	4.9	9.8	13.6	4.0	8.6	10.0
Rough and rotten	16.8	0.9	0.7	0.5	1.2	3.5	4.0
Total	67.8	5.9	10.5	14.1	11.2	12.1	14.1
Farmer:							
Growing stock	58.3	2.3	5.9	13.7	4.6	14.6	17.1
Rough and rotten	22.1	0.8	0.5	0.7	8.0	5.3	6.9
Total	80.4	3.1	6.4	14.4	12.6	19.8	24.0
Miscellaneous private:							
Growing stock	51.6	2.7	6.2	13.8	4.2	14.0	16.9
Rough and rotten	21.5	0.8	0.5	0.7	8.1	5.2	6.2
Total	79.1	3.5	6.7	14.5	12.3	19.2	23.0
All owners:							
Growing stock	57.9	3.1	6.8	15.0	4.2	13.0	15.8
Rough and rotten	20.6	0.8	0.5	0.6	7.8	4.9	5.9
Total	78.5	3.8	1.3	15.7	12.1	17.9	21.8

*Rows and columns may not sum to totals due to rounding.

Table 7.—Area of timberland by site and ownership classes, Mississippi, 1987¹

Site class	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
----- Thousand acres -----						
165 ft or more	2,458.9	171.1	151.1	355.0	653.5	1,128.1
120 to 165 ft	4,937.6	432.4	203.1	859.2	1,295.7	2,147.3
85 to 120 ft	6,785.5	465.8	227.3	1,363.0	1,552.6	3,176.7
50 to 85 ft	2,641.4	142.8	103.6	592.1	657.3	1,145.6
Less than 50 ft	158.2	.....	2 X . . .	28.0	12.3	95.8
All classes	16,981.6	1,212.1	707.1	3,197.3	4,171.5	7,693.4

¹Rows and columns may not sum to totals due to rounding.

Table 8.—Area of timberland by forest types and ownership classes, Mississippi, 1987¹

Type	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
----- Thousand acres -----						
Longleaf-slash pine	841.5	186.5	47.1	256.4	87.9	263.6
Loblolly-shortleaf pine	3,930.7	307.4	124.7	1,058.7	887.5	1,552.4
Oak-pine	3,522.9	357.3	124.0	668.3	787.4	1,585.9
Oak-hickory	5,477.2	232.8	154.8	730.8	1,533.6	2,825.2
Oak-gum-cypress	3,051.7	121.5	237.0	465.6	820.3	1,407.4
Elm-ash-cottonwood	149.5	6.8	19.5	9.4	54.8	58.9
Nontyped	8.1	.....	.....	8.1	.....	.....
All types	16,981.6	1,212.1	707.1	3,197.3	4,171.5	7,693.4

¹Rows and columns may not sum to totals due to rounding.

Table 9.—Area of noncommercial forest land by forest types, Mississippi, 1987¹

Type	All areas	Productive reserved areas	Unproductive areas
----- Thousand acres -----			
Longleaf-slash pine	4.6	4.6	.....
Softwood total	4.6	4.6	.....
Oak-hickory	1.9	1.9	.....
Oak-gum-cypress	2.1	2.1	.....
Hardwood total	4.0	4.0	.....
All types	8.6	8.6	.....

¹Rows and columns may not sum to totals due to rounding.

Table 10—Number of growing-stock trees on timberland by species and diameter classes, Mississippi, 1987¹

