United States
Department of
Agriculture

Forest Service

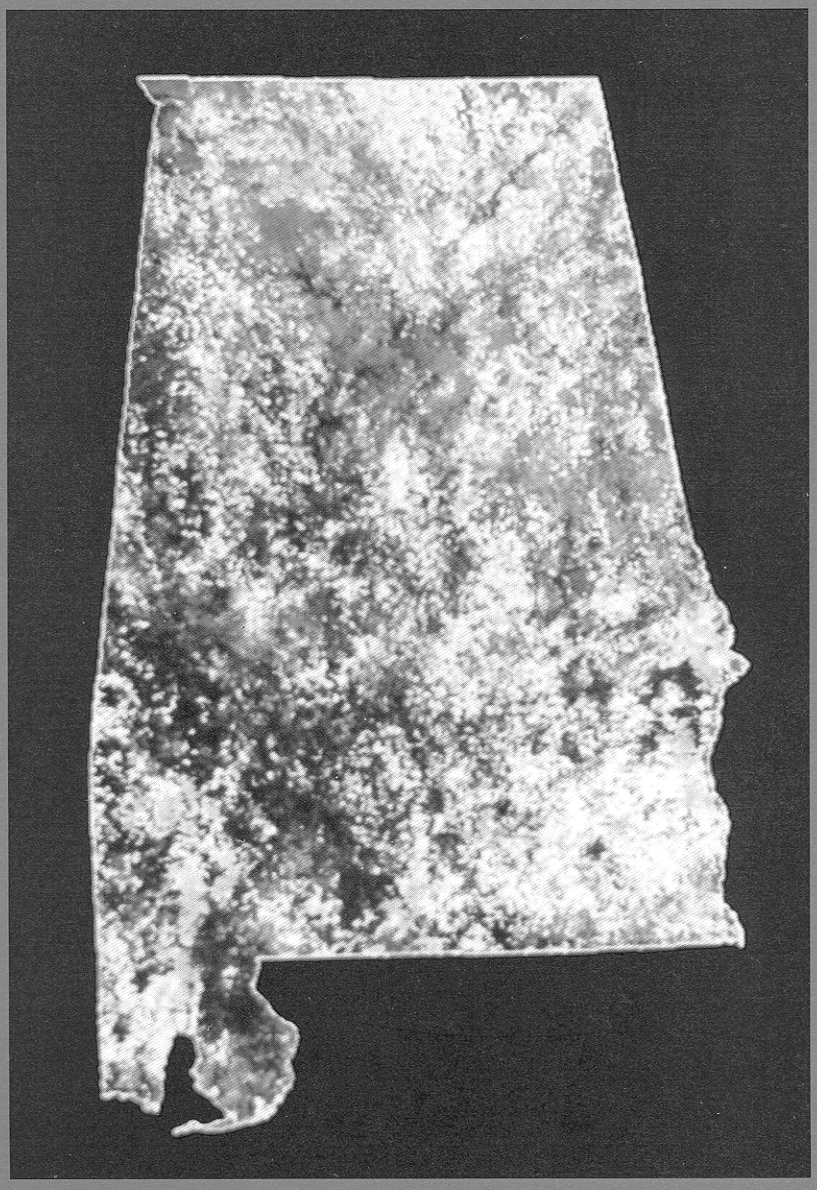
**Southern Forest
Experiment Station**

New Orleans,
Louisiana

Resource Bulletin
SO-170
October 1992

Forest Resources of Alabama

William H. McWilliams



FOREWORD

The USDA Forest Service, Southern Forest Experiment Station, Forest Inventory and Analysis Unit (SO-FIA) headquartered at Starkville, Mississippi, conducts forest inventories covering the States of Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas and the territory of Puerto Rico.

The SO-FIA mission is to develop, analyze, and maintain forest resource information essential for the formulation of forest policies and programs.

The SO-FIA forest inventories are part of a nationwide effort originally authorized by the McSweeney-McNary Act of 1928. More recent legislation pertinent to the SO-FIA mission includes the Forest and Rangeland Renewable Resources Planning Act of 1974, the National Forest Management Act of 1976, the Forest and Rangeland Renewable Resources Research Act of 1978, the Forest Ecosystems and Atmospheric Pollution Research Act of 1988, and the Forest Stewardship Act of 1990.

ACKNOWLEDGMENTS

The SO-FIA (Southern Forest Experiment Station, Forest Inventory and Analysis Unit) gratefully acknowledges the cooperation and excellent assistance provided by the Alabama Forestry Commission in collecting field data. Appreciation is also expressed for the cooperation of other public agencies, forest industries, and private landowners in providing access to measurement plots.

The following members of the SO-FIA field staff completed the field measurements:

Jeffrey Allen
Lief Anderson
Dave Berens
Steve Bergfield
Mark Burge
Thomas Carr
Robert Clement
Patrick Coddington
Susan Crouch
John Davis
Tim Eling
James Flue
Kenny Goins
Ron Gropp
Andy Hartsell
David Hattis
Mary Bergkamp-Hattis
Derrick Heckman
Laurie Hogeboom
Anthony Holland
Todd Hoopes
Leonard Jimmie
Lisa Kennedy
Tim Kennedy
Mike Ladd
Robert Lewis
Jack London
Larry Mahler
Brenda Miller
Patti Mitschke
Steve Overton
Mike Pond
Randy Prewitt
Lynn Rodrigue
Ray Rugg
Jeff Seefeldt
Brian Slagle
Tim Slone
Gary Sullivan
Royal Tyler
Val Urban
Julia Waller

Cover Photo: Advanced Very High Resolution Radiometer (AVHRR) image of Alabama.

CONTENTS

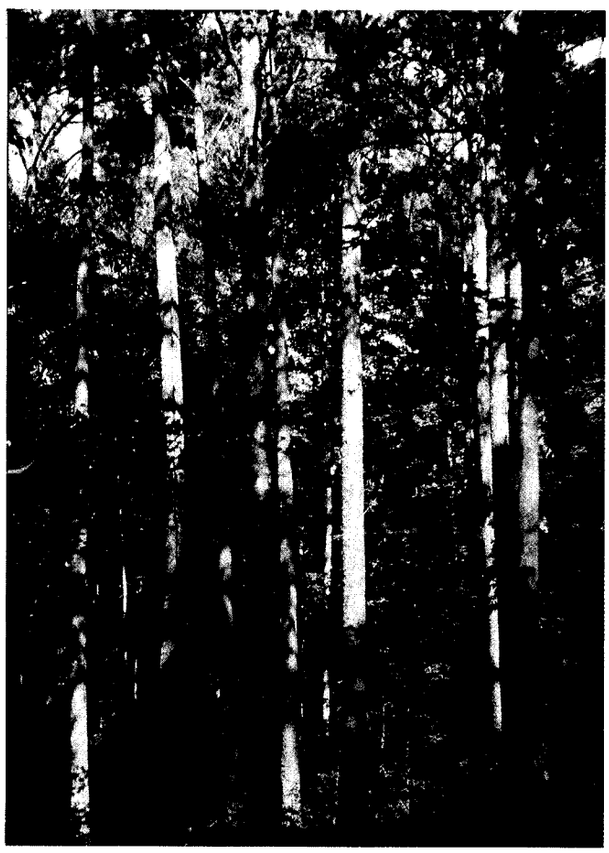
Forest Resources of Alabama

William H. McWilliams

HIGHLIGHTS

Some important findings of the most recent forest inventory of Alabama's forest resources follow:

- Alabama now has 21.9 million acres of timberland, more than ever recorded in the history of the USDA Forest Service inventories. The State's timberland base is the third largest in the Nation.
- The total area of timberland in pine and hardwood forest types in Alabama has not changed much since 1982, though changes in their makeup have been significant. Natural pine stands continued a long-term downward trend, decreasing by 25 percent. The shortleaf pine cover type experienced a 48-percent decrease. Planted pine stands increased by 81 percent and now comprise 46 percent of the pine-type timberland, or 3.4 million acres. An additional 1.0 million acres of planted pine stands are currently classified as oak-pine and hardwood forest types. The increase in planted pine stands was most dramatic on nonindustrial private land.
- Stand-table changes revealed some significant decreases in the number of trees in the 8- to 12-inch diameter classes for softwoods and in the 6-, 8-, and 12-inch range for hardwoods.
- Stocking improved as the area of timberland with full stocking increased by 21 percent, and the area of overstocked timberland decreased by 38 percent. Stocking improvements were most significant in hardwood stands of the Coastal Plain regions. Also, the area of hardwood stands dominated by cull trees decreased by 69 percent.
- Alabama's timberland supports 839.9 million tons of woody biomass (dry weight). Two-thirds of the biomass is hardwood and one-third is softwood. Total woody biomass has not changed since 1982. Loblolly pine is the dominant species in the State, with one-fifth of the total biomass.
- Live-tree inventory volume totals 24.7 billion cubic feet, a 5-percent increase. The current inventory volume is the highest ever reported.
- Inventory volume is 46 percent softwood and 54 percent hardwood. The volume of live softwoods decreased by 4 percent because the inventory includes extensive areas of premerchantable pine stands. The volume of live hardwoods increased by 14 percent due to large increases in the



Loblolly pine growing on a moist site.

William H. McWilliams is a research forester at Forest Inventory and Analysis Unit, U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, Radnor, PA 19087. Research and data compilation for this publication were done by the author while he was employed by the U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Starkville, MS 39759.

Opposite page: Lodge Falls at Desoto State Park (Alabama Department of Conservation and Natural Resources).

volume of trees 9.0 inches in diameter at breast height (d.b.h.) and larger. There was a large reduction in the volume of cull hardwoods in all diameter classes.

- For all species combined, net growth exceeds removals by 8 percent. Net growth and removals increased by 20 percent. The increase in net growth reversed the downward trend that developed between the 1972 and 1982 inventories.
- The net growth of softwoods increased by 2 percent, reversing the 17-percent decrease that occurred previously. After more than doubling between 1972 and 1982, softwood mortality remained level. Softwood removals increased by 13 percent and exceeded growth by 12 percent. Overcut conditions were most severe in central counties. The net growth of softwoods should increase further in the near-term future as premerchantable stands grow to merchantable size.
- The net growth of hardwoods increased by half and exceeded removals by 44 percent. Increased demand for hardwoods caused hardwood removals to increase by about one-third. The relationship between hardwood growth and removals was tight in counties adjacent to the Tennessee-Tombigbee Waterway. Hardwood mortality decreased by 10 percent.
- Harvest activity was evident on 29 percent of Alabama's timberland (6.4 million acres). Clearcuts comprised 45 percent of the harvest activity, and partial cuts were 55 percent. The area harvested on nonindustrial private land was up 36 percent.
- Industrial timber products output totaled 1.2 billion cubic feet in 1989. Pulpwood contributed over half of that total output. The softwood-to-hardwood mix used in the manufacture of pulp and paper was 59 to 41 in 1989, compared with 70 to 30 in 1982. Output of hardwood pulpwood increased by 41 percent.
- Changes in the character of Alabama's forests have accelerated over the past 8 years. Increases in softwood inventory have stalled during a period of conversion from older mature stands to young stands but will likely recover over the next 5 to 10 years. The degree of recovery will depend heavily on the amount of ingrowth from newly established pine stands and future trends in softwood removals. Hardwood inventory expanded as general improvements in the stocking of hardwood stands resulted from increased cutting. The hardwood situation bears close monitoring in the future because the resource is changing very rapidly. If there is a single development that underlies the findings of the 1990 forest inventory of Alabama, it is the willingness of nonindustrial private owners to take an active role in managing timberland to enhance output of forest-related resources.

INTRODUCTION

This bulletin provides an analysis of the sixth forest inventory of Alabama conducted by the USDA Forest Service, Southern Forest Experiment Station, Forest Inventory and Analysis Unit (SO-FIA). A brief analysis and tabular data have been published for each forest inventory region (McWilliams and others 1990a, 1990b, 1990c, 1990d, 1990e; McWilliams and others 1991) (fig. 1), and county-level statistics have been published for the State (Vissage and Miller 1991).

This analysis covers the current status of the State's forest resource and changes undergone since earlier inventories. The overall objective of the SO-FIA inventories has not changed since the process began back in the 1930's. Stated simply, the objective is to quantify, assess, and make conclusions about the State's forests by examining area, volume, growth, removals, and mortality so that policies can be formulated for effective use and conservation of the resource.

Some enhancements have been added to the analysis over time. For example, a stronger emphasis is now given to whole-forest conditions (not just the growing-stock portion) and biomass. Other changes include the ongoing evolution of SO-FIA definitions and procedures. For consistency, all comparisons with the results of the previous inventory undertaken in 1982 are based on recompiled data. Some of the recompilation of 1982 data was completed after the regional reports were published, and so analyses contained in this report supersede previous analyses of trends. Comparisons with results for inventories conducted prior to 1982 use data that have been adjusted to align with current standards as much as possible, though some inconsistencies persist. Such inconsistencies have either been avoided or noted where relevant.

CLIMATE, PHYSIOGRAPHY, AND SOILS

Physical and climatic factors underlie the ecology, productivity, and management of Alabama's forests. Alabama is characterized by variation in weather patterns and a diverse mix of physiography and soil types. A brief overview of the major elements that influence the development of forests in Alabama provides background for later discussion of current forest conditions, trends, and the impact of man-induced

Figure 1. — *Forest inventory regions of Alabama.*

change. For more indepth information, the reader is referred to the excellent works of Hodgkins and others (1976) and Zahner (1984) from which this section is abstracted.

Climate

With the exception of a thin band of land in southern Baldwin and Mobile counties with a subtropical climate, Alabama lies wholly within the warm-temperate zone. Climatic patterns are influenced by movement of tropical air masses originating over the Gulf of Mexico. The length of the growing season, or the frost-free period, averages about 8 months. The growing season is about 1 month shorter in the northern part of the State and more than a month longer in Mobile. One useful index of forest productivity is the amount of rainfall during the period of highest water deficit (usually from June to September). Summer rainfall increases significantly from north to south, averaging 8 inches more rainfall in the extreme south of the State than in the northwest (Zahner 1984). Although relatively infrequent, the effects of glaze storms, hurricanes, and drought impact forests in Alabama. During the 1980's, severe droughts played an important role.

Physiography and Soils

Eight major forest habitat regions of Alabama have been delineated by Hodgkins and others (1976), each with somewhat distinct physiography and soils (fig. 2). The most notable physiographic feature is the Fall Line that separates the Coastal Plain regions from the Limestone Plateau (Highland Rim), Cumberland Mountain Plateau, Great Appalachian Valley (Coosa Valley), Blue Ridge-Talladega Mountain, and Piedmont regions. Regions above the Fall Line contain diverse geologic formations, such as plateaus, bluffs, ridges, and valleys. Elevations in the two plateau regions average around 1,000 feet above sea level and reach as high as 1,800 feet. The highest elevation in the State is 2,400 feet atop Cheaha Mountain in the Blue Ridge-Talledega Mountain region, which has several mountains over 2,000 feet (Harper 1943).

Because of this diversity, soils and growing conditions vary widely. Soil parent material includes limestone, sandstone, shale, schist, chert, quartz, and granite. Site quality depends on soil depth, slope position, and aspect, with the best sites found on the lower slopes and in the valleys. Pines and hardwoods are found in pure and mixed stands. Hardwoods are more common to the north, especially north of the Tennessee River. Pines occur more frequently and with better development to the south where sites with more favorable soils, more rainfall, and longer frost-free periods are more common.

Alabama's Coastal Plain consists of the Hilly Coastal Plain, Middle Coastal Plain, and Flatlands Coastal Plain. The Coastal Plain stretches as far north as the Tennessee border but lies mostly to the south of 34° N. latitude. This area covers the West-Central, Southwest-North, Southwest-South, and Southeast forest inventory regions. The Hilly Coastal Plain includes some rugged terrain to the north; however, most of the region consists of moderate hills. A range from loamy sand to clay loam soils that are acidic is common with medium to very high site quality for pines, depending on topsoil depth and topographic position.

The Black Belt is an east-west belt through the middle of the Hilly Coastal Plain. This subsection has alkaline soils formed from chalk deposits, which are mostly unproductive for vigorous tree growth. To the north of the Black Belt, pines and hardwoods are found in varying concentrations, with pine more frequent to the south.

To the south of the Black Belt are the Southern Red Hills (Braun 1950), where pine stands become increasingly common. Site productivity ranges from medium to excellent for pine and from poor to good for hardwoods. The best sites for hardwood development occur on alluvial soils found along the many rivers and streams of the region.

The Middle Coastal Plain lies to the south of the Hilly Coastal Plain. The topography consists of rolling hills and less relief than the Hilly Coastal Plain. Soils typically contain more sand and/or loam. A major feature of the region is the concentration of highly productive hardwood sites on alluvial soils of the Mobile River Basin. The eastern part of the region consists of the Wiregrass Plains subsection. To the south of the Middle Coastal Plain is a small band of Flatlands Coastal Plain that supports forests only on the drier sites.

PAST FOREST INVENTORIES

The Forest Service initiated a comprehensive forest inventory program in the South in 1931 (Eldredge 1934). The first inventory of Alabama's forests was completed in 1936 (Cruikshank 1940a, 1940b; Eldredge 1938; Spillers 1939, 1940). At that time, second growth forests were well advanced, making up 84 percent of the State's timberland (table I). Roughly half of the second growth timberland was estimated to be of sawlog size (based on different criteria than the current definition). Only 2.5 million acres of "old growth" acreage was left, and most of it had undergone some cutting activity. Analysts raised several issues pertaining to forest conditions and made recommendations for action. There was alarm over poor stocking evident on much of the timberland and the impact this was having on growth. It was recognized

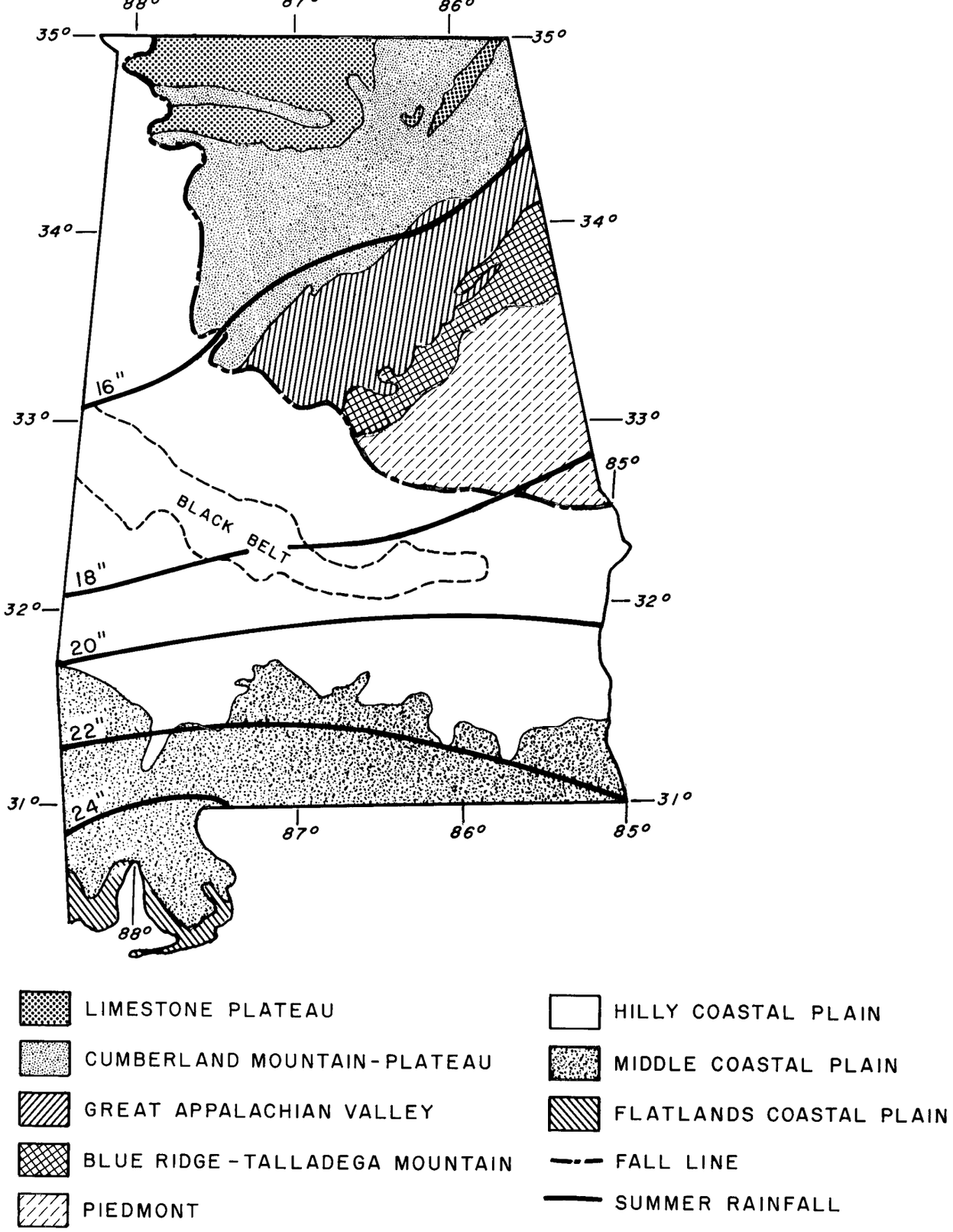


Figure 2. — *Forest habitat regions and summer rainfall of Alabama (source: Hodgkins and others 1976, Zahner 1984).*

Table I. — *Area of timberland classified according to forest condition, Alabama, 1936 (source: Eldredge 1938; Spillers 1939, 1940; Cruikshank 1940a, 1940b)*

Forest condition	Area	Proportion
	Thousand acres	*Percent*
Old growth		
Uncut	783.7	4
Partly cut	1,713.9	9
Total	2,497.6	13
Second growth		
Sawlog size		
Uncut	5,034.9	27
Partly cut	2,641.3	14
Under sawlog size	7,336.9	39
Reproduction	864.3	5
Total	15,877.4	84
Clearcut	485.4	3
Total	18,860.4	100

that poor harvest practices were taking a toll due to removal of only the best trees or the removal of all merchantable pine from mixed species stands. On clearcut acreage, there was often inadequate regeneration. The analysis stated that planting could help offset poor pine regeneration in southwest Alabama. The main suggestions were to begin widespread adoption of sound forest management practices and extend the existing fire control program to cover the entire State.

The second forest inventory of Alabama was dated 1951-53 (Wheeler 1953). The results showed that total timberland area had increased by 10 percent. Abandonment of agricultural land was cited as the source of new timberland. Just over half of the timberland was found to be poletimber size, but overall stocking had improved significantly. Sixty-three percent of the timberland was well stocked with trees, and an additional 28 percent was medium stocked. A negative trend in softwood growing-stock and sawtimber inventory volumes emerged in all regions except southwest Alabama, which showed increases. There was a real concern about depletion of pine trees 10.0 inches in diameter at breast height and larger in all but southwest Alabama. Softwood sawlogs were in great demand, representing 39 percent of timber removals.

The forest inventory of 1963 uncovered some very important changes in the State's forest resource (Sternitzke 1963). The area of timberland continued to increase due to natural seeding following farmland abandonment and planting of idle cropland under the Federal Soil Bank Program. There was also a considerable increase in industry-owned timberland as pulp and paper companies expanded their woodland operations. Pulp and paper production was increasing steadily, and pulp and paper had become the dominant product being cut. The previous downturn in softwood inventory completely reversed as vast areas of pine stands were maturing. Softwood growing-stock volume increased by 28 percent. Though probably not entirely compatible, comparison of published softwood growth estimates indicates a 46-percent increase had occurred between the 1951–53 and 1963 inventories. Also, the growth of softwood growing stock exceeded removals by a factor of two. On the negative side, hardwood growing-stock volume changed very little, hardwood sawtimber volume decreased, and hardwood quality was declining.

The inventory completed in 1972 reported more changes in Alabama's forests (Murphy 1973). Past increases in timberland abated as the total area decreased slightly (by 2 percent). Agriculture was reclaiming timberland, mainly for use as pasture. The productive capacity of the State's pulp and paper industry more than doubled during the interim since the previous inventory. This led to a 70-percent increase in removals of softwood growing stock. The net growth of softwood growing stock also increased and was reported to exceed removals by 50 percent. The margin of softwood growth over removals had tightened. The hardwood resource showed improvement. The growth of hardwood growing stock increased by about three-fourths over the 1963 level, and hardwood removals were static, causing a net increase in hardwood inventory volume of 15 percent. In spite of these positive trends, the analysis mentioned some resource problems. Ten million acres capable of growing pines were found to support pure or mixed hardwood stands. Removal of hardwood cull trees was being recommended to boost the stocking of quality hardwood trees. Also, hardwood sawtimber growth was equal to removals.

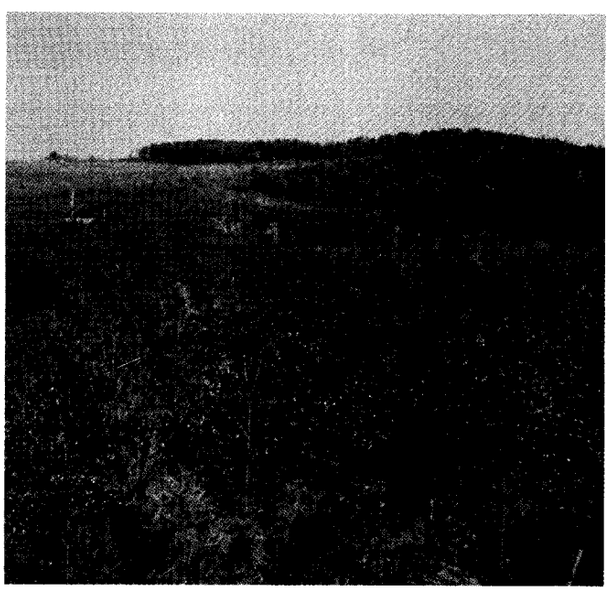
The 1982 forest inventory represented a turning point in the recent history of Alabama's forests. The most important findings pertained to softwood growth and removals. The net growth of softwood growing stock was found to be equal to removals, and softwood growth had decreased (Rudis and others 1984). These were baffling phenomena for analysts that were accustomed to the sharp increases of the past, despite an earlier report by Beltz (1975) that suggested an equilibrium between growth and removals was approaching. The analysis stated that the cause of decreased growth was indeterminate, though climate changes, acid rain, and stand aging were said to be possible explanations. Of the three, stand aging was a definite factor and had been supported by findings of decreases in the number of small trees, increased mortality, and increased cull volume. The effects of climate and acid rain are still not fully understood.

The major cause of decreased growth, which wasn't mentioned, was the impact of man-induced change. Large areas of mature pine stands were being harvested, and forest management had begun to intensify. As older stands with high levels of growth per acre were replaced with young stands with no merchantable growth, softwood growth declined. Poor regeneration following harvest on nonindustrial private land was another factor (McWilliams and Birdsey 1984) and was in part responsible for the 8-percent decrease in the area of pine stands.

The growth of hardwood growing stock also decreased, but there was little change in removals. Hardwood growth exceeded removals by a considerable margin, causing inventory to increase. These and other trends are examined in more detail in the following sections.

FOREST AREA

Forests cover 22.0 million acres or two-thirds of the total land area of Alabama (appendix table 1). All of the forested acreage is classified as able to grow commercial crops of timber. A small area, 32,600 acres, has been withdrawn from timber utilization as reserved forest in the William B. Bankhead and Talledega National Forests. Most of Alabama's counties are at least 50 percent forested (fig. 3). High concentrations of forest are found in northwestern, east-central, and southwestern counties.



Intensive pine management landscape.

Land-Use Change

The area of timberland (commercial forest not withdrawn from utilization) has remained stable in recent decades (fig. 4). Alabama's 21.9 million acres of timberland is more than the State has had in the history of the SO-FIA inventories, even though the area of timberland has increased by only 1 percent since 1982. The current timberland base ranks third in the Nation, behind Georgia (23.6 million acres) and Oregon (22.0 million acres). The Southwest-South, North-Central, and North inventory regions had less timberland than before, each with 4-percent decreases. Only 15 of Alabama's 67 counties had more than a 5-percent loss of timberland (fig. 5). Timberland losses were most apparent around Huntsville, Birmingham, and Mobile.

Change in the area of timberland is the net difference between additions from and diversions to other land uses. A total of 1.8 million acres of timber-

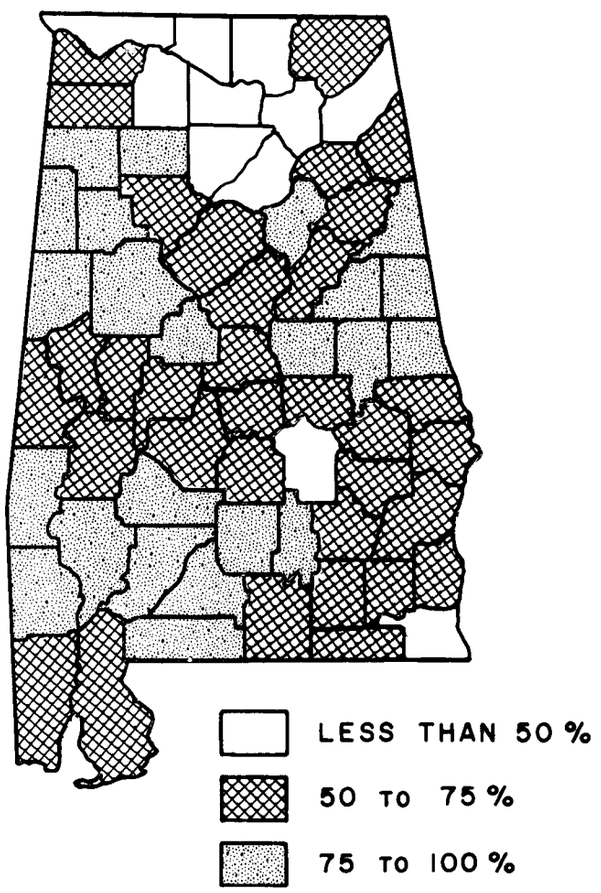


Figure 3. — *Proportion of land area in forest, Alabama, 1990.*

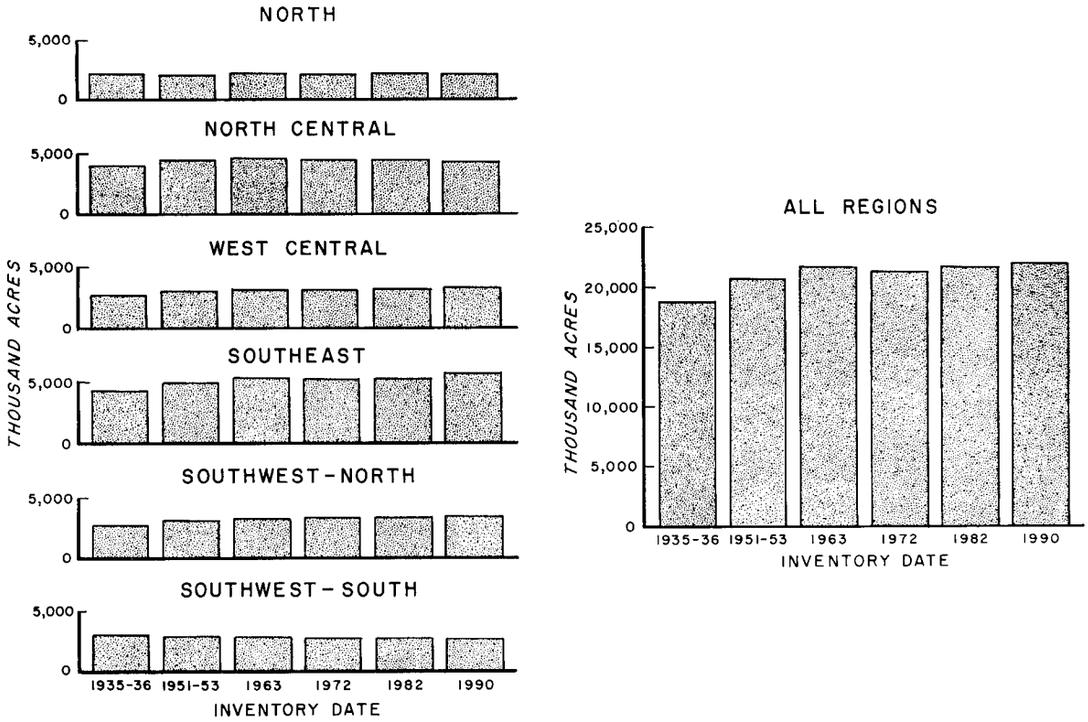


Figure 4. — *Area of timberland by region and inventory date, Alabama, 1935–36 to 1990.*

land changed land use over the past 8 years (table II). Diversions from timberland to nontimberland affected 778,500 acres. Sixty-one percent of the diverted timberland shifted to urban, suburban, and other miscellaneous land uses. Diversions were offset by 1.1 million acres that reverted to timberland. Nine out of 10 acres of this timberland were previously used for agricultural purposes, such as pasture and cropland.

Ownership

Private owners clearly dominate timberland ownership, with 95 percent of Alabama's timberland. The largest share of timberland, 73 percent or 16.0 million acres, is in the hands of nonindustrial private owners. This ownership category is composed of farmers, corporations (other than forest industry), and miscellaneous individuals. Each of these classifications includes a diverse group of owners. Miscellaneous individuals control most of the nonindustrial timberland in Alabama, with 58 percent (9.2 million acres). This group includes a wide variety of interests—from purely economic to esthetic. The area of timberland owned by miscellaneous individuals increased by 10 percent over the past 8 years. Farmers include any owner with at least 10 acres of land that earns a minimum of $1,000 from the sale of agricultural products. Farmers own 31 percent of the nonindustrial private timberland (5.0 million acres). The area of farmer-owned timberland decreased by 15 percent. Corporate owners range from professional woodland management companies to firms that hold timberland but have no timber management goals. Corporate owners have 11 percent of the nonindustrial timberland, about the same as in 1982 (1.8 million acres). Nonindustrial timberland is common throughout the State, with relatively high concentrations in northern and eastern counties (fig. 6). The total area of nonindustrial private timberland did not change significantly since the previous inventory. The estimate of nonindustrial private timberland includes 704,600 acres of timberland under lease to forest industry.

Forest industries own 22 percent of Alabama's timberland, or 4.8 million acres. As used here, the term forest industries includes companies or individuals that operate either primary or secondary wood-using plants. Forest industry timberland is concentrated on the more productive sites found in southwest Alabama. There was a 7-percent increase in the area of forest industry timberland.

Public owners have only 5 percent of the timberland base (1.2 million acres) but are major suppliers of timber in some local areas and provide a wealth of nontimber forest resources. Over half of the public tim-

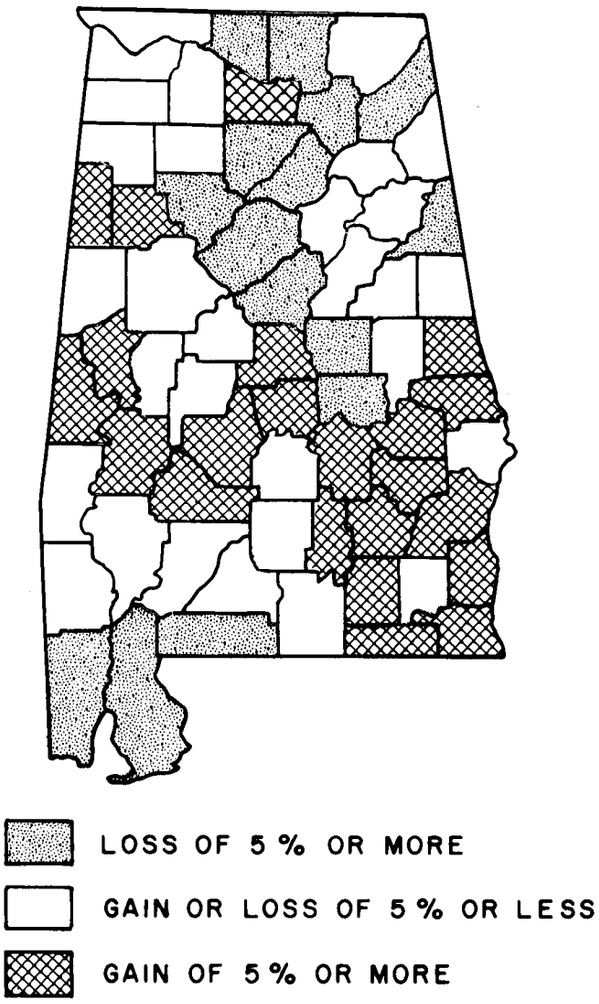


Figure 5. — *Changes in area of timberland by county, Alabama, 1982 to 1990.*

berland is located in Alabama's four national forests. The remaining public timberland is owned by the State, counties, and municipalities.

Forest Type

The SO-FIA categorizes timberland as pine or hardwood forest types using the relative stocking of dominant and codominant sample trees. A stocking percent is assigned to individual trees according to d.b.h. (see Definition of Terms section in appendix). The forest-type group assignment is based on species composition. For example, a plot where hardwoods, which are mostly oaks and hickories, contribute half or more of the stocking is classified as oak-hickory. An exception is the oak-pine type that includes plots where hardwoods contribute at least half of the stocking but are at least 25 percent stocked with pine.

The physiography and hydrology (upland or bottomland) of the area surrounding the plot is another consideration in assigning hardwood forest types. Plots located on bottomland sites are classified as one of two bottomland hardwood types: oak–gum–cypress or elm–ash–cottonwood. So, changes in the area of a particular forest type depend on natural and man-induced changes in the forest canopy, such as succession, insect outbreaks, and partial harvests, as well as the net effect of shifts to and from nonforest land uses.

Alabama's timberland is 34 percent pine, 21 percent oak-pine, 35 percent oak-hickory, and 10 percent bottomland hardwood (fig. 7). Hardwood forest types account for the largest share of the timberland base in all of the inventory regions. Pine-type timberland is most prevalent in the Coastal Plain inventory regions, especially the Southwest-South and Southwest-North regions. Bottomland hardwood timberland is also more concentrated in the Coastal Plain regions.

Table II. — *Changes in timberland by region, Alabama, 1982 to 1990*

Region	All land*	Timberland	Net change	Additions			Diversions		
				Total	Agriculture	Other†	Total	Agriculture	Other†
	Thousand acres								
Southwest–South	3,774.1	2,741.0	–117.2	26.0	21.8	4.2	143.2	...	143.2
Southwest–North	4,342.4	3,463.4	+80.9	147.9	126.2	21.7	67.0	33.5	33.5
Southeast	9,007.5	5,919.0	+503.2	617.6	577.6	40.0	114.4	52.0	62.4
West Central	4,376.8	3,357.5	+85.4	151.3	126.1	25.2	65.9	13.2	52.7
North Central	6,547.6	4,346.0	–196.6	92.8	69.6	23.2	289.4	136.7	152.7
North	4,442.9	2,105.1	–82.6	16.0	12.0	4.0	98.6	68.3	30.3
All regions	32,491.3	21,932.0	+273.1	1,051.6	933.3	118.3	778.5	303.7	474.8

*United States Bureau of the Census.
†Includes urban, industrial, highway, noncommercial forest, water, rights-of-way, and other land uses.

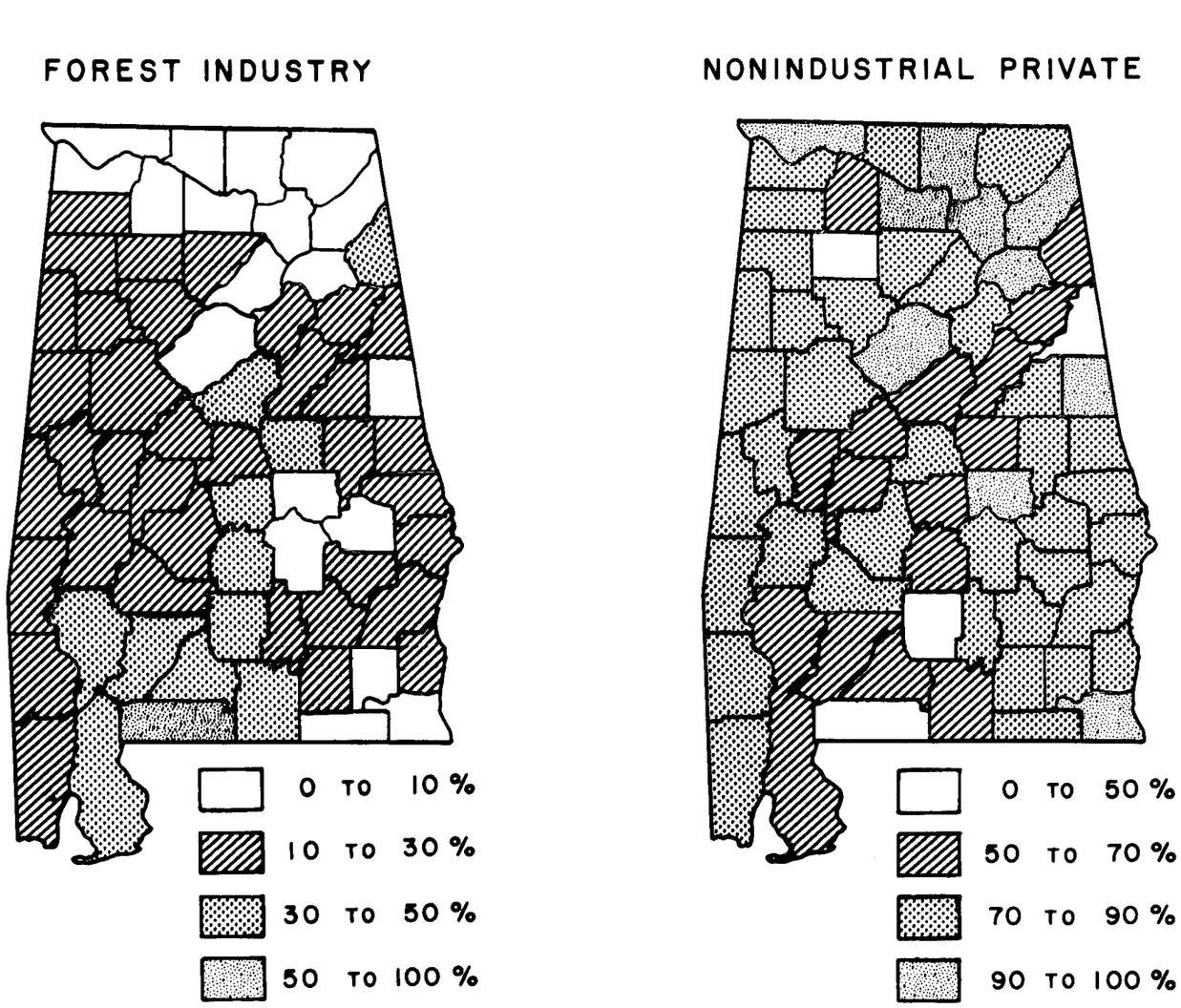


Figure 6. — *Proportion of timberland held by forest industry and nonindustrial private landowners, 1990.*

Pine-type timberland includes the longleaf–slash and loblolly–shortleaf pine forest types. Overall, the area of pine-type timberland increased by 3 percent and now totals 7.5 million acres. Decreases in the area of pine stands in the Southwest-South, North-Central, and North inventory regions were offset by increases in the other regions.

Longleaf–slash pine stands comprise 16 percent of the pine-type timberland (1.2 million acres). Longleaf and slash pine (see Species List in appendix for common and scientific names) dominate the composition of this forest type (fig. 8). The area of longleaf-slash pine decreased by 16 percent (table III), continuing a long-term downward trend. Still, the type remains the most prevalent forest type in the Southwest-South region.

Longleaf–slash forests are separated into the longleaf pine cover type (pine stands dominated by longleaf) and the slash pine cover type (pine stands dominated by slash pine). Forty-five percent of the longleaf-slash timberland is longleaf pine, and 55 percent is slash pine. Both of these cover types have decreased in area since 1982. Losses averaged 19,200 acres per year for the longleaf type and 8,000 acres per year for the slash pine type. Comparison with the 1951–53 inventory information indicates there was roughly twice the area in these types at that time. Emphasis on the economic and biological benefits of longleaf pine management have contributed to a slower rate of decrease in longleaf stands in recent decades (Farrar 1990).