Species	Diameter class (inches at breast height)										
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 & larger
	----- <i>Thousand trees</i> -----										
Longleaf pine	41,420	12,947	8,323	6,548	6,303	3,985	2,068	976	184	87	.....
Slash pine	80,533	38,755	21,137	10,193	5,474	2,591	1,531	546	237	68	.....
S hortleaf pine	171,244	51,705	47,841	31,886	21,496	10,532	5,072	1,926	528	258	.....
Loblolly pine	412,775	149,887	102,417	57,599	39,866	28,410	16,362	9,052	4,861	4,206	114
Spruce pine	8,173	1,836	1,726	1,055	1,129	810	505	406	382	314	9
Redcedar ²	13,859	8,344	3,212	1,266	520	305	140	59	12	.....	.....
Cypress	7,582	2,862	1,924	749	851	278	252	217	94	295	60
Total softwoods	735,587	266,336	186,581	109,296	75,639	46,911	25,931	13,183	6,299	5,228	183
Select white oaks ³	71,967	25,672	15,356	10,276	7,039	5,360	3,568	2,147	1,104	1,398	46
Select red oaks ⁴	33,571	8,654	7,504	4,361	3,667	2,912	2,539	1,443	916	1,398	176
Other white oaks	61,156	20,163	16,077	10,110	5,917	4,245	2,286	888	754	630	87
Other red oaks	201,420	65,345	44,544	34,427	20,080	14,645	9,414	5,440	3,339	3,749	435
Sweet pecan	2,879	967	353	662	302	124	147	82	55	146	39
Water hickory	5,107	1,478	1,376	689	339	393	286	202	153	188	4
Other hickories	50,820	18,117	10,253	8,123	6,201	3,875	2,095	1,110	588	445	12
Persimmon	5,716	3,368	1,289	845	149	21	14	20	10	.....	.....
Hard maple	1,571	858	311	183	101	68	26	13	11	.....	.....
Soft maple	29,498	18,136	6,460	2,503	1,451	515	175	161	66	30	.....
Roxelder	5,857	1,984	1,124	1,439	658	394	156	71	15	16	.....
Beech	6,989	2,144	1,261	886	434	611	596	427	201	402	27
Sweetgum	211,316	98,479	53,085	30,324	12,778	8,394	4,212	2,052	970	974	49
Blackgum	50,994	19,988	13,306	7,654	4,353	3,158	1,539	649	181	164	3
Other gums/tupelos	19,828	4,935	5,627	3,936	2,064	1,535	1,019	456	180	72	4
White ash	5,356	1,727	1,247	973	455	400	167	222	148	18	.....
Other ashes	20,416	8,147	5,050	2,666	1,810	1,135	706	382	219	258	42
Sycamore	8,122	2,213	2,214	930	583	841	544	284	202	277	34
Cottonwood	3,054	263	915	390	213	214	181	208	190	296	184
Hasswood	1,046	77	391	189	61	201	36	24	21	47	.....
Yellow-poplar	30,359	9,498	6,625	3,924	3,299	2,678	1,814	1,130	504	805	82
Magnolia	2,814	1,103	661	415	252	107	106	76	62	28	4
Sweetbay	22,569	10,416	6,215	2,879	1,704	614	472	150	94	26	.....
Willow	4,568	1,745	858	593	347	262	163	230	177	159	35
Black walnut	927	492	144	134	33	40	35	27	21	.....	.....
Black cherry	9,380	5,256	1,861	1,406	298	260	165	91	42	.....	.....
American elm	11,957	3,593	3,415	2,048	787	1,266	411	244	86	91	17
Other elms	19,419	9,655	4,555	2,820	983	782	306	106	104	107	.....
River birch	2,571	512	583	464	322	334	185	89	47	34	.....
Hackberry	20,520	5,570	5,566	3,789	2,025	1,526	860	661	323	192	8
Black locust	1,181	492	167	409	58	55	.....	.....	.....	.....	.....
Other locusts	717	90	149	264	60	31	46	49	28	.....	.....
Sassafras	3,289	1,498	865	432	106	249	47	39	30	21	.....
Dogwood	8,248	7,493	740	.....	.....	.....	15	.....	.....	.....	.....
Holly	2,931	11,602	873	217	177	47	15	.....	.....	.....	.....
Other commercial	1,555	904	489	162	.....	.....	.....	.....	.....	.....	.....
Total hardwoods	939,687	362,635	221,512	141,523	79,108	57,291	34,346	19,173	10,840	11,970	1,287
All species	1,675,273	628,971	408,093	250,819	154,746	104,202	60,277	32,356	17,139	17,199	1,471

¹Rows and columns may not sum to totals due to rounding.

²Includes a small amount of Atlantic white-cedar.

³Includes white, swamp chestnut, and bur oaks.

⁴Includes cherrybark and Shumard oaks.