Loblolly–shortleaf pine is by far the most common pine forest type in Alabama, making up 84 percent of the State's pine-type timberland (6.3 million acres). The area of loblolly–shortleaf stands increased by 8 percent. This contrasts to an 11-percent decrease that

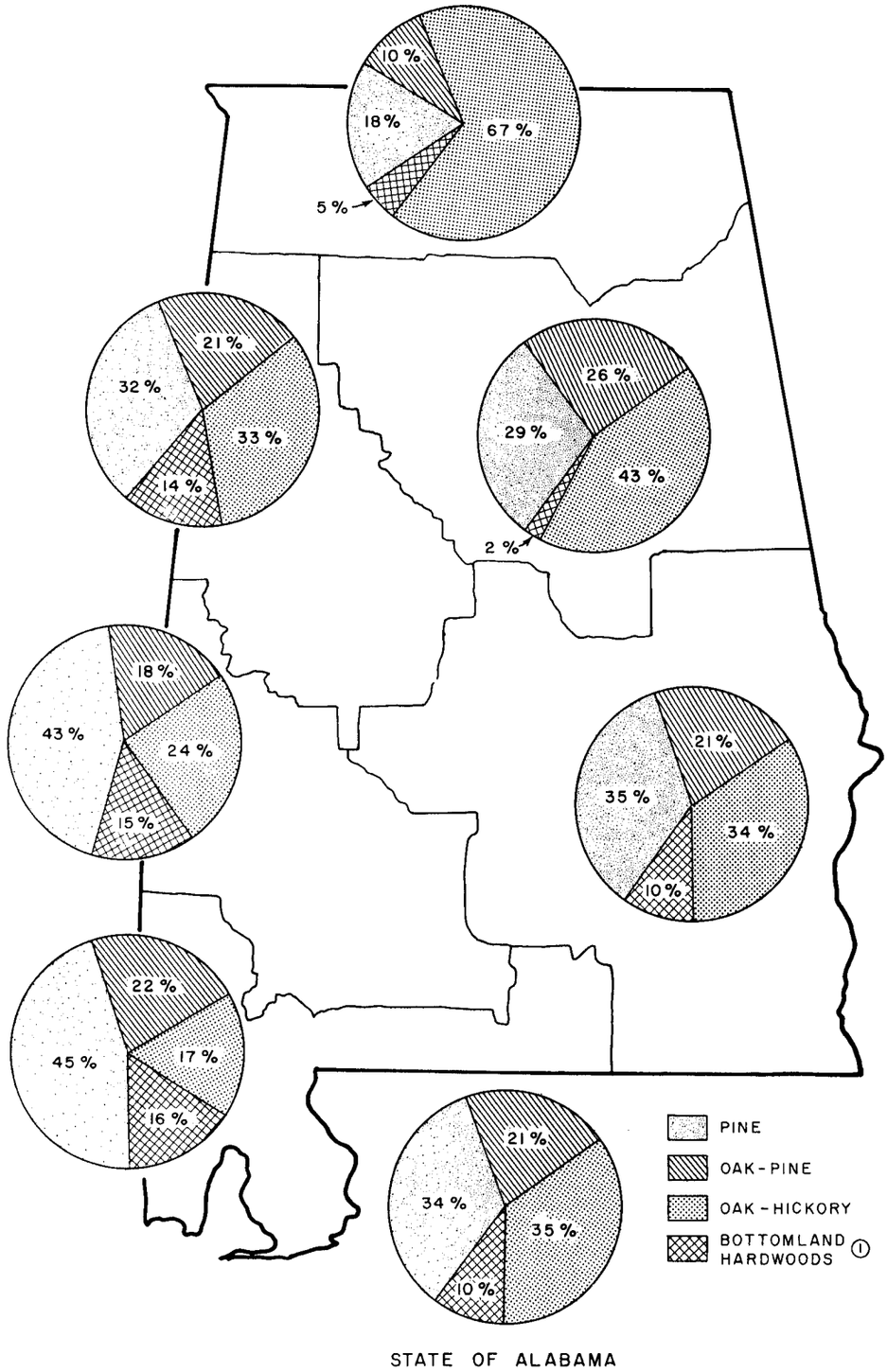


Figure 7. — *Proportion of timberland by forest type and region, Alabama, 1990 (excludes nontyped timberland).*

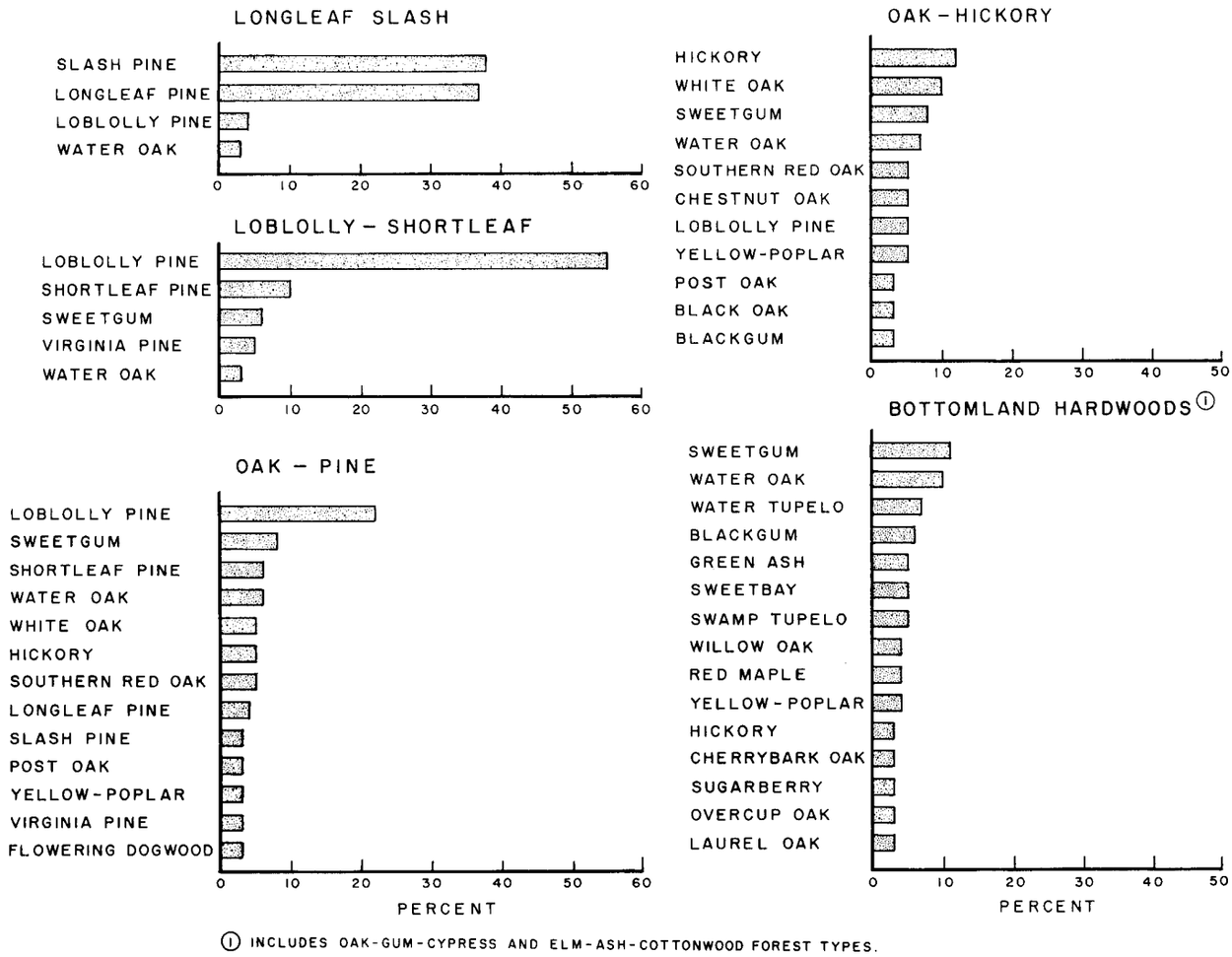


Figure 8. — *Relative species importance by forest type. The importance value is total dry weight of live-tree woody biomass (for trees greater than 1.0 inch in d.b.h.), and species with less than 3 percent of total biomass are excluded.*

took place between 1972 and 1982. The current acreage of loblolly–shortleaf is still less than was inventoried in 1972 (6.5 million acres) and in previous inventories.

The loblolly–shortleaf pine forest type is composed of a number of specific cover types, including loblolly pine, shortleaf pine, Virginia pine, sand pine, redcedar, and spruce pine. The loblolly pine and shortleaf pine cover types make up 92 percent of the timberland classified as loblolly–shortleaf. A preference for loblolly in new stand establishment by forest managers in Alabama has caused changes in the relative abundance of loblolly and shortleaf stands.

Year	Loblolly pine	Shortleaf pine
	Thousand acres	
1972	4,277.1	1,729.6
1982	4,378.8	905.6
1990	5,284.1	467.0

As shown, shortleaf pine stands have decreased by 73 percent over the past 18 years.

Loblolly pine contributes 55 percent of the woody biomass of the loblolly–shortleaf forest type. Shortleaf is the second most important species with 10 percent, followed by sweetgum (6 percent), Virginia pine (5 percent), and water oak (3 percent).

The oak–pine forest type totals 4.5 million acres and increased by a minor 2 percent. Loblolly pine is the most abundant species in oak-pine stands. The term "oak–pine" is somewhat misleading because the stocking of all hardwood species is used to determine forest type. Sweetgum is the most important hardwood species of the type. Water oak, white oak, and southern red oak are the most common oaks. Hickory and yellow-poplar are other important hardwood species.

Oak–hickory forests cover 7.7 million acres of Alabama timberland. Composition includes a mix of species; hickory, white oak, sweetgum, and water oak being the most common. The area of oak–hickory tim-

Table III.—*Area of timberland and percent change by ownership and forest type, Alabama, 1990**

Ownership	Pine				Upland hardwood				Bottomland hardwoods				Nontyped	
	Longleaf–slash		Loblolly–shortleaf		Oak–pine		Oak–hickory		Oak–gum–cypress		Elm–ash–cottonwood			
	Thousand acres	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*
Public†	132.7	−3	199.7	−21	361.4	+13	381.5	+11	81.3	−26	...	...	...	...
Forest industry	428.2	−19	1,981.7	+30	956.9	+7	946.7	−9	469.5	+1	6.3	(¶)	5.7	(¶)
Nonindustrial private‡	636.4	−17	4,078.5	+1	3,203.4	(§)	6,333.1	+4	1,708.1	−9	10.0	−71	5.4	(¶)
All owners	1,197.4	−16	6,259.9	+8	4,521.8	+2	7,661.4	+3	2,258.9	−8	16.3	−59	11.1	−74

*Rows and columns may not sum to totals due to rounding.
†Excludes 5.2 thousand acres of white-red-jack pine forest type.
‡Includes timberland leased to forest industry.
§Less than 1 percent.
¶Change is based on one plot only.

berland increased by 3 percent. This minor change masks considerable shifting that occurred between oak–hickory and other forest types. For example, 30 percent of the current oak–hickory forest came from other forest types, and 26 percent of the oak–hickory forest in 1982 shifted to other forest types. These shifts often occur where intensive pine management is practiced (whether it involves natural or artificial management) and where extensive harvesting has taken place. Changes in the relative stocking of pine and hardwoods in young recently harvested stands cause forest type classification to adjust to changing conditions over time. A typical situation involves young pine stands that are classified as oak–hickory because hardwood seedlings and saplings temporarily overtop newly established pines. As pines grow to a dominant canopy position, the classification changes to pine or oak–pine. In this case, there is an initial shift toward oak–hickory and then a shift toward pine or oak–pine.

Bottomland hardwood forests are found on 2.3 million acres of Alabama timberland. Nearly all of this acreage is oak–gum–cypress timberland. Bottomland hardwoods contain the richest diversity of species of all the SO-FIA forest types. The most common species are sweetgum (11 percent of the woody biomass), water oak (10 percent), water tupelo (7 percent), blackgum (6 percent), green ash (5 percent), sweetbay (5 percent), and swamp tupelo (5 percent). The area of bottomland hardwood timberland decreased by 9 percent since the previous inventory, an average of 27,100 acres a year. Half of the loss occurred in the Southwest–South and Southwest–North inventory regions.

Plantations

Establishment of planted pine stands over large areas of the State has been the most consequential development to impact Alabama's forest over the past 35 years. Pine plantation establishment began in earnest in the 1950's. Three distinct phases are apparent when examining Forest Service historical planting records (USDA FS 1955–90): from 1955–65, 1966–78, 1979–89 (fig. 9).

During the first phase, most of the planting in the State was done on nonindustrial private land as part of the Federal Soil Bank Program (1956–63). The trend of this phase may be described as a spike that peaked in 1959, when 156,200 acres were planted on nonindustrial land. Planting began to expand on forest industry land during the late 1950's.

The second phase of planting was characterized by a buildup of planted acreage on forest industry land. Planting on industry land tripled between 1966 and 1971 and then was steady until the end of the period.

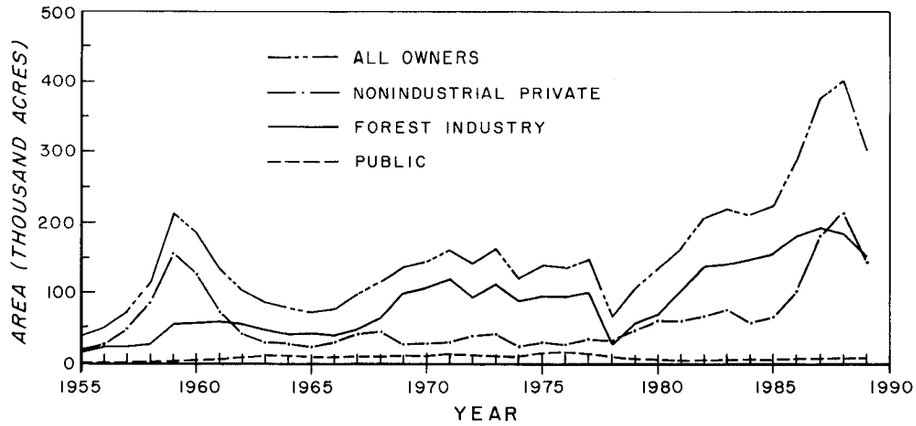


Figure 9. —*Area of forest planting by ownership, 1955 to 1989 (source: USDA FS 1956 to 1990).*

Planting on nonindustrial land was relatively low but steady in this phase. Industry planting averaged 83,400 acres per year for the period, compared to 38,600 acres per year for nonindustrial owners.

In the third phase, the most extensive planting in the history of Alabama's forests transpired. On forest industry land, planting increased rapidly and peaked at 192,000 acres in 1987. Planting on nonindustrial land expanded shortly after Congress approved the Forestry Incentives Program in 1974. Nonindustrial planting then shot upward in 1986. That year coincided with the beginning of the Conservation Reserve Program (CRP), which was part of the 1985 Federal Farm Bill.

Conservation Reserve Program planting, however, has not been the sole impetus for the rise in planting. For the years 1986 through 1989, 637,200 acres were planted on nonindustrial private land. To put the CRP into perspective, the acreage contracted through the ninth signup in 1989 was 278,500 acres. It should be recognized that contract acres do not yet equate to an equivalent area of planted pine timberland because some planting land has failed due to drought or other factors, and some is temporarily dominated by hardwood species. So, even an optimistic estimate would not put the CRP's contribution much above one-third of the increase in nonindustrial planted pine recorded in the latest inventory. (The increase in planted pine acreage was 814,400 acres.)

The most important factor in the increase in nonindustrial planted pine stands has been an expansion in harvesting and regeneration. This took place as demand for softwoods shifted from industrial to nonindustrial timberland. For both ownerships combined, planting reached a historical peak in 1988 when 403,400 acres were planted.

The impact of increased planting over the past two inventory periods is illustrated in figures 10 and 11. The current acreage of planted pine is 3.4 million acres, an 81-percent increase since 1982. There are an additional 1.0 million acres with evidence of artificial origin (including direct seeding) that are classified as hardwood forest types due to the stocking of hardwoods (table IV). The rate of increase in planted pine timberland tripled between the two most recent inventory periods, averaging 61,700 acres per year from 1972 to 1982, compared to 184,700 acres per year from 1982 to 1990. (These planting rates are based on the area planted and classified as pine forest types according to SO-FIA guidelines.)

Planted stands are now 46 percent of Alabama's pine-type timberland. The area of planted pine timberland increased by 80 and 84 percent for forest industry and nonindustrial owners, respectively. The increase on industry timberland continues the trend that developed between the 1972 and 1982 inventories. Forest industry's planted-pine stands total 1.5 million acres and are 64 percent of their pine-type timberland (up from 22 percent in 1972). The dramatic increase in planted pine stands for nonindustrial private owners reverses the more sluggish expansion that took place between 1972 and 1982. This development counters a common perception within the forestry community that nonindustrial owners aren't willing to invest in forest management. Nonindustrial planted pine stands total 1.8 million acres and are 39 percent of the nonindustrial pine-type timberland in Alabama (up from 15 percent in 1972). Increases for nonindustrial owners have been apparent in the Southwest-North and West-Central inventory regions.

It is important to put the expansion of planted pine stands into proper perspective. Natural pine stands have been the mainstay of Alabama's forest resources throughout history and continue to be so today, despite the recent 25-percent decrease in area. Stands

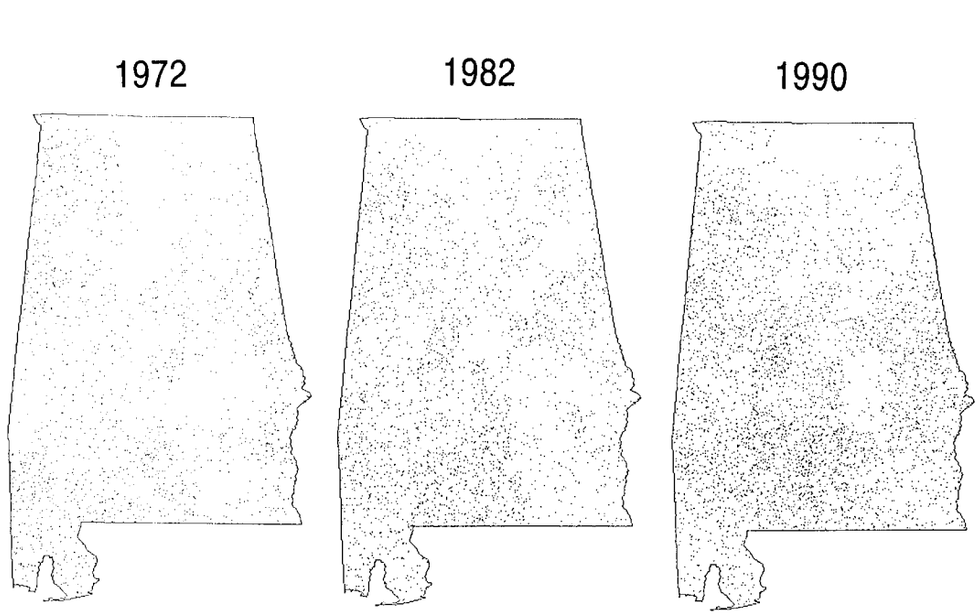


Figure 10. — *Area of timberland with evidence of planting or direct seeding, Alabama, 1972, 1982, and 1990. Each dot represents 1,000 acres.*

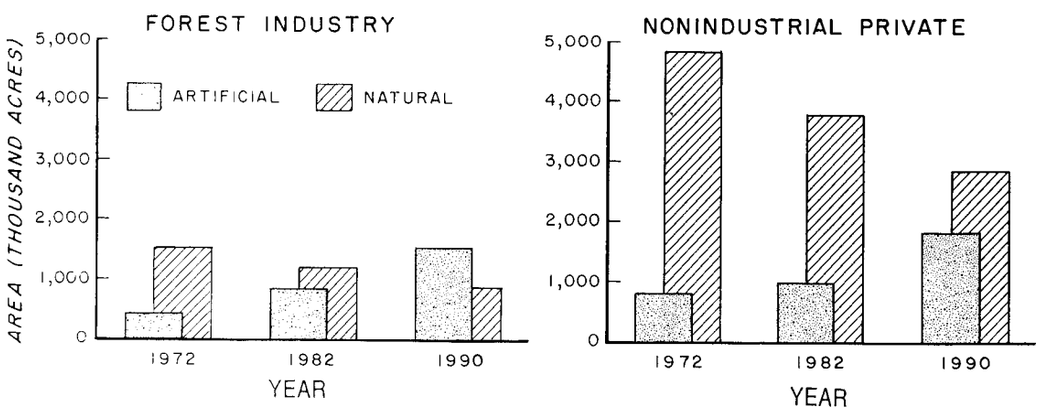


Figure 11. — *Area of privately owned pine-type timberland by ownership, stand origin, and inventory date, Alabama, 1972 to 1990.*

Table IV. —*Area of timberland with evidence of artificial origin by ownership and forest type, Alabama, 1990**

Ownership	All types	Longleaf–slash	Loblolly–shortleaf	Oak–pine	Oak–hickory	Bottomland hardwoods†
	Thousand acres					
Public	70.3	15.3	26.1	17.2	11.7	...
Forest industry	1,969.7	195.3	1,349.4	296.7	122.3	6.0
Nonindustrial private‡	2,365.8	231.6	1,614.6	292.7	221.2	5.7
All owners	4,405.8	442.2	2,990.1	606.6	355.2	11.7

*Excludes 5.2 thousand acres of white–red–jack pine forest type.
†Includes oak–gum–cypress and elm–ash–cottonwood forest types.
‡Includes timberland leased to forest industry.

Table V. — *Area of timberland and percent change by ownership and stand-size class, Alabama, 1982 to 1990**

Ownership	Sapling-seedling		Poletimber		Sawtimber		Nonstocked[†]	
	Thousand acres	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*	*Thousand acres*	*Percent change*
Public	261.4	–9	268.9	–13	631.8	+12	...	...
Forest industry	2,013.7	+10	1,351.3	+15	1,414.1	–2	15.7	([§])
Nonindustrial private[‡]	6,060.9	+10	4,292.2	–12	5,593.5	([¶])	28.4	–60
All owners	8,336.0	+10	5,912.5	–7	7,639.4	+1	44.1	–53

*Rows and columns may not sum to totals due to rounding.
[†]Less than 16.7 percent stocked with live trees.
[‡]Includes timberland leased to forest industry.
[§]Change is based on one plot only.
[¶]Change is less than 1 percent.

of natural origin account for 78 percent of the State's softwood inventory volume. Across all forest types, planted pine stands are only 16 percent of the timberland base. Moreover, natural stand management is a very important forest management tool, particularly for the nonindustrial private owner. In many cases, it is the only viable option for establishing and maintaining forest cover. Also, research has shown that natural regeneration yields a higher internal rate of return on investment than planting, 10.8 versus 10.1 percent (Coleman and Edwards 1991). The emphasis on planted pine in this report is made because the trend toward intensified management underlies and explains many of the changes being documented in area, inventory volume, growth, and removals.

Stand Size

The distribution of Alabama's timberland by stand-size class is 38 percent sapling-seedling, 27 percent poletimber, and 35 percent sawtimber (table V). On private land, the distribution for nonindustrial owners is the same as the Statewide average, whereas the distribution for forest industry is skewed more toward the sapling-seedling class. Public timberland has a high percentage of sawtimber stands (54 percent).

Sapling–seedling was the only stand-size class to undergo a significant increase, by 10 percent. The increase was most apparent for pine stands of the Coastal Plain inventory regions and for oak–hickory stands of the Mountain regions (fig. 12).

A 7-percent decrease in the area of poletimber stands was due to decreases on nonindustrial private land. The area of forest-industry poletimber stands increased by 15 percent.

The area of sawtimber stands was essentially unchanged. Significant decreases in the area of pine-type sawtimber stands of the Coastal Plain and Mountain regions were balanced by increases in hardwood-type sawtimber stands.

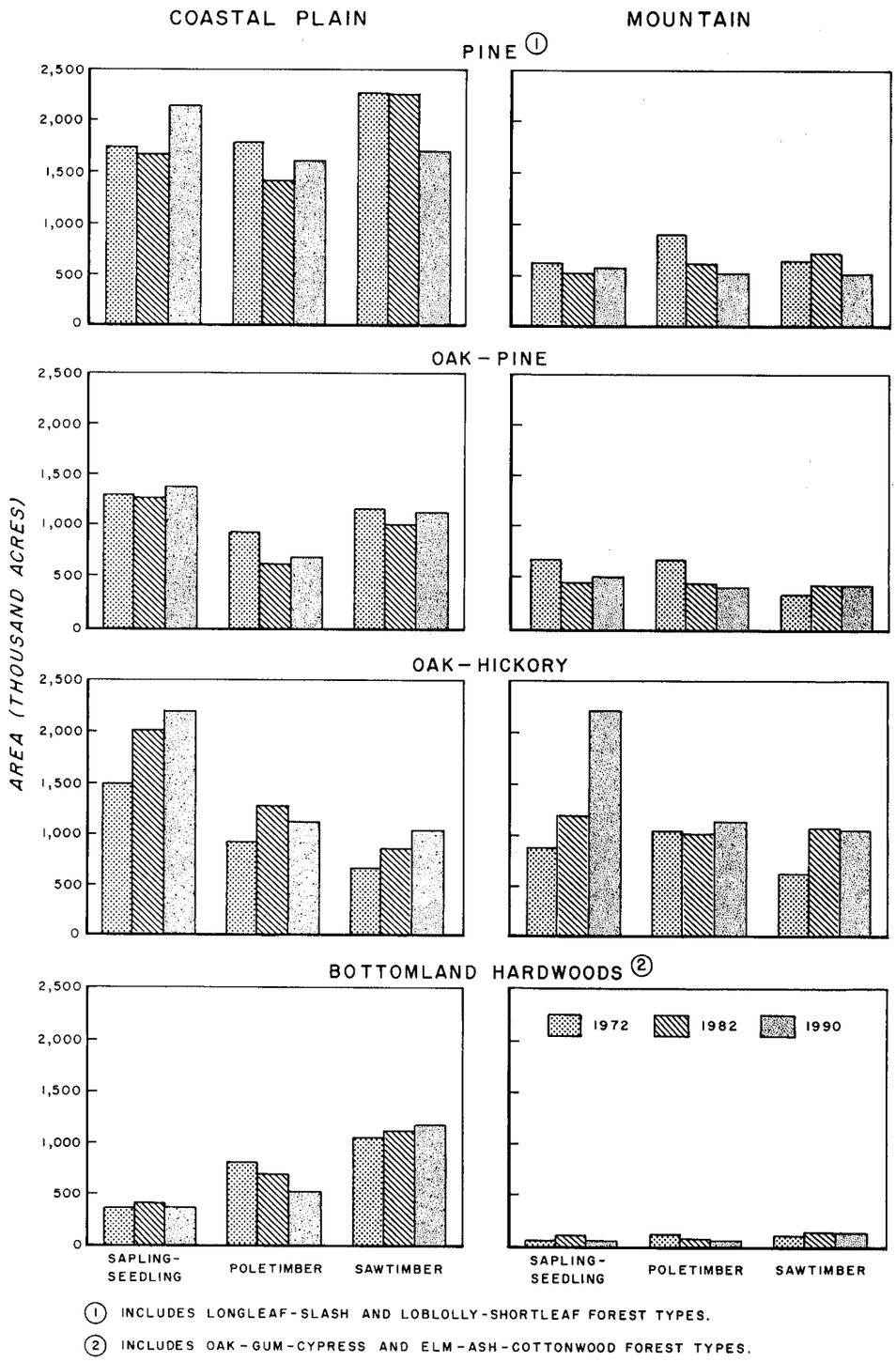


Figure 12. — *Area of timberland by forest type, stand-size class, and physiographic region, Alabama, 1972 to 1990 (excludes nontyped timberland).*

STAND STRUCTURE

Three measures of stand structure may be used to characterize Alabama's forests: number of trees per acre, basal area per acre, and stocking. Each of these three attributes has slightly different implications. The first two are alternate measures of stand density. Portraying number of trees per acre by diameter class (or the stand table) highlights changes in average stand conditions. Basal area gives an indication of the degree of site occupancy, and when partitioned by tree class, a general idea of the impact of cull trees. Stocking is a relative measure of site occupancy expressed in relation to a standard that represents "full" occupancy. Stocking can be used to make broad conclusions regarding forest vigor.

Number of Trees

Shifts in the stand table were not as drastic between 1982 and 1990 as they were between 1972 and 1982 (fig. 13), when there were very large decreases in the number of softwoods in the 2- to 6-inch range. Between 1982 and 1990, the number of softwood trees in these classes did not change much; however, some significant decreases did show up in the 8- through 12-inch classes. For hardwoods, the past decrease in the 2-inch class abated. Some decreases took place in the 6- to 12-inch classes, but most of these classes now have more trees than they did in 1972.

Basal Area

The average acre of timberland in Alabama contains 74.1 square feet of basal area, of which 38 percent is softwood and 62 percent is hardwood (table VI). This represents a slight decrease from 77.1 square feet in 1982. Most of the reduction was due to a decrease in the basal area of rough and rotten trees. With the exception of a decrease in softwood basal area in pine forest types, the basal area of growing-stock trees did not change much.

Most of the decrease in basal area was concentrated in the 6- to 14-inch classes (fig. 14). This contrasts with decreases that occurred in the 2- to 6-inch classes in the previous inventory period. Increased basal area in the 18-inch and larger classes that appeared in the previous inventory period continued between 1982 and 1990.

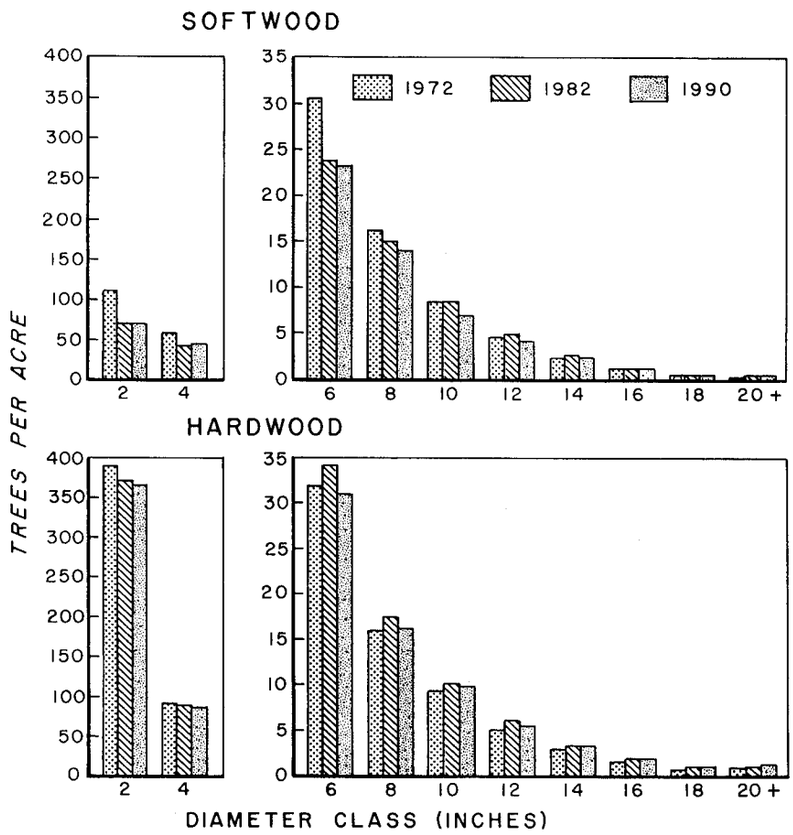


Figure 13. — *Number of live trees by diameter class, Alabama, 1972 to 1990.*

Table VI. —*Average basal area per acre of live trees by forest type, Alabama, 1982 and 1990**

Species group and forest type	Tree class 1990			Tree class 1982		
	All trees	Growing stock	Rough and rotten	All trees	Growing stock	Rough and rotten
	Square feet per acre					
Softwoods						
Pine types	56.6	54.2	2.4	63.1	58.9	4.2
Oak–pine	29.1	27.8	1.3	29.9	28.1	1.8
Oak–hickory	7.0	6.5	0.4	6.8	6.3	0.5
Bottomland hardwoods	5.7	5.5	0.3	5.7	5.4	0.2
All softwoods	28.3	27.0	1.3	30.2	28.2	2.0
Hardwoods						
Pine types	19.6	14.3	5.3	19.5	13.1	6.3
Oak–pine	43.0	31.8	11.3	43.4	30.0	13.4
Oak–hickory	60.1	46.1	13.9	61.4	44.1	17.4
Bottomland hardwoods	89.6	70.7	18.9	90.2	66.6	23.7
All hardwoods	45.8	34.8	11.0	46.9	33.4	13.6
Totals	74.1	61.8	12.3	77.1	61.6	15.6

*Rows may not sum to totals due to rounding.

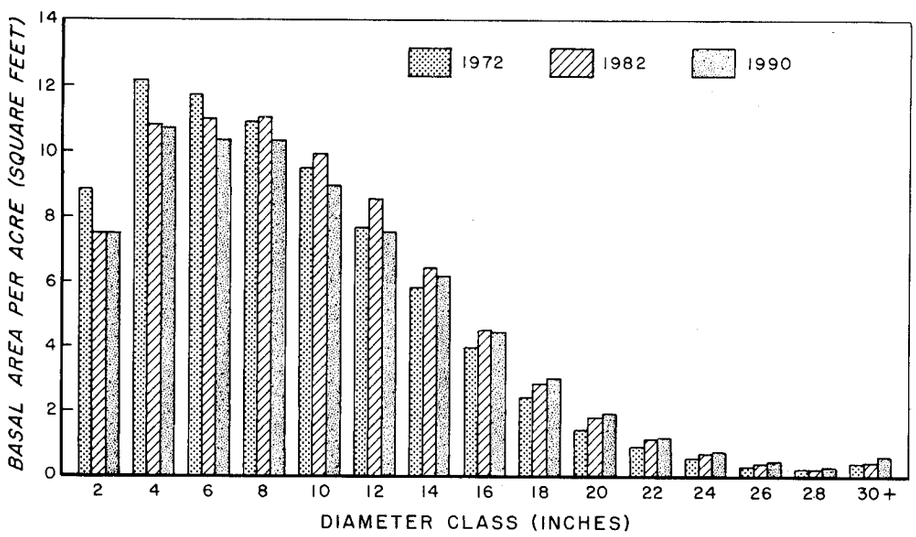


Figure 14. — *Basal area per acre by diameter class, Alabama, 1972 to 1990.*

Stocking

For analytical purposes, timberland is grouped into four stocking classes according to the stocking of live trees: understocked (less than 61 percent stocked), optimally stocked (61 to 100 percent stocked), fully stocked (101 to 130 percent stocked), and overstocked (greater than 130 percent stocked). Trends in the distribution of timberland in these four classes have reversed over the past two inventory periods:

Stocking class	1972–82	1982–90	1990
	Percent change		*Thousand acres*
Understocked	+55	–19	675.0
Optimally stocked	–3	+1	6,587.4
Fully stocked	–16	+21	11,933.1
Overstocked	+86	–38	2,725.4

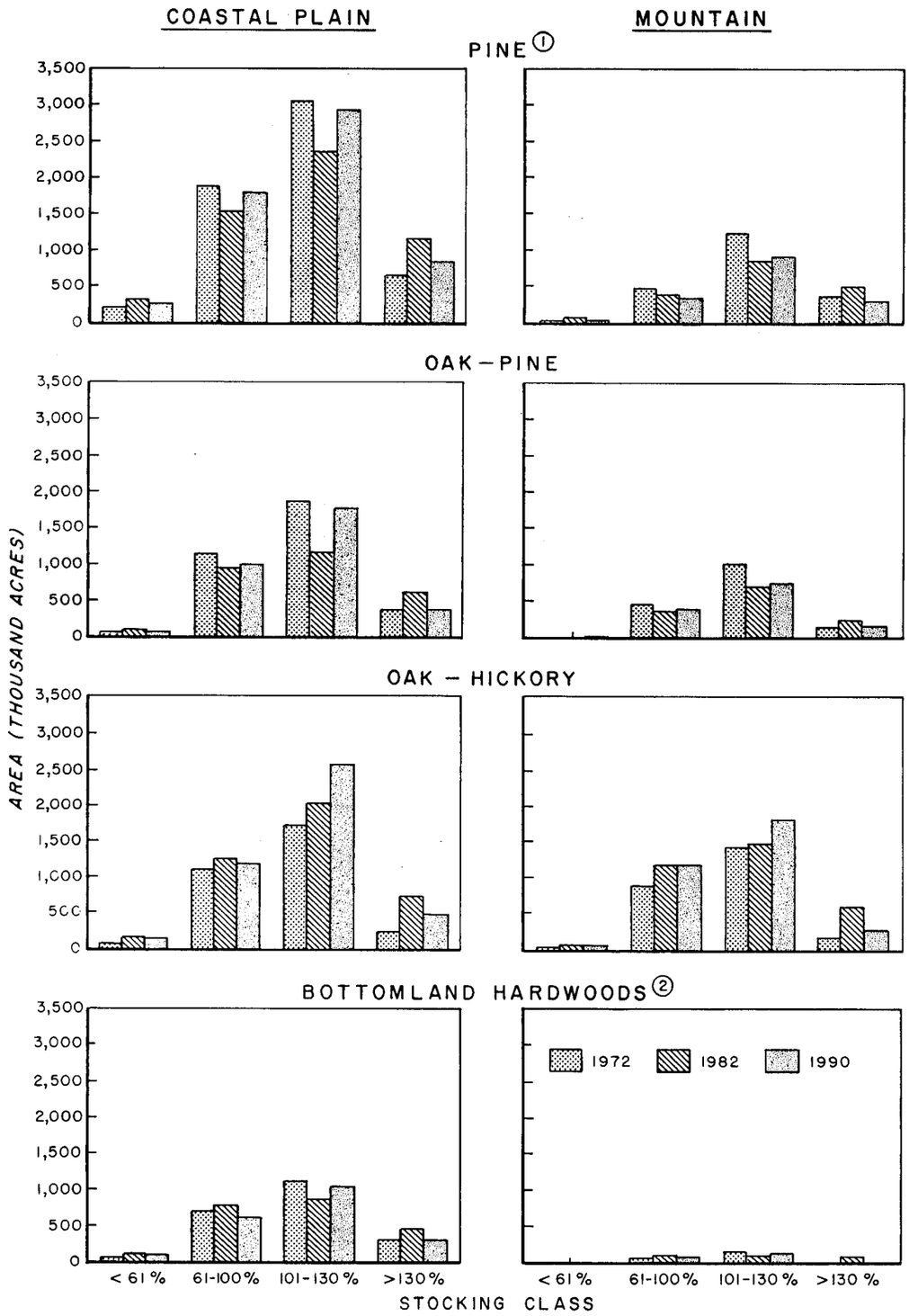


Figure 15. — *Area of timberland by forest type and stocking class, Alabama, 1972 to 1990 (excludes nontyped timberland).*

The recent decreases in the understocked and overstocked classes are notable, as these classes are associated with less vigorous growth than the others. Both of these classes had very large increases between 1972 and 1982. The increases in fully stocked acreage between 1982 and 1990 were concentrated in hardwood stands of the Coastal Plain inventory regions (fig. 15). Though growth potential is highest in optimally stocked stands, utilization of growth potential is highest in fully stocked stands (in terms of growth per acre).

Another favorable trend has developed in the area of cull stands. Cull stands are stands where 60 percent or more of the stocking is composed of rough and rotten trees. The area of hardwood cull stands decreased to 344,400 acres, compared to 1.1 million acres in 1982.

BIOMASS AND SPECIES DISTRIBUTION

Alabama's forest land supports 839.9 million tons of woody biomass (dry weight), or an average of 38 tons per acre (table VII). Woody biomass includes the total weight of trees at least 1.0 inches in d.b.h., excluding fruits, leaves, stumps, and roots (Rosson and Thomas 1986). Biomass estimates have become important in light of the role of forests in carbon sequestration and as a source of energy. Two-thirds of the State's biomass is hardwood and one-third softwood. Total woody biomass did not change much since 1982.

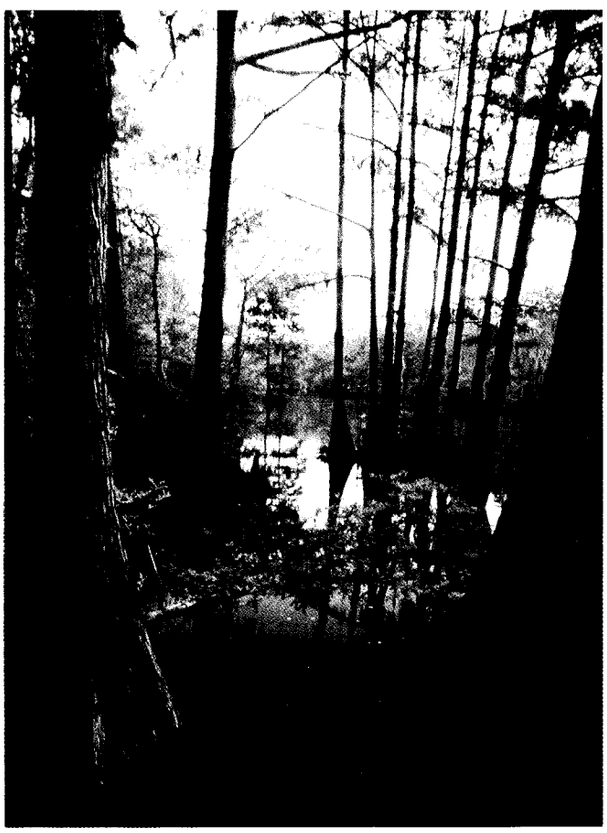
Species Group	1982	1990
	Million tons	
Softwood	304.5	292.6
Hardwood	533.6	547.3
Total	838.1	839.9

Total biomass is divided into merchantable and residual components. Merchantable biomass represents the weight of the merchantable portion (or bole) of growing-stock trees—the biomass that is typically utilized in harvesting. Residual biomass includes tree material that is not usually harvested, such as saplings, crowns and limbs of growing-stock trees, rough trees, rotten trees, and noncommercial species. Total biomass is 59 percent merchantable and 41 percent residual. Softwoods have a higher percentage of merchantable biomass than of total biomass due to better form; for example, fewer limbs and smaller crowns.

Public forest land carries the highest average weight per acre, with 51 tons (table VIII). Publicly owned bottomland hardwood forests average 73 tons per acre but account for only 81,400 acres. Forest industry and nonindustrial private forests average about the same total biomass per acre, 38 and 36 tons, respectively. Nonindustrial private forests carry a higher percentage of hardwood biomass than industrial forests (69 versus 52 percent).

Alabama's biomass is split among 109 species that were sampled on forest land (table IX). There are 34 species that contribute at least 1 percent of the total biomass. Combined, these species make up 93 percent of the total biomass. Loblolly pine is by far the most important species in the State, with 21 percent of the biomass, followed by sweetgum (8 percent), hickories (6 percent), water oak (6 percent), and white oak (5 percent). These five species contribute 46 percent of the total biomass. By physiographic region, pines are more important in the Coastal Plain inventory regions, and hickories and oaks are more important in the Mountain regions.

Woody biomass is a useful measure for assessing the spatial distribution of species in the State. Figures 16 and 17 show the distribution of 4 major southern pines and the 10 most important hardwood species (or species groups). The maps depict county-level biomass estimates, with each symbol representing 100,000 tons. Because of this, it is possible for a county that is known to contain a particular species not to have any



Mobile Delta Wetlands (Alabama Department of Conservation and Natural Resources).