Table 11.—*Volume of timber on timberland by classes of timber and by softwoods and hardwoods, Mississippi, 1987*¹

Class of timber	All species	Softwood	Hardwood
	<i>Million cubic feet</i>		
Sawtimber trees:			
Saw-log portion	11,987.7	6,423.6	5564.1
Upper-stem portion	1,851.0	785.3	1,065.7
Total	<u>13,838.7</u>	<u>7,208.9</u>	<u>6,629.8</u>
Poletimber trees	5,586.8	1,877.9	3,708.9
All growing stock	<u>19,425.5</u>	<u>9,086.8</u>	<u>10,338.7</u>
Rough trees	2,459.6	310.0	2,149.5
Rotten trees	412.2	14.1	398.1
Salvable dead trees	199.6	139.5	60.1
All timber	<u>22,496.8</u>	<u>9,550.4</u>	<u>12,946.4</u>

¹Rows and columns may not sum to totals due to rounding.

Table 12.—*Volume of growing stock and sawtimber on timberland by ownership classes and by softwoods and hardwoods, Mississippi, 1987*¹

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	<i>Million cubic feet</i>			<i>Million board feet²</i>		
National forest	1,994.8	1,298.5	696.2	9,082.0	6,791.2	2,290.8
Other public	1,069.6	446.2	623.4	4,634.3	2,238.7	2,395.6
Forest industry	2,952.3	1,671.2	1,281.1	10,576.5	6,379.6	4,197.0
Farmer	4,702.1	1,978.7	2,723.3	16,972.3	8,426.9	8,545.3
Miscellaneous private	8,706.8	3,692.1	5,014.7	31,944.8	15,760.7	16,184.1
All ownerships	<u>19,425.5</u>	<u>9,086.8</u>	<u>10,338.7</u>	<u>73,209.9</u>	<u>39,597.1</u>	<u>33,612.8</u>

¹Rows and columns may not sum to totals due to rounding.

²International 1/4-inch rule.

Table 13—Volume of growing stock on timberland by species and diameter classes, Mississippi, 1987¹

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 & larger	
	<i>Million cubic feet</i>											
Longleaf	604.5	37.2	57.9	90.9	141.2	123.4	85.4	49.9	11.5	6.9	.....
Slash pine	671.0	93.0	134.0	127.5	112.2	83.2	65.9	32.0	16.3	6.9	.....
Shortleaf pine	2,100.9	153.8	345.8	439.4	449.6	327.7	215.1	105.7	38.6	25.2	.....
Loblolly pine	5,347.0	365.9	622.6	723.6	802.7	854.8	678.1	501.3	343.9	432.1	21.9	
Spruce pine	189.5	5.8	11.0	12.3	22.5	26.8	22.0	25.2	28.0	34.2	1.6	
Redcedar ²	65.4	17.1	17.0	11.3	7.2	6.0	4.1	2.2	0.5	.....	.....
Cypress	108.5	5.5	11.3	10.0	16.7	8.1	8.9	10.5	4.8	24.3	8.3	
Total softwoods	9,086.8	678.4	1,199.5	1,415.1	1,552.2	1,430.0	1,079.5	726.7	443.7	529.8	31.8	
Select white oaks ³	939.8	67.1	95.9	116.1	126.6	139.3	126.5	94.0	61.8	104.6	7.9	
Select red oaks	616.6	23.4	45.3	47.4	67.4	76.6	88.4	68.9	52.9	117.7	28.7	
Other white oaks	593.8	45.9	82.5	96.3	88.6	90.3	63.6	34.2	34.4	45.6	12.3	
Other red oaks	2,577.1	173.5	265.5	367.5	341.0	352.8	307.4	232.6	182.8	289.3	64.7	
Sweet pecan	51.9	2.0	2.1	6.7	5.7	3.1	5.3	3.6	4.0	13.1	6.4	
Water hickory	74.8	4.6	7.5	6.7	4.8	9.4	9.6	8.7	8.2	14.6	0.7	
Other hickories	588.8	41.6	57.8	85.8	107.0	99.7	74.5	51.0	34.2	36.4	0.9	
Persimmon	32.9	9.1	7.8	10.9	2.6	0.5	0.5	1.0	0.6	.....	.....
Hard maple	11.8	2.5	1.8	2.2	2.1	1.5	0.8	0.4	0.6	.....	.....
Soft maple	158.2	45.1	36.9	24.6	22.8	12.0	4.9	6.4	3.2	2.4	.....
Boxelder	55.5	5.1	6.9	14.6	10.9	8.8	5.3	2.5	0.6	0.8	.....
Beech	129.9	5.2	6.6	9.7	6.8	15.3	20.1	19.4	11.4	31.1	4.3	
Sweetgum	1,771.0	220.7	310.4	336.7	240.2	230.8	163.3	106.1	64.5	90.7	7.6	
Blackgum	448.1	44.7	72.2	81.4	73.1	76.4	52.0	26.2	10.1	11.7	0.3	
Other gums/tupelos	226.6	13.0	32.5	43.4	36.1	37.2	31.0	19.2	9.3	4.5	0.4	
White ash	68.8	4.9	8.4	9.8	8.0	10.5	6.3	10.7	8.5	1.7	.....
Other ashes	210.2	21.1	30.3	29.5	30.6	26.9	23.1	15.3	11.2	17.2	5.2	
Sycamore	153.2	7.8	16.3	14.0	11.7	24.5	21.0	14.7	13.0	25.5	4.7	
Cottonwood	126.6	0.7	6.2	4.3	4.0	5.0	7.3	11.4	12.7	34.1	40.8	
Basswood	19.9	0.3	2.5	2.0	1.5	5.5	1.3	1.2	1.1	4.5	.....
Yellow-poplar	502.0	25.9	43.1	47.0	61.9	74.5	72.6	56.9	32.9	72.5	14.7	
Magnolia	29.8	2.7	3.9	4.1	4.2	2.3	3.9	3.2	3.0	1.9	0.5	
Sweetbay	171.1	29.6	39.9	31.7	28.4	14.5	15.2	5.8	4.5	1.6	.....
Willow	76.6	3.8	4.6	5.5	5.6	7.0	6.6	12.8	11.4	14.7	4.5	
Black walnut	7.2	0.7	0.5	1.4	0.5	1.1	1.1	1.1	0.8	.....	.....
Black cherry	63.4	13.2	10.5	15.3	5.4	7.0	6.0	4.0	2.0	.....	.....
American elm	130.1	9.3	19.6	22.3	14.2	29.9	13.3	9.9	4.0	5.6	2.0	
Other elms	146.4	21.8	26.2	31.1	17.0	19.6	10.2	4.9	5.9	9.8	.....
River birch	39.3	1.9	3.4	5.2	5.7	8.3	6.3	3.8	2.5	2.2	.....
Hackberry	233.3	14.1	31.6	39.7	32.6	33.7	24.6	27.5	16.1	12.4	0.9	
Black locust	9.2	1.9	1.3	3.9	1.0	1.2	.....	.....	.....	.....	.....
Other locusts	11.2	0.5	0.9	2.9	1.3	0.6	1.3	2.2	1.5	.....	.....
Sassafras	27.7	3.0	5.5	4.4	1.8	6.0	1.5	1.9	1.8	1.7	.....
Dogwood	16.6	13.7	2.7	.....	.....	.....	0.3	.....	.....	.....	.....
Holly	13.2	3.5	4.1	1.8	2.4	0.8	0.6	.....	.....	.....	.....
Other commercial	6.0	2.5	2.0	1.5	.....	.....	.....	.....	.....	.....	.....
Total hardwoods	10,338.7	886.1	1,199.5	1,295.6	1,527.2	1,373.8	1,432.7	1,175.4	861.5	611.4	967.9	207.1
All species	19,425.5	1,564.4	2,495.2	2,942.3	3,079.4	2,803.8	2,512.2	1,588.3	1,055.1	1,497.7	238.9	

¹ Rows and columns may not sum to totals due to rounding.

² Includes a small amount of Atlantic white-cedar.

³ Includes white, swamp chestnut, and bur oaks.

⁴ Includes cherrybark and Shumard oaks.