Table VII.—*Total dry weight, merchantable dry weight, and residual dry weight of live-tree woody biomass sampled on forest land by physiographic region and species group, Alabama, 1990**

Physiographic region	Species group	Total dry weight	Merchantable dry weight	Residual dry weight
		Thousand tons		
Coastal Plain	Softwood	224,040.0	163,586.9	60,453.0
	Hardwood	356,473.5	184,657.8	171,815.7
	Total	580,513.6	348,244.7	232,268.7
Mountain	Softwood	68,535.6	48,887.9	19,647.8
	Hardwood	190,843.2	100,119.0	90,724.3
	Total	259,378.8	149,006.8	110,372.1
All regions	Softwood	292,575.6	212,474.8	80,100.8
	Hardwood	547,316.7	284,776.8	262,540.0
	Total	839,892.4	497,251.5	342,640.8

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

Table VIII.—*Total dry weight of live-tree woody biomass sampled on forest land by ownership, species group, and forest type, Alabama, 1990**

Ownership	Species group	Total	Planted pine†	Natural pine‡	Oak–pine	Oak–hickory	Bottomland hardwoods§
		Thousand tons					
Public	Softwood	20,786.7	893.3	10,498.7	7,035.7	2,215.1	143.9
	Hardwood	38,994.8	373.7	4,504.3	10,390.5	17,960.5	5,765.9
	Total	59,781.5	1,267.0	15,003.0	17,426.1	20,175.6	5,909.8
Forest industry	Softwood	83,037.4	36,033.9	26,530.9	14,657.2	3,543.3	2,272.3
	Hardwood	88,954.7	8,220.4	9,033.5	19,154.0	25,037.4	27,509.3
	Total	171,992.0	44,254.4	35,564.0	33,811.2	28,580.7	29,781.7
Nonindustrial private¶	Softwood	188,751.5	34,719.3	83,221.4	45,424.5	20,742.7	4,643.6
	Hardwood	419,367.2	9,850.7	34,560.0	68,854.8	217,812.1	88,289.5
	Total	608,118.9	44,570.1	117,781.4	114,279.4	238,555.0	92,933.1
All owners	Softwood	292,575.6	71,646.5	120,250.7	67,117.4	26,501.2	7,059.8
	Hardwood	547,316.7	18,444.8	48,097.8	98,399.3	260,810.0	121,564.8
	Total	839,892.4	90,091.4	168,348.4	165,516.7	287,311.3	128,624.6

*Rows and may not sum to totals due to rounding. Excludes nontyped timberland.
†Includes longleaf–slash and loblolly–shortleaf stands having evidence of artificial origin.
‡Includes longleaf–slash and loblolly–shortleaf stands having no evidence of artificial origin.
§Includes oak–gum–cypress and elm–ash–cottonwood forest types.
¶Includes woody biomass on timberland leased to forest industry.

Table IX. —*Ranking of species importance by total tree dry weight, Alabama, 1990**

Alabama†			Coastal Plain‡			Mountain§		
Rank	Species	Dry weight	Rank	Species	Dry weight	Rank	Species	Dry weight
		Thousand tons			*Thousand tons*			*Thousand tons*
1	Loblolly pine	173,207.2	1	Loblolly pine	132,779.2	1	Loblolly pine	40,428.0
2	Sweetgum	65,016.7	2	Sweetgum	50,782.4	2	Hickories	28,013.7
3	Hickories	51,873.3	3	Water oak	46,436.1	3	White oak	24,447.1
4	Water oak	51,049.5	4	Shortleaf pine	26,871.5	4	Chestnut oak	16,454.9
5	White oak	44,129.4	5	Slash pine	25,462.7	5	Sweetgum	14,234.3
6	Shortleaf pine	36,630.3	6	Longleaf pine	23,900.2	6	Virginia pine	12,028.9
7	Southern red oak	29,509.7	7	Hickories	23,859.6	7	Southern red oak	10,314.2
8	Longleaf pine	28,057.9	8	White oak	19,682.3	8	Yellow-poplar	10,146.0
9	Yellow-poplar	26,736.5	9	Southern red oak	19,195.5	9	Shortleaf pine	9,748.8
10	Slash pine	25,653.7	10	Yellow-popular	16,590.6	10	Post oak	9,198.1
11	Blackgum	20,841.2	11	Blackgum	16,396.4	11	Black oak	8,060.3
12	Chestnut oak	20,135.2	12	Laurel oak	12,782.0	12	Scarlet oak	7,534.0
13	Post oak	18,551.3	13	Red maple	12,418.6	13	Red maple	5,570.2
14	Red maple	17,988.9	14	Sweetbay	12,003.1	14	Flowering dogwood	5,426.3
15	Virginia pine	16,196.0	15	Flowering dogwood	10,080.2	15	Northern red oak	5,250.4
16	Flowering dogwood	15,506.5	16	Post oak	9,353.2	16	Water oak	4,613.4
17	Laurel oak	13,478.8	17	Willow oak	9,005.4	17	Blackgum	4,444.7
18	Sweetbay	12,035.0	18	Water tupelo	8,982.9	18	Sourwood	4,402.7
19	Willow oak	11,612.0	19	Swamp tupelo	6,999.7	19	Longleaf pine	4,157.7
20	Black oak	10,937.5	20	Green ash	6,837.8	20	White ash	2,969.7
21	Scarlet oak	9,294.4	21	Spruce pine	5,930.3	21	Black cherry	2,690.2
22	Sourwood	9,142.7	22	American beech	5,151.9	22	Willow oak	2,606.6
23	Water tupelo	9,053.3	23	Cherrybark oak	4,835.0	23	Chinkapin oak	2,488.5
24	Green ash	8,667.5	24	Sourwood	4,740.0	24	American beech	2,487.2
25	American beech	7,639.0	25	Virginia pine	4,167.1	25	Green ash	1,829.7
26	Northern red oak	7,299.8	26	Overcup oak	3,846.9	26	Sugar maple	1,680.5
27	Swamp tupelo	6,999.7	27	Chestnut oak	3,680.3	27	Cherrybark oak	1,616.8
28	Cherrybark oak	6,451.8	28	American hornbeam	3,669.7	28	Eastern redcedar	1,570.9
29	Spruce pine	5,930.3	29	Sugarberry	3,529.8	29	Winged elm	1,379.1
30	Black cherry	5,369.7	30	Baldcypress and Pond cypress	2,969.1	30	Blackjack oak	1,297.2
31	White ash	4,343.5	31	Black oak	2,877.2			
32	Sugarberry	4,233.9	32	Black cherry	2,679.6			
33	American hornbeam	4,073.3						
34	Overcup oak	4,007.6						

*Includes live trees at least 1.0 inches in d.b.h. sampled on forest land. Species that contribute less than 1 percent of the total woody biomass are excluded from each column.

†Excludes 75 species that contribute 58,239.4 thousand tons of woody biomass.

‡Excludes 73 species that contribute 42,017.8 thousand tons of woody biomass.

§Excludes 55 species that contribute 12,278.8 thousand tons of woody biomass.

symbols because the minimum threshold was not reached.

Loblolly pine is widely distributed in the State, with somewhat higher concentrations in the Coastal Plain inventory regions. The species is relatively uncommon in Baldwin and Mobile counties. Shortleaf pine is much less abundant than loblolly pine but is common in all but the northernmost and southernmost counties. Longleaf pine is most often found in southwestern counties and also in the Great Appalachian Valley and the Blue Ridge–Talledega Mountain regions. Slash pine is confined to southern-tier counties.

Hardwood species are found in varying abundance, with some spatial differences showing up by physiographic region. Sweetgum, southern red oak, yellow-poplar, blackgum, post oak, and red maple are well distributed across the State, with some local concentrations occurring for specific species. Water oak is most common in Coastal Plain counties. Hickories, white oak, and chestnut oak have highest concentrations in mountain counties.

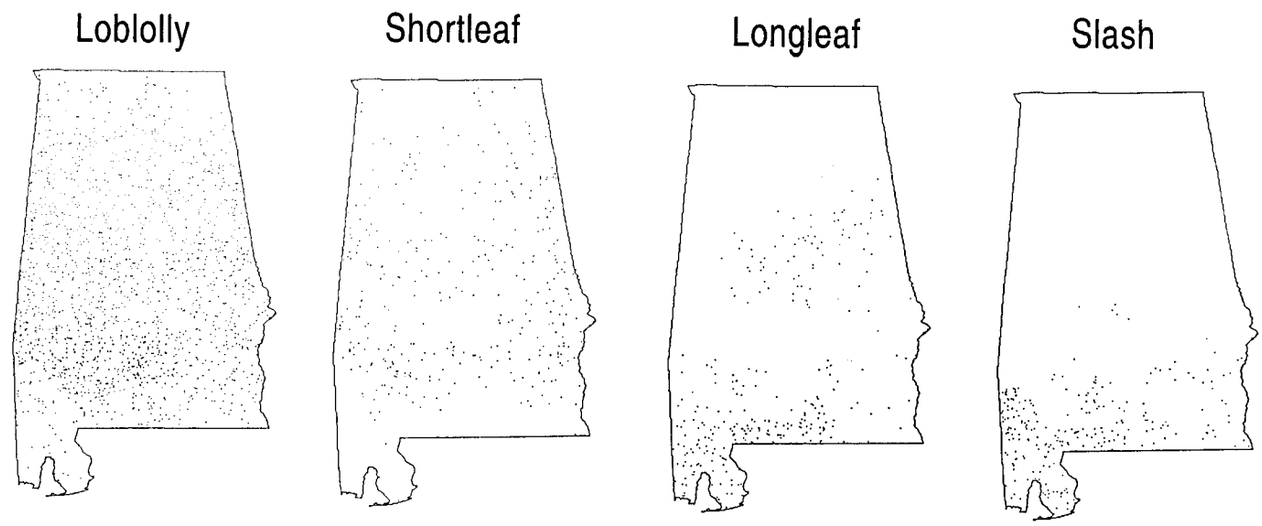


Figure 16,—*Distribution of four southern pines in Alabama, 1990. Each dot represents 100,000 tons of live-tree woody biomass (dry weight).*

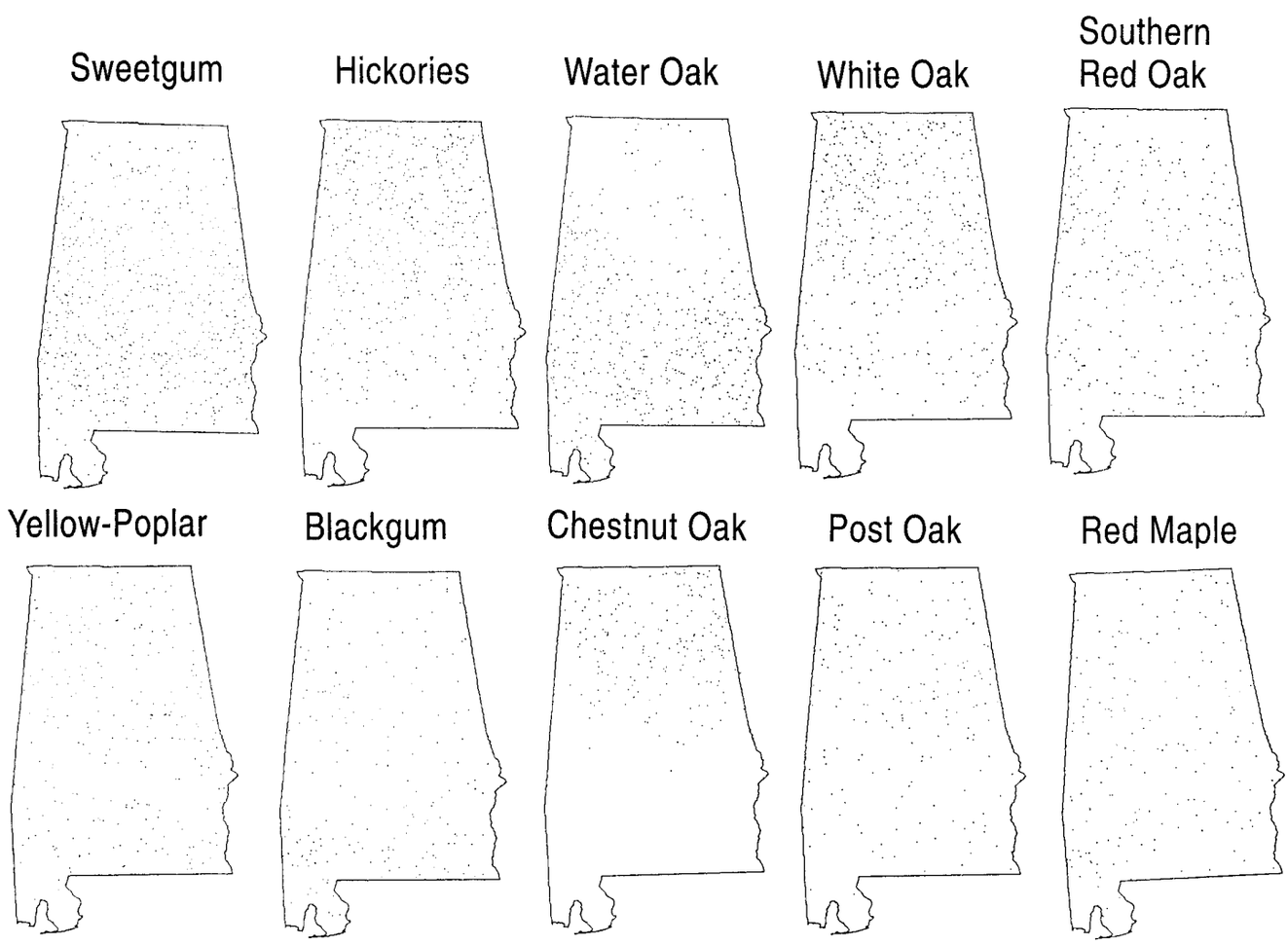


Figure 17. — *Distribution of 10 major hardwoods in Alabama, 1990. Each symbol represents 100,000 tons of live-tree woody biomass (dry weight).*

Mixed pine–hardwood stand (Alabama Department of Conservation and Natural Resources).

INVENTORY VOLUME

Alabama's inventory has been expanding over the past 40 years and has now reached the highest volume recorded since the SO-FIA inventory process was initiated (fig. 18). A slight reduction between the first two inventories marked the end of an era of large-scale exploitation of the State's timber resource that began in the late 1800's. This was followed by sharp increases in inventory in the 1960's and 1970's. Volume increases have slowed in the two most recent decades, mainly due to a leveling of softwood inventory.

The current volume of live trees on Alabama's timberland is 24.7 billion cubic feet (table X). This volume includes the sound-wood volume of growing-stock trees, rough trees, and rotten trees at least 5.0 inches in d.b.h. The growing-stock component—the volume of trees with good management potential—comprises 93 percent of the live-tree inventory. Total live-tree inventory has increased by 5 percent since 1982. Significant increases in volume were evident in all regions of the State, except the West–Central and North–Central regions.

Softwood

The volume of live softwoods is 11.3 billion cubic feet, or 46 percent of the total inventory. About three-fourths of the softwood volume is located in the Coastal Plain regions. By timber class, 71 percent of the softwood inventory is in sawtimber-size trees, 27 percent in pole-size trees, and 2 percent in cull trees (fig. 19).

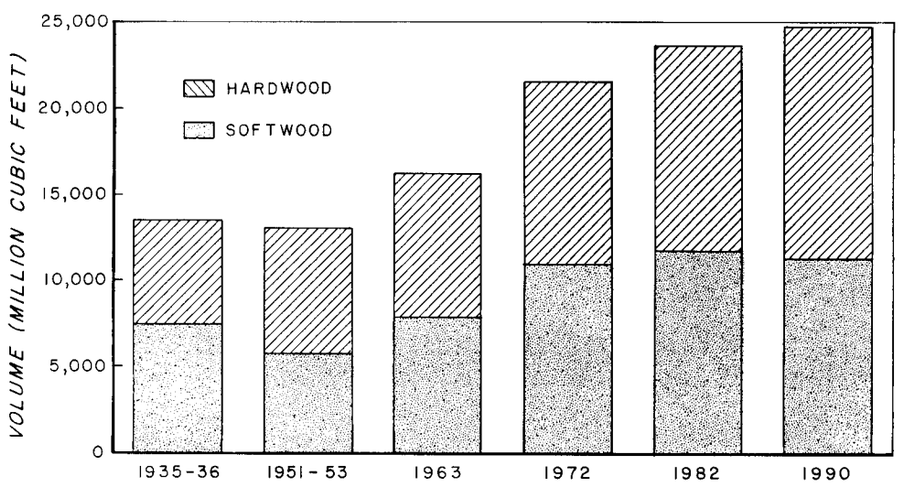


Figure 18. — *Volume of live trees by species group and inventory data, Alabama, 1935–1936 to 1990.*

Table X. — *Volume of live trees and percent change by inventory region, Alabama, 1982 to 1990**

Inventory region	All species		Softwood		Hardwood	
	Volume	Change	Volume	Change	Volume	Change
	Million cubic feet	*Percent*	*Million cubic feet*	*Percent*	*Million cubic feet*	*Percent*
Southwest-South	2,951.4	+5	1,749.8	+4	1,201.6	+8
Southwest-North	4,602.2	+8	2,488.0	+11	2,114.2	+5
Southeast	6,198.5	+10	2,822.9	(†)	3,375.6	+20
West Central	3,871.1	–2	1,604.9	–15	2,266.3	+10
North Central	4,600.0	(†)	1,999.7	–19	2,600.3	+21
North	2,512.6	+9	627.8	–3	1,884.8	+13
All regions	24,736.0	+5	11,293.1	–4	13,442.9	+14

*Rows and columns may not sum to totals due to rounding.
†Change is less than 1 percent.

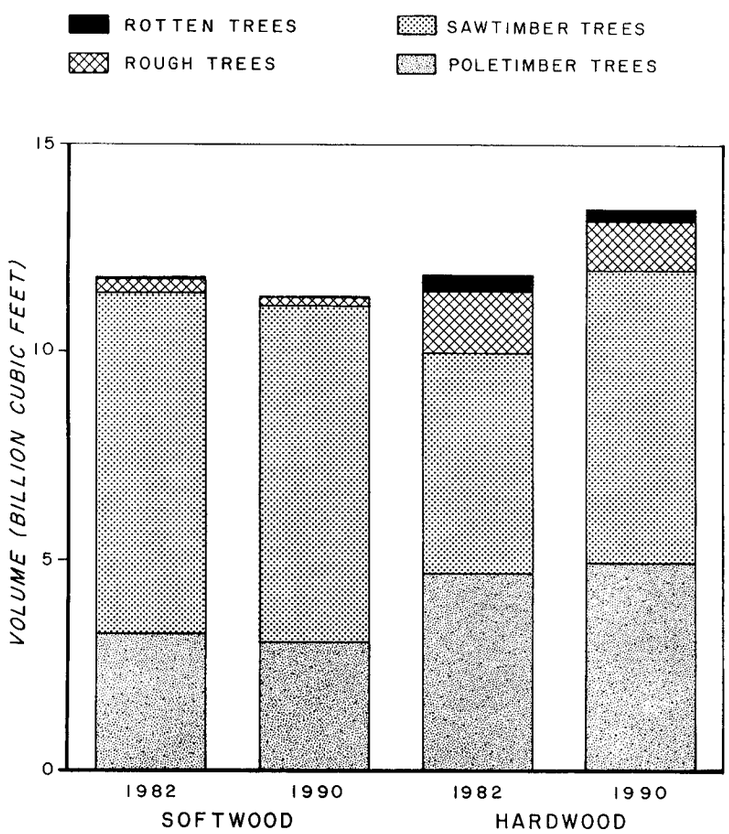


Figure 19. — *Volume of live trees by species group and class of timber, Alabama, 1982 and 1990.*

Total softwood inventory decreased by 4 percent, compared to a 7-percent increase in the previous period. The decline was due to a decrease of 15 percent in the West-Central region and 19 percent in the North-Central region. Softwood inventory increased in these regions between 1972 and 1982.

Some important increases in softwood volume were evident in the two southwestern regions. Both regions had decreases between 1972 and 1982. This trend reversal illustrates the lag period associated with intensive harvest and management activities. Southwest Alabama was the first part of the State to experience increased demand for pine pulpwood as industry was attracted to a buildup of softwood inventory. As harvesting increased, older pine stands were replaced with young premerchantable stands. (The lower limit of merchantability is 5.0 inches in d.b.h.) This prompted an overcut situation to develop as softwood removals exceeded growth and inventory decreased. As the young stands grew to merchantable size over the past 8 years, ingrowth has caused net growth to exceed removals and inventory to increase. These developments are important because they foretell potential developments in the West–Central and North–Central regions. Whether this kind of recuperation will occur in the West–Central and North–Central regions will depend on the adequacy of pine regeneration following harvest.

Changes in the distribution of volume by diameter class, or the stock table, clarify changes in softwood inventory (fig. 20). Between 1972 and 1982, softwood volume expanded considerably in all classes above the 6-inch class (except for a minor decrease in the 28-inch class). The 6-inch class decreased in volume by 6 percent. Then, between 1982 and 1990, major decreases showed up in the 6- through 12-inch classes. Only minor increases took place in the larger size classes. The decreases in the 6- to 12-inch range are the result of very heavy cutting in these size classes, particularly in the West–Central and North–Central regions (McWilliams and others 1990b, McWilliams and others 1991).