Table 14-Volume of sawtimber on timberland by species and diameter classes, Mississippi, 1987

Species	Diameter class (inches at breast height)								
	All classes	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 & larger
	-----Milliboard feet ³ -----								
Longleaf pine	2,716.1	404.7	752.9	684.9	485.1	280.8	67.6	40.1	.....
Slash pine	2,306.8	513.5	576.6	488.6	392.9	192.3	98.2	44.6	.....
Shortleaf pine	8,711.5	2,017.1	2,434.0	1,914.4	1,297.0	644.1	244.1	160.8	.....
Loblolly pine	24,248.4	3,117.9	4,229.9	4,882.1	4,008.5	3,027.0	2,128.7	2,713.9	140.5
Spruce pine	1,004.5	52.5	115.2	153.0	131.2	154.7	173.3	214.5	10.0
Redcedar ³	138.7	44.4	29.9	28.5	22.1	11.2	2.6	.....	.....
Cypress	471.2	37.0	74.6	43.9	45.3	57.8	26.1	135.3	51.3
Total softwoods	39,597.1	6,187.0	8,213.1	8,195.4	6,382.1	4,367.9	2,740.5	3,309.2	201.8
Select white oaks ⁴	3,469.2	.....	523.5	694.8	677.7	532.3	357.5	632.8	50.6
Select red oaks ⁴	2,670.4	.....	263.0	388.2	466.9	378.9	304.8	700.5	168.2
Other white oaks	1,861.9	.....	365.7	445.4	336.9	184.5	186.6	267.1	75.7
Other red oaks	8,956.9	.....	1,336.5	1,703.4	1,606.5	1,247.5	1,014.0	1,658.6	390.5
Sweet pecan	229.6	.....	25.2	15.1	26.8	20.3	24.5	76.5	41.2
Water hickory	294.0	.....	18.5	43.7	49.5	49.4	44.4	84.7	3.8
Other hickories	2,040.9	.....	446.1	497.8	394.9	288.3	192.8	215.1	6.0
Persimmon	23.1	.....	9.4	2.7	1.6	6.0	3.4	.....	.....
Hard maple	28.1	.....	11.1	6.9	4.8	2.0	3.2	.....	.....
Soft maple	227.2	.....	89.9	55.2	22.2	32.0	15.8	12.1	.....
Boxelder	133.1	.....	45.3	43.7	24.6	12.4	3.7	3.4	.....
Beech	597.5	.....	29.3	76.3	107.8	106.1	65.9	190.5	21.5
Sweetgum	4,429.1	.....	919.0	1,108.1	878.7	581.6	374.2	527.9	39.6
Blackgum	1,188.3	.....	290.9	363.1	275.5	134.3	55.0	68.1	1.4
Other gums/tupelos	596.3	.....	123.3	151.8	150.0	98.5	47.1	23.9	1.8
White ash	232.8	.....	34.7	50.4	33.8	56.3	48.4	9.2	.....
Other ashes	603.8	.....	118.3	119.2	117.6	80.4	59.1	82.9	26.2
Sycamore	598.4	.....	46.7	118.0	110.8	77.0	72.9	144.2	28.8
Cottonwood	685.1	.....	13.8	23.7	41.6	62.8	75.4	211.6	256.2
Basswood	81.4	.....	6.9	27.9	6.1	8.1	6.4	26.0	.....
Yellow-poplar	2,023.1	.....	247.9	371.5	391.5	316.4	188.4	424.3	83.1
Magnolia	98.5	.....	17.1	10.8	22.0	18.6	16.5	11.2	2.2
Sweetbay	325.9	.....	115.3	68.2	77.0	32.6	24.1	8.7	.....
Willow	365.5	.....	22.9	37.9	37.1	80.9	69.3	91.5	26.0
Black walnut	22.8	.....	2.0	4.8	5.8	5.6	4.6	.....	.....
Black cherry	122.9	.....	21.4	36.7	32.4	22.8	9.6	.....	.....
American elm	393.2	.....	62.2	144.6	68.2	52.5	22.6	31.8	11.1
Other elms	339.0	.....	69.6	98.4	55.3	25.9	33.2	56.6	.....
River birch	143.3	.....	25.7	40.9	31.8	19.2	13.7	12.1	.....
Hackberry	694.3	.....	123.6	148.6	119.9	146.6	87.9	64.5	3.2
Black locust	9.4	.....	3.5	5.9	.....	.....	.....	.....	.....
Other locusts	34.8	.....	4.7	2.8	6.7	11.7	8.9	.....	.....
Sassafras	75.1	.....	6.8	29.6	6.6	11.3	10.6	10.2	.....
Dogwood	1.5	.....	.....	.....	1.5	.....	.....	.....	.....
Holly	16.5	.....	9.1	4.1	3.3	.....	.....	.....	.....
Total hardwoods	33,612.8	.....	5,448.7	6,940.0	6,193.7	4,702.5	3,444.4	5,646.1	1,237.2
All species	73,209.9	6,187.0	13,661.9	15,135.4	12,575.9	9,070.4	6,185.0	8,955.4	1,439.0

Rows and columns may not sum to totals due to rounding.