Most softwood species underwent decreases in volume, the most notable of which was a 19-percent decrease in the volume of shortleaf pine (fig. 21). The

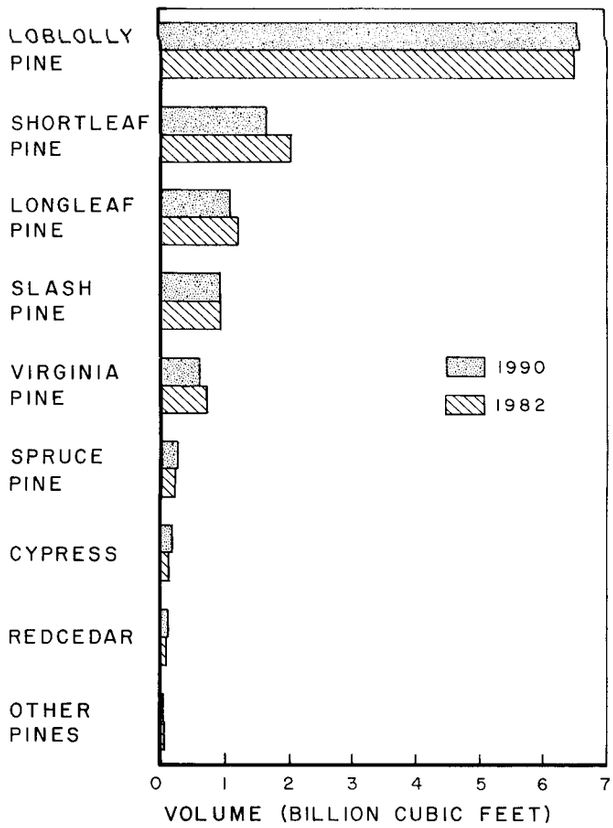


Figure 21. — *Volume of live softwoods by species, Alabama, 1982 and 1990.*

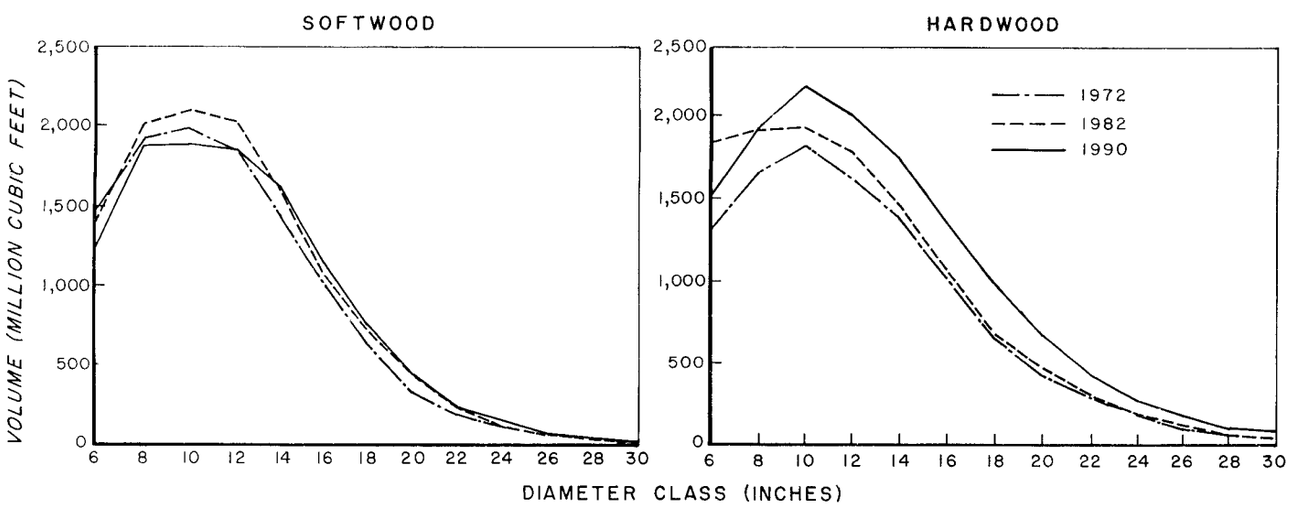


Figure 20. — *Changes in the volume of live trees by diameter class, Alabama, 1972 to 1990.*

decrease in shortleaf pine inventory reflects a preference by forest managers for regenerating harvested pine stands with loblolly pine. Shortleaf pine still ranks second for its share of total softwood volume, with 14 percent. Loblolly pine increased in volume and now contributes 58 percent of the softwood volume.

Softwood inventory on forest industry timberland in Alabama increased by 7 percent, reflecting management intensification that began in the mid-1960's (table XI). During the previous inventory period, softwood volume did not change significantly because industry was active harvesting stands and regenerating with pine. Over the most recent inventory period, stands that were previously premerchantable grew to merchantable size. As a result, softwood volume in planted pine stands more than doubled. Future expansion in softwood volume on industry land can be expected because intensive pine management continued during the 1980's.

Harvesting and pine management have also affected softwood inventory on nonindustrial private timberland but didn't begin on a large scale until the late 1970's. Softwood inventory decreased by 8 percent between 1982 and 1990, compared to a 9-percent gain in volume previously. Still, the effects of intensive management have begun to show up. Softwood volume in nonindustrial planted pine stands has increased by 39 percent. Total softwood inventory should begin to increase as new planted stands and young naturally regenerated stands reach merchantable size.

The increased emphasis on planted pine management has brought about the conversion of natural stands containing pine and caused softwood inventory in natural stands to decrease by 26 percent. Despite this trend, natural pine stands continue to be the most important source of softwood volume in the State, with 43 percent of the total inventory.

Hardwood

Alabama's hardwood inventory totals 13.4 billion cubic feet, or more than half of the State's inventory volume. Fifty-two percent of the hardwood volume is in sawtimber-size trees, 37 percent in pole-size trees, and 11 percent in cull trees. Nearly all of the cull volume is in rough cull trees (82 percent).

The hardwood inventory expanded by 14 percent, continuing a record of increases that spans all of the SO-FIA inventories of Alabama. All regions of the State had increased hardwood inventory. The largest increases were in the Southeast and North-Central regions.

Hardwood stock table changes reveal some conspicuous shifts in volume among size classes. Be-

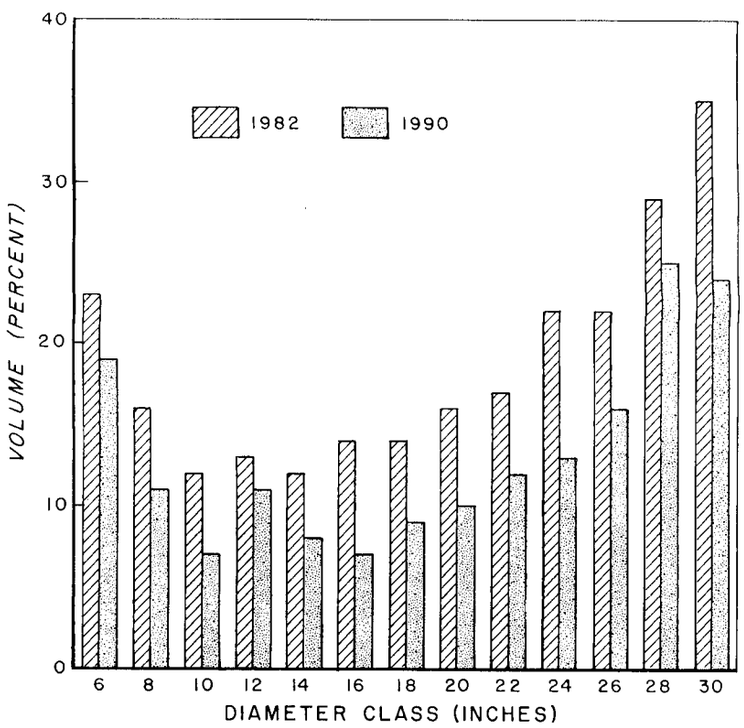


Figure 22. — *Percent of live-tree hardwood volume in cull trees by diameter class, Alabama, 1982 and 1990.*

Table XI. —*Volume of live trees and percent change by ownership, forest type, and species group, Alabama, 1982 to 1990**

Ownership and species group	Total		Planted pine†		Natural pine‡		Oak–pine		Oak–hickory		Bottomland hardwoods§	
	Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*
Public												
Softwood	843.5	–2	27.4	+853	425.9	–23	292.3	+40	91.8	+32	6.2	–76
Hardwood	934.4	+40	5.0	+148	90.4	+36	233.6	+67	442.3	+35	163.1	+16
Total	1,777.9	+16	32.4	+561	516.3	–16	525.9	+51	534.1	+34	169.3	+2
Forest industry												
Softwood	3,035.8	+7	1,109.7	+112	1,083.4	–29	539.3	+7	149.1	+2	100.2	–7
Hardwood	2,154.2	+7	112.9	+220	168.3	–25	440.4	+25	595.9	–5	836.7	+9
Total	5,190.0	+7	1,222.6	+119	1,251.7	–28	1,033.7	+14	745.1	–4	936.9	+7
Nonindustrial private¶												
Softwood	7,413.8	–8	1,158.1	+39	3,349.7	–26	1,833.5	+2	852.8	+22	219.8	+15
Hardwood	10,354.3	+13	162.8	+138	718.6	+1	1,564.6	+8	5,354.3	+21	2,554.2	+2
Total	17,768.1	+3	1,320.8	+47	4,068.2	–22	3,398.1	+5	6,207.0	+21	2,773.9	+2
All owners												
Softwood	11,293.1	–4	2,295.2	+69	4,859.0	–26	2,719.1	+6	1,093.7	+19	326.2	(**)
Hardwood	13,442.9	+14	280.7	+166	977.2	–3	2,238.6	+16	6,392.5	+19	3,553.9	+4
Total	24,736.0	+5	2,575.9	+76	5,836.2	–23	4,957.7	+10	7,486.2	+19	3,880.1	+4

*Rows and columns may not sum to totals due to rounding.
†Includes longleaf–slash and loblolly-shortleaf stands having evidence of artificial origin.
‡Includes longleaf–slash and loblolly–shortleaf stands having no evidence of artificial origin.
§Includes oak–gum–cypress and elm–ash–cottonwood forest types.
¶Includes live-tree volume on timberland leased to forest industry.
**Change is less than 1 percent.

tween 1972 and 1982, most of the increase in hardwood inventory was in the 6- to 12-inch range, including a 40-percent increase in the 6-inch class. Then, between 1982 and 1990, a sharp decrease in volume of the 6-inch class was coupled with substantial increases for larger diameter classes (10-inch class and larger). These changes are the net effect of trends in growth and removals to be discussed in a subsequent section.

Associated with the expansion in volume was a striking improvement in the quality of the hardwood inventory between the 1982 and 1990 inventories. Large decreases in the amount of cull volume occurred across all diameters (fig. 22).

The expansion of hardwood volume was spread among all of the major species and species groups (fig. 23). Other red oaks, select white oaks, yellow-poplar, other white oaks, select red oaks, and soft maple had pronounced increases.

Public and nonindustrial private owners had the largest gains in hardwood volume, particularly in the oak-hickory forest type. Hardwood volume gains on forest industry timberland were modest.

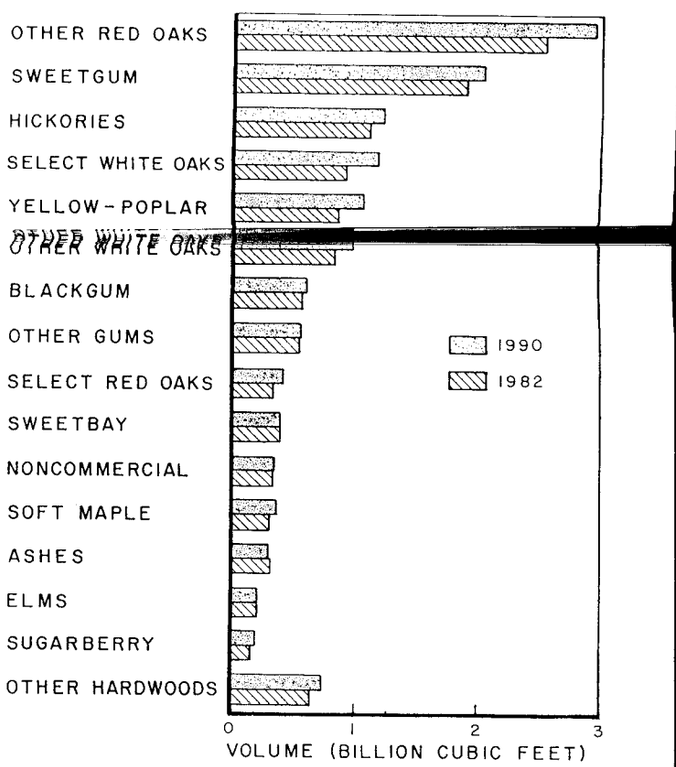


Figure 23. — *Volume of live hardwoods by species, Alabama, 1982 and 1990.*

SAWTIMBER VOLUME

Alabama's sawtimber inventory is currently 76.2 billion board feet (International ¼-inch Rule), of which 56 percent is softwood and 44 percent is hardwood. The total volume of sawtimber increased by 12 percent—but only because of a 34-percent increase in hardwood sawtimber (table XII). Softwood sawtimber volume showed no significant change. Increases in softwood sawtimber in the southwestern inventory regions were offset by decreases in the West-Central and North-Central regions. Hardwood sawtimber gained in all regions of the State.

The reason for no change in softwood sawtimber inventory is the reduction in volume that is occurring in natural pine stands (21 percent) as older stands are being converted to young stands (table XIII). All other forest types had increases in softwood sawtimber. Changes in the volume of softwood sawtimber by ownership were negligible.

As with live-tree volume, hardwood sawtimber increases were concentrated on public and nonindustrial private land. The oak-hickory forest type had the largest increase (43 percent). An 18-percent increase in hardwood sawtimber on bottomland hardwood timberland is noteworthy, given the 9-percent decrease in the area of this type.

Some of the most important factors affecting the availability of sawtimber are volume per acre and timber characteristics, such as species, size, and quality (May and LeDoux, in press; McWilliams, in press; McWilliams and Rosson 1988). Although the sale of pulpwood supplements sawtimber removals, the existing sawtimber volume per acre limits the feasibility of harvesting any given tract for sawlogs. The impact of this constraint is illustrated in figure 24. As shown, timberland supporting relatively low volume accounts for a large share of the timberland base. For example, just over half of the State's timberland supports 3,000 board feet per acre or less. And one-quarter of the timberland (with at least 5,000 board feet per acre) supports two-thirds of the sawtimber volume.

Species, Size, and Quality

Information on sawtimber inventory is most useful when interpreted in terms of species, size, and quality. The distribution of sawtimber volume by species group, tree size, and tree grade is summarized in table XIV. More specific data for tree grades one to three are shown in tables XV to XVII. The SO-FIA assigns the total board-foot volume in the sawlog section of each sample tree to the grade of the first 16-foot section.

The distribution of softwood sawtimber volume for grades one to three is 24 percent, 19 percent, and 55 percent, respectively. This is similar to the distribution in 1982. An additional 2 percent is in the "other" category, which is reserved for trees that do not contain a gradable log in the first 16-foot section but contain one 12-foot or two 8-foot logs elsewhere in the sawlog section.

The distribution of hardwood sawtimber volume for grades one to three is 9 percent, 18 percent, and 41 percent, respectively. Tie and timber volume and the other category account for the remaining volume. It is not possible to get a clear assessment of the trend in hardwood sawtimber by grade because the SO-FIA implemented modified tree grading procedures in 1990. The purpose of the modification was to implement grading standards that would be consistent among all of the eastern Forest Inventory and Analysis units (Hanks 1976).

An important point to consider when using the estimate of higher grade hardwood sawtimber volume is that it includes all species, regardless of suitability for manufacture into grade lumber and other high-quality products. For example, soft hardwood species, such as sweetgum, contribute a considerable share of the tree grade one and two volume in both the Coastal Plain and Mountain inventory regions (fig. 25).

Table XII. —*Volume of sawtimber and percent change by inventory region, Alabama, 1982 to 1990**

Inventory region	All species		Softwood		Hardwood	
	Volume	Change	Volume	Change	Volume	Change
	Million board feet†	*Percent*	*Million board feet*	*Percent*	*Million board feet*	*Percent*
Southwest–South	9,198.6	+12	6,507.5	+6	2,691.0	+30
Southwest–North	16,316.1	+14	10,474.4	+10	5,841.7	+21
Southeast	18,567.1	+15	10,716.9	+1	7,850.1	+42
West Central	11,872.1	+4	6,059.2	–11	5,812.9	+28
North Central	13,346.9	+11	7,173.7	–11	6,173.1	+53
North	6,875.0	+18	1,882.3	–2	4,992.7	+27
All regions	76,175.6	+12	42,814.1	(‡)	33,361.6	+34

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.
‡Change is less than 1 percent.

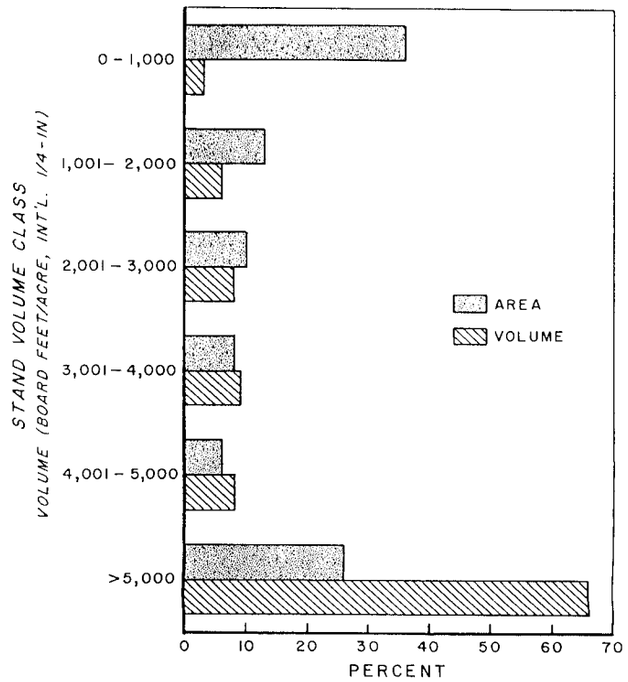


Figure 24. — *Area of timberland and volume of sawtimber by stand volume class, Alabama, 1990.*

Table XIII.—*Volume of sawtimber and percent change by ownership, forest type, and species group, Alabama, 1982 to 1990**

Ownership and species group	Total		Planted pine†		Natural pine‡		Oak–pine		Oak–hickory		Bottomland hardwoods§	
	Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change	Volume	Change
	Million board feet¶	*Percent*	*Million board feet*	*Percent*	*Million board feet*	*Percent*	*Million board feet*	*Percent*	*Million board feet*	*Percent*	*Million board feet*	*Percent*
Public												
Softwood	3,892.6	+6	43.9	(**)	1,948.8	–19	1,421.0	+66	443.4	+51	35.5	–69
Hardwood	2,575.7	+79	11.4	+227	171.0	+84	607.7	+166	1,200.6	+63	585.1	+55
Total	6,468.3	+26	55.3	+1,485	2,119.8	–16	2,028.8	+88	1,644.0	+60	620.6	+26
Forest industry												
Softwood	10,450.7	+1	2,253.2	+114	4,392.3	–25	2,676.1	+12	665.4	+14	463.7	–1
Hardwood	5,424.9	+17	176.2	–52	302.4	–17	1,006.6	+42	1,352.4	+3	2,587.4	+18
Total	15,875.6	+6	2,429.4	+121	4,694.7	–24	3,682.6	+19	2,017.8	+6	3,051.1	+15
Nonindustrial private††												
Softwood	28,470.8	–2	3,333.8	+65	13,077.1	–20	7,481.4	+6	3,536.1	+32	1,042.4	+16
Hardwood	25,360.9	+34	315.3	+293	1,284.7	+17	3,245.8	+30	13,404.0	+48	7,111.1	+16
Total	53,831.7	+12	3,649.0	+73	14,361.8	–17	10,727.2	+12	16,940.1	+44	8,153.5	+16
All owners												
Softwood	42,814.1	(‡‡)	5,630.8	+83	19,418.2	–21	11,578.5	+12	4,644.9	+30	1,541.6	+4
Hardwood	33,361.6	+34	502.8	+284	1,758.1	–13	4,860.1	+42	15,957.0	+43	10,283.6	+18
Total	76,175.6	+12	6,133.6	+91	21,176.3	–19	16,438.6	+20	20,601.9	+40	11,825.2	+16

*Rows and columns may not sum to totals due to rounding.
†Includes longleaf-slash and loblolly-shortleaf stands having evidence of artificial origin.
‡Includes longleaf-slash and loblolly-shortleaf stands having no evidence of artificial origin.
§Includes oak-gum-cypress and elm-ash-cottonwood forest types.
¶International 1/4-inch Rule.
**None sampled in 1982.
††Includes sawtimber volume on timberland leased to forest industry.
‡‡Change is less than 1 percent.

Table XIV.—*Volume of sawtimber by species group, tree size* and tree grade, Alabama, 1990*†

Species group and tree size	Total	Tree Grade 1	Tree Grade 2	Tree Grade 3	Tie and timber	Other‡
	Million board feet§					
Softwood						
9.0–15.0	26,252.1	4,773.3	4,567.2	16,359.7	...	552.0
15.0+	16,562.0	5,356.1	3,587.7	7,104.4	...	513.8
Total	42,814.1	10,129.4	8,154.8	23,464.0	...	1,065.8
Hardwood						
11.0–15.0	14,423.4	...	1,608.1	7,746.8	4,073.4	995.2
15.0+	18,938.2	3,001.5	4,436.9	5,877.1	3,715.3	1,907.1
Total	33,361.6	3,001.5	6,045.0	13,623.9	7,788.6	2,902.5

*Diameter at breast height expressed in inches.
†Rows and columns may not sum to totals due to rounding.
‡Trees that contain at least one 12-foot or two 8-foot logs above the first 16-foot section but do not contain a gradable 12-foot log in the first 16-foot section.
§International ¼-inch Rule.