*International 1/4-inch rule.

³Includes a small amount of Atlantic white-cedar.

⁴Includes white, swamp chestnut, and bur oaks.

⁵Includes cherrybark and Shumard oaks.

Table 15—Volume of sawtimber on timberland by species and tree grades, Mississippi, 1987¹

Species	All grades	Grade 1	Grade 2	Grade 3	Grade 4
	-----Million board feet ² -----				
Yellow pines	38,987.2	5,889.1	6,701.2	26,397.0	.....
Cypress	471.2	72.6	114.4	284.1	
Redcedar	136.4	136.4			
Other softwoods	2.3	2.3			
Total softwoods	39,597.1	6,100.4	6,815.6	26,681.1	
Select white-red oaks ³	6,139.6	763.1	1,601.4	2,695.3	1,079.8
Other white-red oaks	10,818.7	403.1	1,632.0	4,731.0	4,052.6
Hickory	2,564.5	171.2	485.1	1,444.6	463.5
Hard maple	28.1			12.8	15.3
Sweetgum	4,429.1	375.4	888.5	2,256.0	909.1
Tupelo and blackgum	1,784.6	105.6	514.3	1,000.6	164.2
Ash-walnut-black cherry	982.3	168.6	275.0	471.6	67.1
Yellow-poplar	2,023.1	240.2	422.6	915.0	445.3
Other hardwoods	4,842.8	663.6	965.2	1,899.4	1,314.6
Total hardwoods	33,612.8	2,890.9	6,784.2	15,426.4	8,511.3
All species	73,209.9	8,991.3	13,599.8	42,107.5	8,511.3

¹Rows and columns may not sum to totals due to rounding.²International 1/4-inch rule.³Includes white, swamp chestnut, cherrybark, and Shumard oaks.Table 16—Average net annual growth and average annual removals of growing stock on timberland by species, Mississippi, 1977-1987¹

Species	Growth	Removals
	-----Million cubic feet-----	
Yellow pines	504.3	514.9
Cypress	1.7	4.2
Redcedar	3.4	1.2
Total softwoods	509.1	520.4
Select white-red oaks ²	75.1	42.8
Other white-red oaks	147.6	85.3
Hickory	25.4	15.7
Hard maple	0.6	0.2
Sweetgum	73.1	38.7
Tupelo and blackgum	16.7	11.9
Ash-walnut-black cherry	14.4	5.7
Yellow-poplar	28.4	13.7
Other hardwoods	55.1	26.9
Total hardwoods	436.3	240.8
All species	945.4	761.2

¹Columns may not sum to totals due to rounding.²*Includes white, swamp chestnut, bur, cherrybark, and Shumard oaks.

Table 17.—Average net annual growth and average annual removals of growing stock on timberland by ownership classes and by softwoods and hardwoods, Mississippi, 1977-1987¹

Ownership class	Net annual growth			Annual removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	----- Million cubic feet -----					
National forest	67.7	43.8	23.9	55.9	50.8	5.1
Other public	28.1	13.4	14.8	15.8	6.9	8.9
Forest industry	183.9	124.1	59.8	223.2	156.0	67.2
Farmer	233.5	115.4	118.1	168.5	108.2	60.3
Miscellaneous private	432.2	212.4	219.8	297.9	198.5	99.4
All ownerships	945.4	509.1	436.3	761.2	520.4	240.8

¹Rows and columns may not sum to totals due to rounding.

Table 1b—Average net annual growth and average annual removals of sawtimber on timberland by species, Mississippi, 1977-1987

Species	Growth	Removals
	----- Million board feet ² -----	
Yellow pines	2510.1	2,125.8
Cypress	6.2	17.9
Redcedar	7.2	2.9
Total softwoods	2,522.7	2,146.6
Select white-red oaks ³	341.7	168.5
Other white-red oaks	606.4	294.9
Hickory	101.3	59.5
Hard maple	1.2	0.6
Sweetgum	203.4	88.0
Tupelo and blackgum	49.2	36.3
Ash-walnut-black cherry	46.7	12.8
Yellow-poplar	125.8	60.5
Other hardwoods	190.6	92.2
Total hardwoods	1,666.3	813.3
All species	4,189.0	2,959.9

Columns may not sum to totals due to rounding.