Table XV. —*Volume of sawtimber for tree grade one on timberland by detailed species and diameter class, Alabama counties, 1990**

Species	All classes	Diameter class (*Inches at breast height*) 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
	Million board feet†								
Longleaf pine	848.1	126.5	228.6	239.5	149.4	67.5	17.5	19.0	...
Slash pine	1,285.3	158.0	257.6	308.2	247.7	138.3	91.5	83.8	...
Shortleaf pine	1,771.3	315.0	408.3	515.1	259.0	165.2	62.2	46.5	...
Loblolly pine	5,432.8	337.1	646.5	939.2	984.9	979.1	637.3	863.2	45.5
Virginia pine	40.8	7.5	7.8	9.9	9.8	2.5	3.2	...	...
Spruce pine	153.9	8.7	1.8	...	11.6	35.0	50.0	46.7	...
Redcedar	167.1	66.8	44.1	20.6	20.7	6.1	2.4	6.4	...
Hemlock–spruce	26.1	6.0	5.2	5.3	...	2.0	...	7.5	...
Cypress	404.0	17.9	41.5	50.3	36.3	58.0	47.9	138.2	13.9
Total softwoods	10,129.3	1,043.6	1,641.4	2,088.2	1,719.5	1,453.8	912.0	1,211.3	59.4
Select white oaks	392.2	...	...	...	50.8	60.1	100.7	155.5	25.1
Select red oaks	269.8	...	...	...	20.3	58.1	36.9	105.9	48.6
Other white oaks	136.5	...	...	...	19.3	28.0	23.4	62.4	3.3
Other red oaks	435.7	...	...	...	26.5	108.0	101.5	143.9	55.8
Water hickory	16.6	...	...	...	3.4	3.2	4.9	5.0	...
Other hickories	162.2	...	...	...	27.1	52.1	51.9	31.1	...
Soft maple	15.7	...	...	...	...	4.2	5.8	5.7	...
Boxelder	3.0	...	...	...	...	...	3.0	...	...
Beech	4.3	...	...	...	4.3	...	...	...	...
Sweetgum	405.7	...	...	...	70.0	129.3	72.5	124.0	9.9
Blackgum	98.5	...	...	...	17.3	28.3	31.0	21.9	...
Other gums/tupelos	225.8	...	...	...	48.3	76.7	46.3	52.6	1.9
White ash	42.6	...	...	...	9.0	20.5	4.2	8.9	...
Other ashes	101.4	...	...	...	12.6	37.1	16.7	35.0	...
Sycamore	77.3	...	...	...	10.5	17.0	20.0	27.8	2.0
Cottonwood	22.3	...	...	...	...	8.1	...	14.1	...
Basswood	6.0	...	...	...	...	2.3	3.7	...	...
Yellow-poplar	473.7	...	...	...	43.5	104.0	85.4	233.7	7.2
Sweetbay	27.9	...	...	...	8.0	6.2	4.3	9.4	...
American elm	23.6	...	...	...	2.5	5.4	8.6	7.2	...
Other elms	19.8	...	...	...	2.5	3.8	8.1	5.4	...
River birch	1.3	...	...	...	1.3	...	...	...	...
Hackberry	39.9	...	...	...	16.9	14.0	2.9	6.0	...
Total hardwoods	3,001.6	...	...	...	394.1	766.6	631.6	1,055.5	153.7
All species	13,130.9	1,043.6	1,641.4	2,088.2	2,113.5	2,220.4	1,543.7	2,266.9	213.2

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

Table XVI. *Volume of sawtimber for tree grade two on timberland by detailed species and diameter class, Alabama counties, 1990**

Species	All classes	Diameter class (*Inches at breast height*) 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
	Million board feet†								
Longleaf pine	860.8	118.9	189.2	281.4	165.6	68.0	32.6	5.2	...
Slash pine	422.9	67.8	88.4	102.2	85.6	33.4	15.6	29.9	....
Shortleaf pine	1,414.9	263.7	414.8	371.0	212.0	126.2	21.3	5.7	...
Loblolly pine	4,985.1	540.1	859.5	1,084.0	1,007.5	578.6	411.6	478.0	25.8
Virginia pine	99.8	19.4	35.2	33.8	6.9	...	4.4	...	...
Spruce pine	225.9	4.3	14.6	27.7	14.9	53.7	46.7	64.1	...
Pitch pine	1.0	1.0	...	...	...	...	...	...	...
Hemlock-spruce	4.3	...	...	...	...	...	4.3	...	...
Cypress	140.3	6.8	23.7	19.7	27.3	16.8	14.4	31.5	...
Total softwoods	8,154.9	1,022.0	1,625.4	1,919.8	1,519.8	876.6	551.0	614.5	25.8
Select white oaks	797.1	...	...	167.6	250.9	130.9	93.1	135.9	18.7
Select red oaks	343.5	...	...	35.9	76.3	86.2	67.2	57.0	20.9
Other white oaks	345.7	...	...	71.3	99.9	75.7	44.7	46.1	8.0
Other red oaks	1,123.2	...	...	185.7	244.8	258.4	139.6	242.7	52.0
Water hickory	19.0	...	...	3.9	11.3	...	...	3.8	...
Other hickories	581.5	...	...	177.6	168.1	111.2	58.6	66.0	...
Hard maple	5.6	...	...	...	...	5.6	...	...	...
Soft maple	18.9	...	...	*6.5*	9.4	...	3.0	...	...
Boxelder	1.9	...	...	...	1.9	...	...	...	...
Beech	18.4	...	...	...	...	5.0	4.0	6.3	3.2
Sweetgum	876.3	...	...	345.3	242.3	125.5	97.2	55.9	10.1
Blackgum	225.5	...	...	111.0	69.7	19.6	17.5	7.7	...
Other gums/tupelos	417.8	...	...	162.4	92.4	86.1	29.1	47.7	...
White ash	59.4	...	...	10.1	18.3	12.7	4.6	13.7	...
Other ashes	141.5	...	...	30.4	53.2	28.3	12.9	16.7	...
Sycamore	77.4	...	...	4.2	42.3	5.3	6.1	9.2	10.4
Cottonwood	21.7	...	...	2.2	13.8	2.7	...	3.0	...
Basswood	28.7	...	...	7.7	8.3	5.2	3.9	3.5	...
Yellow-poplar	676.6	...	...	166.4	173.6	121.5	86.0	110.3	18.7
Magnolia	7.4	...	...	3.0	3.3	1.2	...	...	...
Sweetbay	71.7	...	...	46.0	14.2	8.8	2.7	...	...
Black walnut	2.3	...	...	2.3	...	...	...	...	...
Black cherry	7.8	...	...	5.6	...	...	2.2	...	...
American elm	33.8	...	...	6.7	8.2	5.8	10.4	2.7	...
Other elms	34.4	...	...	18.3	5.6	6.4	...	4.0	...
River birch	37.7	...	...	12.0	12.7	10.7	2.3	...	...
Hackberry	66.0	...	...	24.4	11.8	14.6	6.3	8.9	...
Other commercial	4.1	...	...	1.4	2.7	...	...	...	...
Total hardwoods	6,045.0	...	...	1,608.1	1,634.9	1,127.6	691.3	841.1	142.0
All species	14,199.9	1,022.0	1,625.4	3,527.9	3,157.7	2,004.2	1,242.2	1,455.6	167.9

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

Table XVII. *Volume of sawtimber for tree grade three on timberland by detailed species and diameter class, Alabama counties, 1990**

Species	All classes	Diameter class (*Inches at breast height*) 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
	Million board feet†								
Longleaf pine	2,774.7	612.3	780.8	638.9	437.7	195.5	81.7	27.9	...
Slash pine	1,220.2	348.3	296.4	246.1	160.2	92.3	40.5	36.4	...
Shortleaf pine	3,145.5	884.4	961.0	708.2	313.8	147.7	83.7	46.7	...
Loblolly pine	14,002.4	3,214.5	3,317.1	2,725.3	2,033.6	1,294.9	734.0	649.5	33.5
Virginia pine	1,342.6	521.1	444.2	247.8	89.2	35.0	5.3	...	...
Spruce pine	779.2	71.8	97.1	148.5	120.3	113.4	73.0	150.1	5.0
Other southern pines	1.4	...	...	...	1.4	...	...	...	...
E. white pine	16.0	1.3	4.1	3.3	4.1	2.1	...	...	...
Hemlock-spruce	21.4	3.2	11.7	5.9	...	0.6	...	...	...
Cypress	160.7	22.4	17.3	26.7	19.1	26.3	5.9	4.0	39.0
Total softwoods	23,464.1	5,679.2	5,929.8	4,750.7	3,180.5	1,907.7	1,024.1	914.6	77.4
Select white oaks	1,508.2	...	495.2	363.4	283.5	157.9	72.5	117.6	18.2
Select red oak	532.4	...	154.8	98.9	79.6	66.2	43.6	74.5	14.8
Other white oaks	1,115.1	...	370.8	292.5	171.9	105.2	69.3	75.3	30.1
Other red oaks	2,825.6	...	651.0	707.0	489.9	372.8	240.4	328.6	35.9
Water hickory	36.0	...	7.4	15.7	5.3	4.2	...	3.5	...
Other hickories	1,556.5	...	525.4	382.0	312.8	161.4	84.8	90.2	...
Persimmon	14.2	...	7.1	7.0	...	...	...	...	...
Hard maple	32.4	...	15.9	7.2	4.0	5.2	...	...	...
Soft maple	144.3	...	46.6	27.3	21.8	22.9	9.0	13.8	2.9
Boxelder	4.6	...	...	4.6	...	...	...	...	...
Beech	155.7	...	18.4	26.2	20.3	21.4	21.5	40.0	8.0
Sweetgum	1,883.1	...	819.9	455.3	244.2	128.0	120.1	115.7	...
Blackgum	583.1	...	318.1	134.7	80.2	17.6	13.5	18.4	0.7
Other gums/tupelos	593.5	...	219.0	152.2	121.3	56.3	15.9	25.4	3.4
White ash	*92.7*	...	*28.2*	*28.2*	*22.0*	*5.2*	*7.1*	*2.0*	...
Other ashes	217.9	...	93.9	39.4	39.1	18.4	6.3	20.8	...
Sycamore	85.3	...	31.1	4.7	19.5	3.4	6.2	17.4	3.0
Cottonwood	11.0	...	4.0	4.3	...	...	2.6	...	...
Basswood	*53.1*	...	*16.9*	*17.6*	*3.2*	*4.7*	*10.8*	...	...
Yellow-poplar	1,340.3	...	337.4	273.8	255.5	187.4	115.3	151.3	19.6
Magnolia	39.4	...	10.2	14.7	5.9	2.4	...	6.2	...
Sweetbay	227.9	...	92.8	69.7	31.3	15.5	4.8	11.1	2.7
Willow	*10.4*	...	*4.6*	*3.9*	*1.2*	*0.7*	...	...	...
Black walnut	*17.9*	...	*2.5*	*1.6*	*2.7*	*5.0*	*6.0*	...	...
Black cherry	26.5	...	19.0	4.4	3.1	...	...	...	...
American elm	58.3	...	23.6	14.3	8.3	7.9	4.3	...	...
Other elms	111.7	...	62.7	24.6	9.1	6.9	3.3	5.1	...
River birch	97.5	...	26.8	22.7	16.4	6.3	8.4	16.8	...
Hackberry	215.4	...	64.7	58.2	41.1	25.1	13.2	13.1	...
Black locust	8.9	...	2.4	1.4	5.1	...	...	...	...
Other locusts	5.1	...	1.6	2.3	1.2	...	...	...	...
Sassafras	3.1	...	...	...	...	3.1	...	...	...
Holly	2.3	...	2.3	...	...	...	...	...	...
Other commercial	14.5	...	3.3	9.3	2.0	...	...	...	...
Total hardwoods	13,623.9	...	4,477.7	3,269.1	2,301.5	1,410.9	878.9	1,146.6	139.2
All species	37,087.9	5,679.2	10,407.4	8,019.8	5,482.0	3,318.6	1,903.0	2,061.2	216.6

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

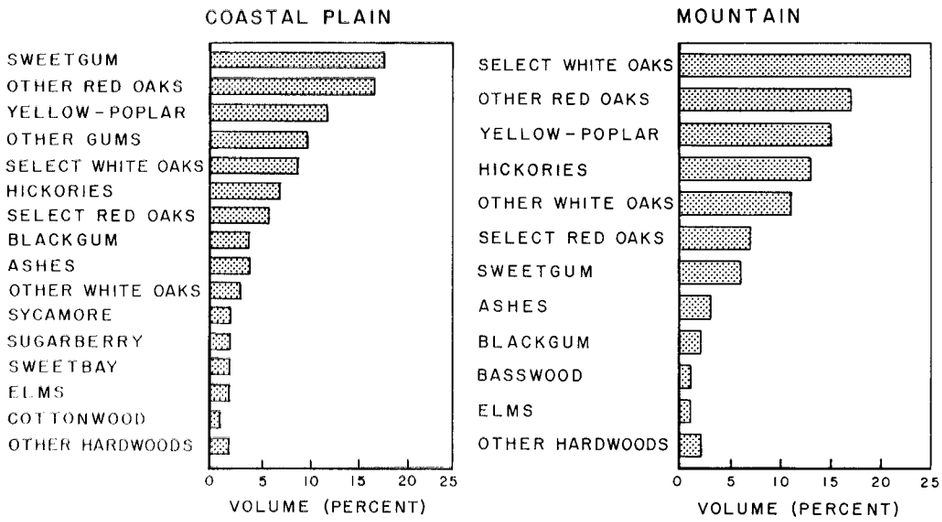


Figure 25. — *Distribution of tree grades one and two hardwood sawtimber volume by species, Alabama, 1990.*

Fully stocked loblolly pine stand.

COMPONENTS OF CHANGE

Change in the volume of trees on Alabama's timberland depends on inter-relationships between growth, removals, and mortality. The SO-FIA uses three terms to discuss changes in volume: gross growth, net growth, and net change. All three are expressed as average annual estimates for the period from the year of the previous inventory through the year prior to the present inventory and may be conceptualized as follows:

GROSS GROWTH = Survivor Growth + Ingrowth + Growth on Removals + Growth on Mortality

(In the case of growing-stock and sawtimber estimates, the net difference between trees entering and departing the growing stock class, or "cull increment," is added or subtracted as appropriate.)

NET GROWTH = Gross Growth – Mortality

NET CHANGE = Net Growth – Removals

The ratio of net growth to removals is one measure of a forest's capacity to expand in volume. A ratio greater than 1.0 to 1.0 indicates increases in volume (growth exceeds removals). A ratio less than 1.0 to 1.0 indicates overcutting (removals exceed growth) and decreases in volume.

Inventory Volume

Total gross growth associated with Alabama's timberland averaged 1.5 billion cubic feet over the past 8 years (table XVIII). The volume of trees that died (mortality) was 268.3 million cubic feet. Total net growth averaged 1.2 billion cubic feet, an increase of 20 percent since the previous inventory period. This reverses the negative trend (minus 13 percent) reported in 1982. Removals averaged 1.1 billion cubic feet from 1982 to 1989, an increase of 20 percent. Net growth exceeded removals by 8 percent, leading to a positive net change in inventory volume (table XIX). All but the West-Central region had positive net changes in inventory volume, but there was only a small net change in the North-Central region. Trends in the net growth of softwoods and hardwoods have been very different over the past two inventory periods.

Between 1972 and 1982, softwood net growth decreased by 17 percent (fig. 26). This decline was a major reversal of findings from previous inventories that indicated large increases in growth. The primary cause for the decrease in growth was that softwood harvests had risen sharply as large areas of mature pine stands were being harvested, and forest management had begun to intensify. As older stands with high levels of growth per acre were replaced with young stands with no merchantable growth, growth declined. (Trees do not contribute to growth until they reach the SO-FIA merchantability limit of 5.0 inches in d.b.h., at which time the entire volume of the tree adds to growth.) At the same time, softwood mortality more than doubled as aging stands were more susceptible to damage by insects and disease. Mortality was an important factor in the softwood growth decrease because the entire volume of trees that die is subtracted from gross growth to calculate net growth. The increase in softwood mortality equated to more than half of the decrease in net growth.

Between 1982 and 1990, softwood growth increased by 2 percent. While harvesting continued to increase, ingrowth from stands established in the 1970's and early 1980's boosted softwood growth. Further increases in growth are expected because of the acceleration of new stand establishment during the 1980's.

Softwood removals in Alabama have been increasing over the past two decades and now total 726.0 million cubic feet. The largest expansion occurred between the 1972 and 1982 inventories when removals increased by 46 percent (compared to a 13-percent increase recently). Over the past three decades, the

Table XVIII.—*Average net annual growth, average annual removals, and average annual mortality of live trees by species group and ownership, Alabama, 1982 to 1989**

	All owners	Public	Forest industry	Nonindustrial private†
	Million cubic feet			
Net growth				
Softwood	650.8	21.4	207.8	421.5
Hardwood	560.8	31.9	92.4	436.6
Total	1,211.6	53.3	300.2	858.1
Removals				
Softwood	726.0	22.7	206.3	497.1
Hardwood	390.5	8.7	+92.5	289.4
Total	1,116.6	31.4	298.7	786.5
Mortality				
Softwood	123.1	8.1	30.2	84.8
Hardwood	145.2	7.5	27.7	110.1
Total	268.3	15.5	57.9	195.0

*Rows and columns may not sum to totals due to rounding.
†Includes net growth, removals, and mortality on timberland leased to forest industry.

Table XIX.—*Components of average annual change in the volume of live trees by species group and region, Alabama, 1982 to 1989**

Region	Species group	Survivor growth†	Ingrowth‡	Growth on removals	Growth on mortality	Mortality	Timberland removals	Land-clearing removals	Net changes§
		Million cubic feet							
Southwest–South	Softwood	59.3	19.0	17.2	3.7	10.0	74.5	2.3	12.4
	Hardwood	42.5	9.7	5.8	5.3	16.6	24.4	0.8	21.5
	Total	101.8	28.7	23.0	9.0	26.6	98.9	3.1	33.9
Southwest–North	Softwood	100.3	27.5	26.9	7.4	18.5	126.3	0.2	17.1
	Hardwood	78.9	13.5	16.7	4.6	20.2	84.5	0.9	8.1
	Total	179.2	41.0	43.6	12.0	38.7	210.8	1.1	25.2
Southeast	Softwood	122.4	34.2	56.3	11.7	31.5	199.9	7.1	–13.9
	Hardwood	127.7	26.9	23.0	8.4	35.3	102.2	5.3	43.2
	Total	250.1	61.1	79.3	20.1	66.8	302.1	12.4	29.3
West-Central	Softwood	71.0	16.5	25.4	6.9	24.2	134.9	1.8	–41.1
	Hardwood	95.6	14.3	11.8	5.2	32.4	80.0	4.3	10.2
	Total	166.6	30.8	37.2	12.1	56.6	214.9	6.1	–30.9
North-Central	Softwood	70.4	17.6	30.9	8.8	28.7	127.9	23.0	–51.9
	Hardwood	100.0	16.8	10.0	4.5	19.0	46.0	9.7	56.6
	Total	170.4	34.4	40.9	13.3	47.7	173.9	32.7	4.7
North	Softwood	30.1	5.8	2.3	2.3	10.2	24.2	4.0	2.1
	Hardwood	72.8	7.8	1.8	2.4	21.7	23.9	8.6	30.6
	Total	102.9	13.6	4.1	4.7	31.9	48.1	12.6	32.7
All regions	Softwood	453.5	120.6	159.0	40.8	123.1	687.7	38.4	–75.3
	Hardwood	517.5	89.0	69.1	30.4	145.2	361.0	29.6	170.2
	Total	971.1	209.6	228.1	71.2	268.3	1,048.8	68.0	94.9

*Rows and columns may not sum to totals due to rounding.
†Includes nongrowth trees.
‡Includes ongrowth trees.
§Equal to: survivor growth + ingrowth + growth on removals + growth on mortality – mortality-timberland removals – land-clearing removals.

softwood growth-to-removals ratio has changed as follows:

Period	Growth-to-removals ratio
1963 to 1971	1.8 to 1.0
1972 to 1981	1.0 to 1.0
1982 to 1989	0.9 to 1.0

The most recent inventory indicates that most of the negative net change in softwood inventory volume is taking place in the 6- to 12-inch diameter classes on nonindustrial private timberland (fig. 27). The West-Central and North-Central regions contain most of the counties experiencing overcutting of softwoods (fig. 28). It is important to note the improvement in the growth-to-removals relationship that is evident in southwestern counties where ingrowth from stands planted during the 1970's is having an impact. It is likely that similar improvements will occur in some central counties.

Hardwood growth in Alabama was sluggish between 1972 and 1982, when a 5-percent decrease was reported (fig. 29). Both the 1972 and 1982 inventories recorded low hardwood growth (on a per-acre basis) in Alabama relative to some other regions of the South. Also, hardwood mortality had increased by more than 50 percent. Harvesting of hardwoods has risen considerably over the past decade as demand for hardwoods has increased, mainly for use in the manufacture of pulp and paper. Between the two most recent inventories, hardwood removals increased by 34 percent. Increased hardwood cutting has stimulated growth, which increased by 50 percent between the 1982 and 1990 inventories. At the same time, hardwood mortality decreased by 10 percent. The following changes have contributed to the improved vigor of Alabama's hardwood forests:

- decreased area of overstocked stands
- increased area of fully stocked stands
- decreased area of cull stands
- decreased area of older slow-growing stands
- decreased number of small trees in the inventory

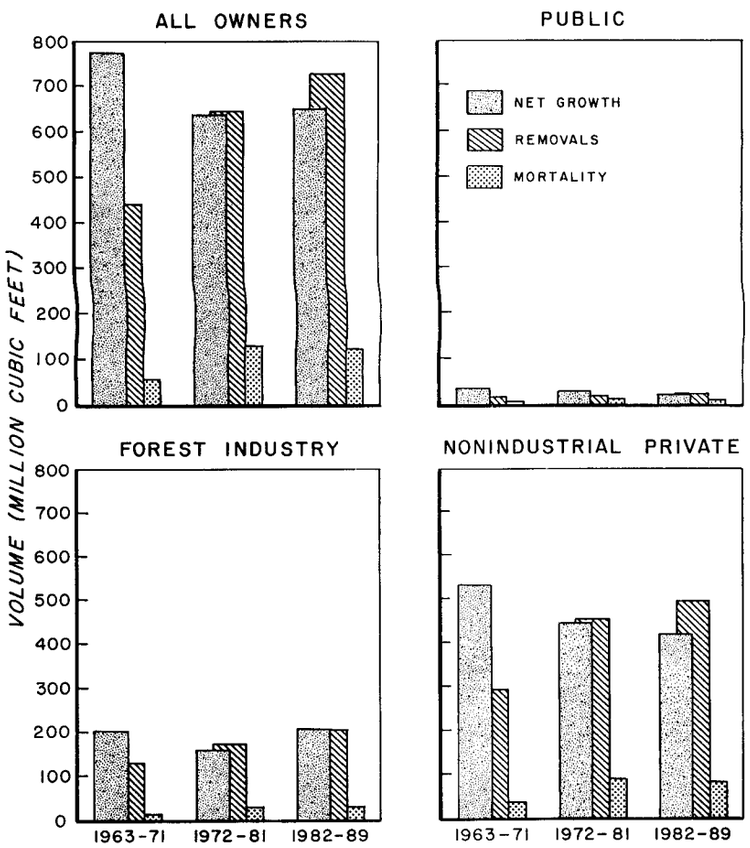


Figure 26. — *Average net annual growth, average annual removals, and average annual mortality of live softwoods by ownership, Alabama, 1963 to 1971, 1972 to 1981, and 1982 to 1989,*

- decreased number of cull trees in the inventory
- decreased mortality

These changes have allowed forest landowners to capitalize on hardwood growth potential that was not previously utilized.