²International 1/4-inch rule.

³Includes white, swamp chestnut, cherrybark, and Shumard oaks.

Table 19.—Average net annual growth and average annual removals of sawtimber on timberland by ownership classes and by softwoods and hardwoods, Mississippi, 1977-1987¹

Ownership class	Net annual growth			Annual removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	----- Million board feet ² -----					
National forest	321.8	243.3	78.5	271.0	256.5	14.5
Other public	160.6	87.6	73.0	64.9	32.7	32.2
Forest industry	740.1	525.8	214.3	836.8	605.1	231.7
Farmer	1,041.0	596.3	444.7	646.3	436.3	210.0
Miscellaneous private	1,925.4	1,069.7	855.7	1,140.9	816.0	324.9
All ownerships	4,189.0	2,522.7	1,666.3	2,959.9	2,146.6	813.3

¹Rows and columns may not sum to totals due to rounding.

²International 1/4-inch rule.

Table 20.—Average annual mortality of growing stock and sawtimber on timberland by species, Mississippi, 1977-1987¹

Species	Growing stock		Sawtimber	
	<i>Million cubic feet</i>		<i>Million board feet</i>	
Yellow pines	91.1		270.7	
Cypress	0.5		1.1	
Redcedar	0.7		1.3	
Other softwoods	0.8		0.9	
Total softwoods	93.1		273.9	
Select white-red oaks ³	6.6		18.0	
Other white-red oaks	22.5		58.3	
Hickory	5.0		21.5	
Sweetgum	12.8		32.9	
Tupelo and blackgum	3.0		9.4	
Ash-walnut-black cherry	3.0		6.7	
Yellow-poplar	1.2		5.7	
Other hardwoods	22.6		67.0	
Total hardwoods	76.7		219.5	
All species	169.8		493.4	

¹Columns may not sum to totals due to rounding.

²International 1/4-inch rule.

³Includes white, swamp chestnut, bur, cherrybark, and Shumard oaks.

Table 21.—Average annual mortality of growing stock and sawtimber on timberland by ownership classes and by softwoods and hardwoods, Mississippi, 1977-1987¹

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	<i>Million cubic feet</i>			<i>Million board feet²</i>		
National forest	18.7	12.9	5.8	76.8	58.5	18.3
Other public	12.2	4.8	7.4	43.4	18.0	25.4
Forest industry	27.2	16.2	11.1	71.4	36.1	35.4
Farmer	41.3	21.8	19.6	107.1	59.2	48.0
Miscellaneous private	70.4	37.4	33.0	194.6	102.2	92.4
All ownerships	169.8	93.1	76.7	493.4	273.9	219.5

¹Rows and columns may not sum to totals due to rounding.

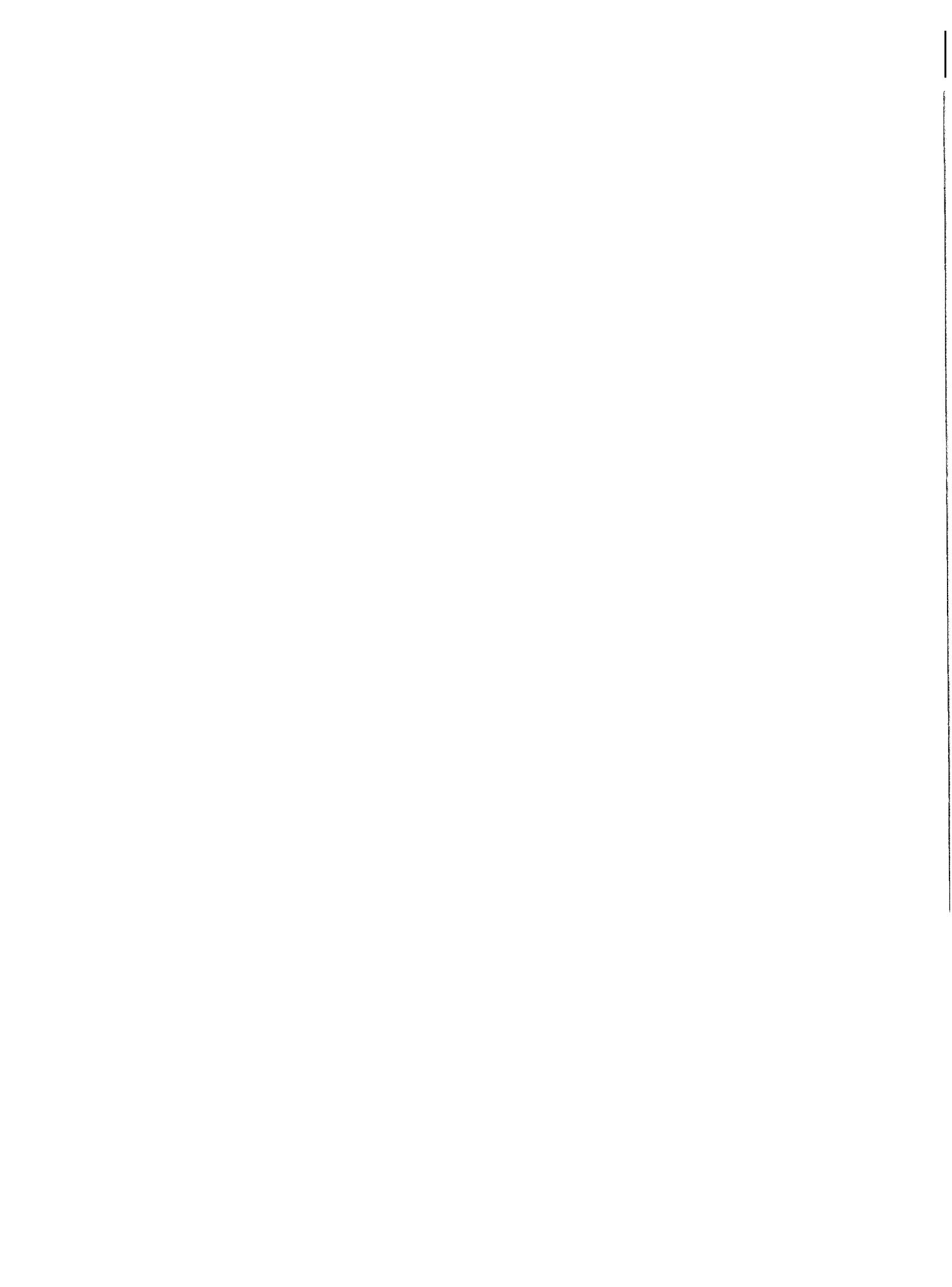
²International 1/4-inch rule.

Table 22.—Average annual mortality of growing stock and sawtimber on timberland by causes of death and by softwoods and hardwoods, Mississippi, 1977-87¹

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	<i>Million cubic feet</i>			<i>Million board feet²</i>		
Bark beetles	25.4	25.4	.....	99.8	99.8	.....
Other insects	0.2	0.2	.....	0.5	0.5	.....
Disease	88.8	39.3	49.5	249.0	108.6	140.5
Fire	2.8	1.4	1.4	4.9	3.2	1.7
Beaver	3.6	0.2	3.4	10.6	0.7	9.9
Other animals	0.2	0.1	0.1	0.7	0.7	.....
Weather	24.9	10.7	14.1	92.4	39.4	53.0
Hurricane	1.3	0.6	0.7	5.0	3.1	2.0
Suppression	12.9	9.9	3.1	4.8	4.4	0.4
Other	9.7	5.3	4.4	25.6	13.6	12.0
All causes	169.8	93.1	76.7	493.4	273.9	219.5

¹Rows and columns may not sum to totals due to rounding.

²International 1/4-inch rule.



Kelly, John F.; Sims, Mike. 1989. Forest resources of Mississippi. Resour. Bull. SO-147. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 63p.

The principal findings of the sixth forest survey of Mississippi (1987) and changes that have occurred since earlier surveys are presented in this report. Topics examined include the status and trends in forest area, timber volume, growth, removals, mortality, and timber product output.

Keywords: Biomass, forest inventory, timberland, timber supply, volume.