The improvement in growth has meant that the growth-to-removals ratio for hardwoods remains favorable at 1.4 to 1.0, with good conditions over most of the State. Counties with relatively tight growth-to-removals relationships are beginning to show up along the Tennessee-Tombigbee Waterway. Positive net change in hardwood inventory has occurred in the 10-inch and larger diameter classes.

Sawtimber Volume

Gross growth of sawtimber was 5.0 billion board feet (appendix tables 19 and 20). Mortality was 489.0 million board feet, making net growth equal to 4.5 billion board feet.

Exact comparisons of sawtimber growth estimates over time are not possible because of the modification of SO-FIA's definition of growing stock that was implemented in the 1990 inventory (see Inventory Methods section of appendix). The change also makes the estimation of sawtimber removals tenuous because trees that were cut during the period between inventories could not be inspected to determine a tree class. To overcome this pitfall, trees of sawtimber size that were cut and utilized (based on the field forester's determination) were assumed to be growing-stock trees in the calculation of removals. This assumption has probably caused an overestimate of sawtimber removals because it is likely that some of the trees cut and used were either rough or rotten trees (cull).

Although exact comparisons are not possible, it can be concluded that net growth has exceeded removals in Alabama since 1982. The current estimates indicate negative net change in sawtimber inventory has occurred in the West-Central region (table XX), and these findings are most likely valid. General trends in net growth, removals, and mortality of sawtimber have probably paralleled trends in live-tree change components.

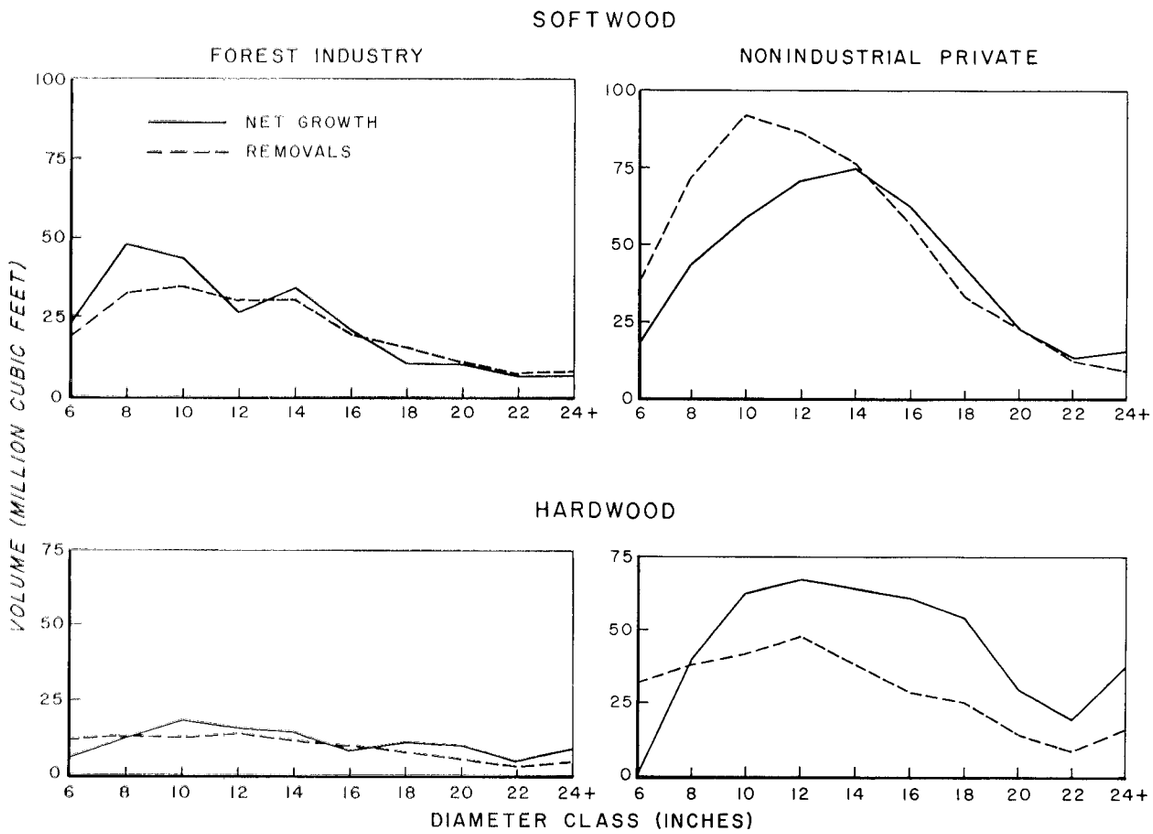


Figure 27. — *Average net annual growth and average annual removals of live trees by ownership, species group, and diameter class for private owners, Alabama, 1982 to 1989.*

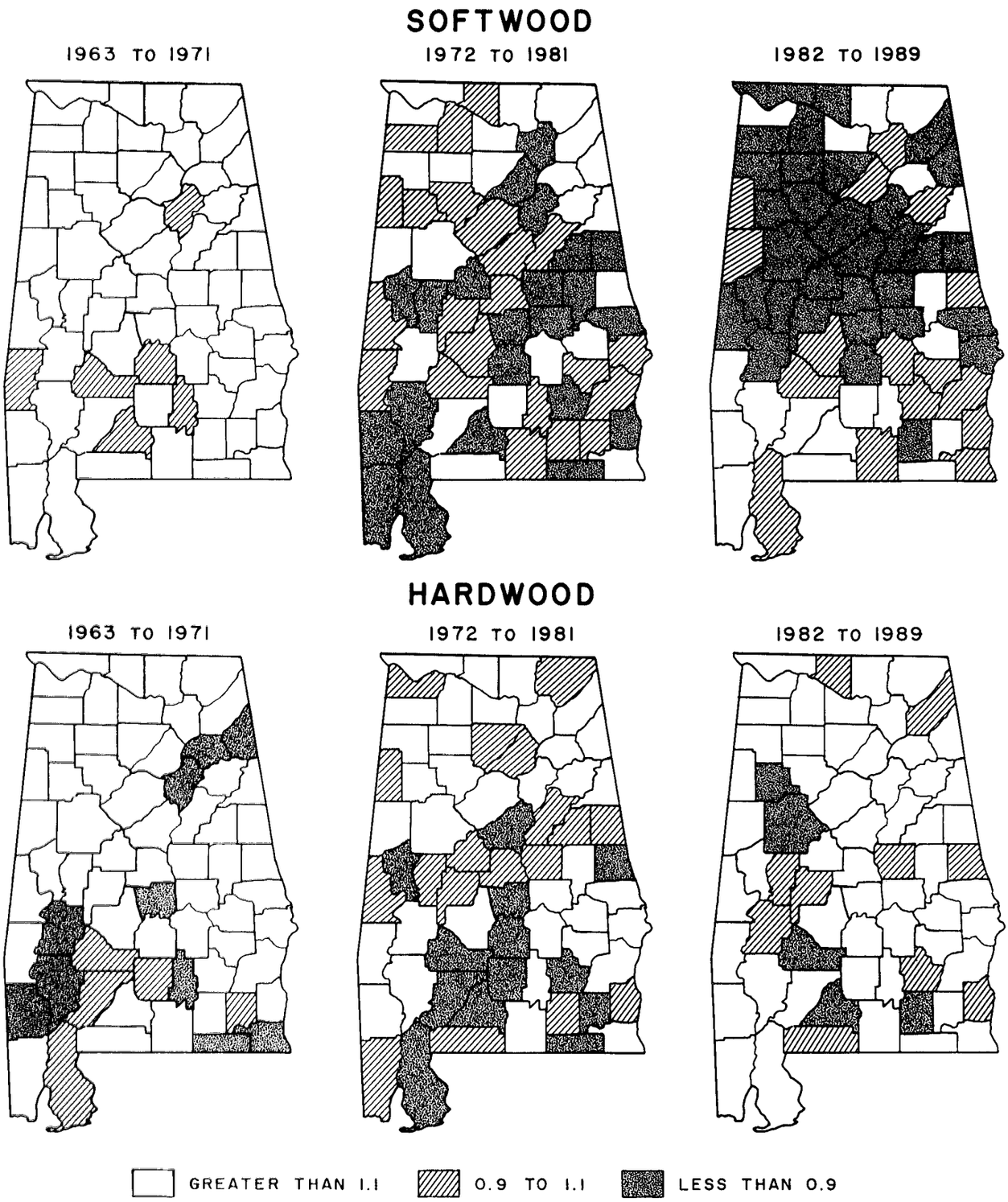


Figure 28. — *Ratio of average net annual growth to average annual removals of live trees by species group and county, Alabama, 1963 to 1971, 1972 to 1981, and 1982 to 1989.*

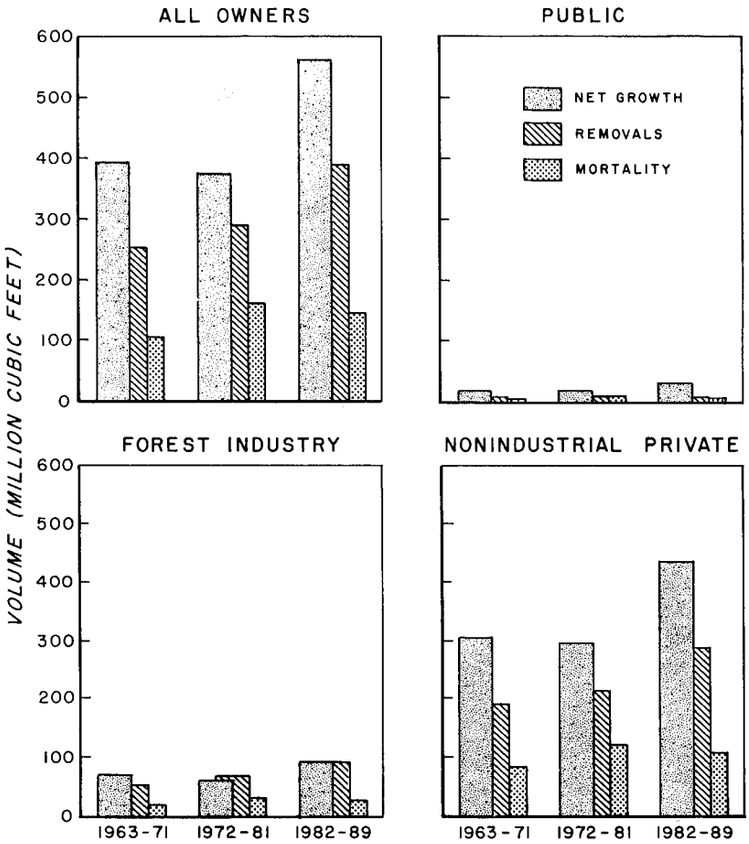


Figure 29. — *Average net annual growth, average annual removals, and average annual mortality of live hardwoods by ownership, Alabama, 1963 to 1971, 1972 to 1981, and 1982 to 1989.*

Table XX.—*Components of average annual change in the volume of sawtimber by species group and region, Alabama, 1982 to 1989**

Region	Species group	Survivor growth†	Ingrowth‡	Growth on removals	Growth on mortality	Cull increment	Mortality	Timberland removals	Land-clearing removals	Net change§
					Million board feet¶					
Southwest–South	Softwood	162.6	108.0	70.9	9.3	–4.6	25.3	282.8	2.1	45.2
	Hardwood	64.6	43.8	18.5	5.0	–22.9	20.6	61.9	1.4	70.9
	Total	227.2	151.8	89.4	14.3	–27.5	–45.9	344.7	3.5	116.1
Southwest–North	Softwood	342.1	181.1	132.1	13.0	–18.8	37.6	563.9	0.4	85.2
	Hardwood	161.9	105.7	56.6	5.4	–17.6	30.7	250.6	3.6	62.3
	Total	504.0	286.8	188.7	18.4	–36.4	–68.3	814.5	4.0	147.5
Southeast	Softwood	347.5	225.1	235.4	27.9	–29.2	73.3	803.9	23.6	–35.7
	Hardwood	161.0	170.1	71.6	9.4	–40.5	43.3	283.8	9.3	116.2
	Total	508.5	395.2	307.0	37.3	–69.7	–116.6	1,087.7	32.9	80.5
West Central	Softwood	225.3	130.3	120.9	19.3	–7.2	64.2	537.3	7.3	–105.8
	Hardwood	181.0	107.2	45.4	10.3	–36.3	59.8	214.8	5.4	100.2
	Total	406.3	237.5	166.3	29.6	–43.5	–124.0	752.1	12.7	–5.6
North Central	Softwood	213.9	131.3	130.5	22.3	–13.6	65.1	444.9	80.1	–78.5
	Hardwood	131.0	140.6	28.5	4.3	–53.7	19.9	117.4	19.4	201.4
	Total	344.9	271.9	159.0	26.6	–67.3	85.0	562.3	99.5	122.9
North	Softwood	73.7	47.0	10.9	6.2	–3.2	18.1	102.1	12.2	8.6
	Hardwood	115.3	76.3	8.5	3.3	–32.5	40.1	86.5	19.8	89.5
	Total	189.0	123.3	19.4	9.5	–35.7	58.2	188.6	32.0	98.1
All regions	Softwood	1,365.0	822.8	700.7	98.0	–76.6	283.5	2,734.9	125.8	–81.1
	Hardwood	814.8	643.6	229.0	37.7	–203.4	214.4	1,015.1	59.0	640.0
	Total	2,179.8	1,466.4	929.7	135.7	–280.0	497.9	3,750.0	184.8	558.9

*Rows and columns may not sum to totals due to rounding.
†Includes nongrowth trees.
‡Includes ongrowth trees.
§Equal to: survivor growth + ingrowth + growth on removals + growth on mortality–cull increment–mortality–timberland removals–land-clearing removals.
¶International ¼-inch Rule.

DISTURBANCE

Just over one-third of the timberland in Alabama, or 8.0 million acres, showed signs of harvest or management activity over the period since the previous inventory (table XXI). Eight out of 10 acres of the disturbed timberland were harvested, for an average of 772,900 acres per year. (Stands where only a few trees were removed for firewood or other use are excluded from the estimate of harvest area.) Harvesting was divided between clearcutting (45 percent of the harvested area) and partial cutting (55 percent). The partial cut category includes a wide range of practices, such as selection cuts, diameter-limit cuts, salvage cuts, and highgrading. Partial cutting was most common on nonindustrial private timberland, whereas clearcutting was most prevalent on forest industry timberland.

The current estimate of harvest area in Alabama represents an increase of about one-third over the period prior to 1982. A large proportion of the increase occurred on nonindustrial private timberland in the West-Central and Southeast inventory regions (fig. 30). The increase on nonindustrial land counters concerns by some about whether the nonindustrial private owner would expand harvest once forest industries began to reach an equilibrium in the area harvested on their own timberland.

The "other management" category of disturbance includes practices such as precommercial and com-

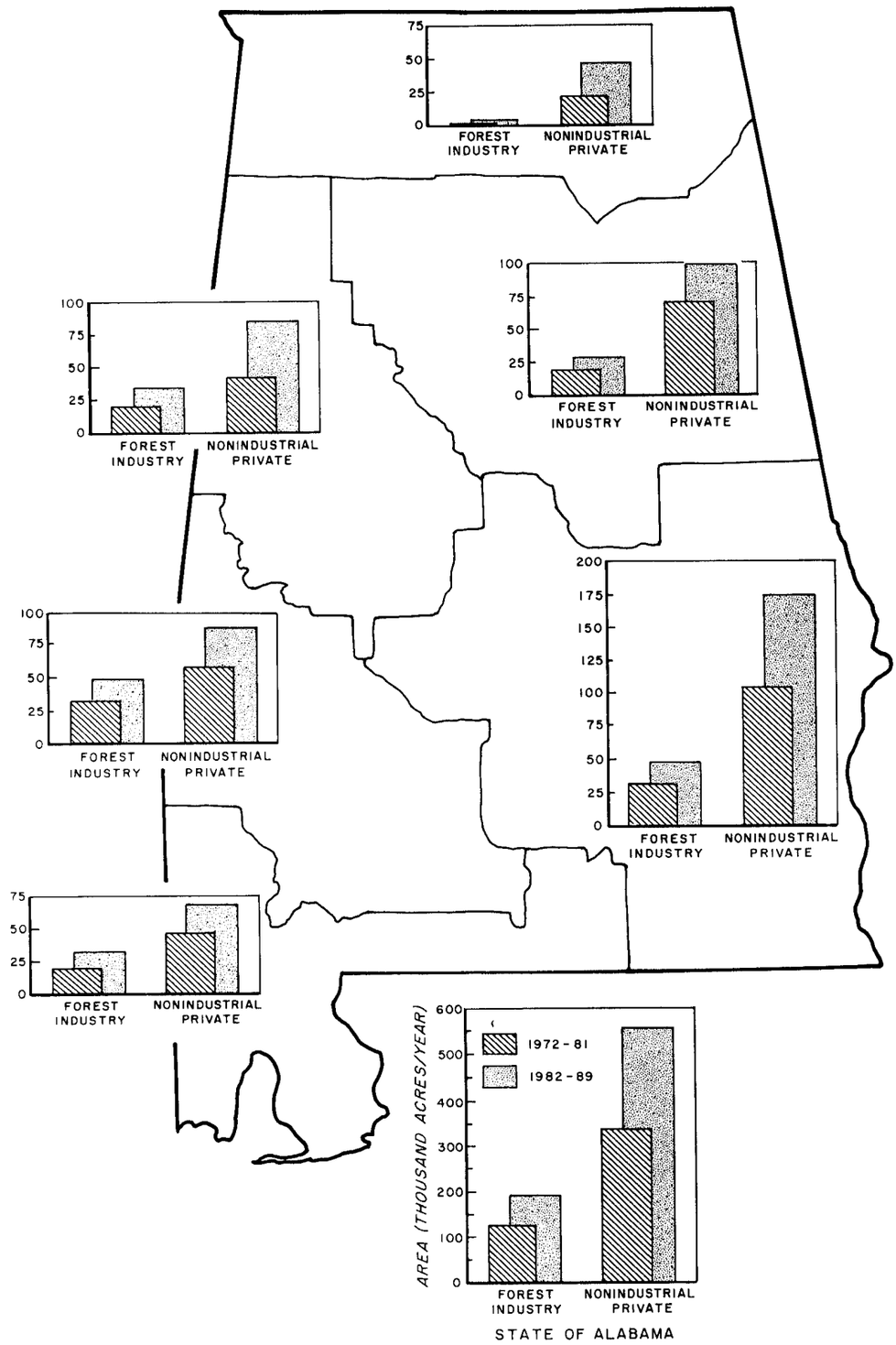


Figure 30. — *Average annual area (thousand acres per year) of privately owned timberland harvested by region, Alabama, 1972 to 1981 and 1982 to 1989. Note: scale on the y-axis of the graph for the State of Alabama differs from the others.*

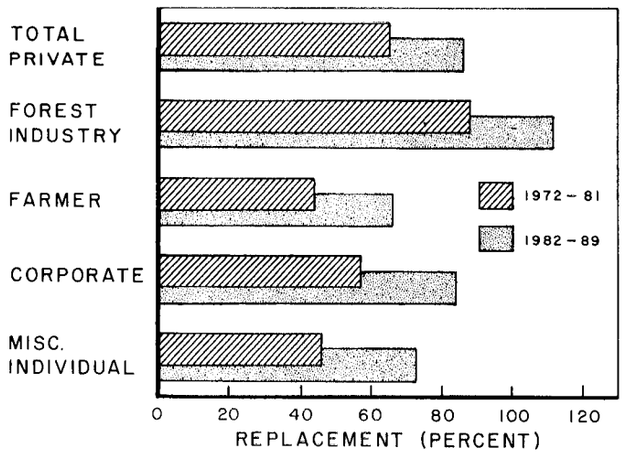


Figure 31. — *Percent replacement of privately owned pine forests on commercially harvested pine-site timberland by ownership, Alabama, 1972 to 1981 and 1982 to 1989.*

Table XXI.—*Area of timberland by ownership and type of harvest or management activity, Alabama, 1982 to 1989**

Ownership	Total	No treatment	Harvest†		Other management‡
			Clearcut	Partial cut	
	Thousand acres				
Public	1,162.1	859.2	69.8	94.0	139.1
Forest industry	4,794.9	2,653.6	990.5	622.5	528.3
Nonindustrial private§	15,975.1	10,392.1	1,830.1	2,817.7	935.2
All owners	21,932.0	13,904.8	2,890.4	3,534.2	1,602.6

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

†Clearcut includes seed tree and shelterwood cuts. Partial cut includes selection, diameter-limit, and salvage cuts; some heavy thinnings of dominant and codominant trees in sawtimber stands may also be included.

‡Includes commercial thinning, precommercial thinning, stand improvement cuts (such as release of desirable species), and stand conversion. In stands where both harvest and management activities were present, such as partial cut and stand improvement, the associated timberland was included in the harvest category.

§Includes timberland leased to forest industry.

mercial thinning, stand improvement, and stand conversion. Timberland with management (other than harvest) totaled 1.6 million acres, or 7 percent of the timberland.

Evidence of natural disturbance was also recorded for sample locations that showed significant damage due to wildfire, flood, insects, or disease. There were 146,800 acres classified as showing signs of natural disturbance.

An analysis was conducted to evaluate the success of pine regeneration on privately owned upland sites capable of supporting pine forests (termed "pine sites"). The analysis was prompted by concern over pine timber supply and regeneration of nonindustrial pine forests (USDA FS 1988). The results indicate pine regeneration success has improved significantly for all of the private owner groups. The measure used to gauge regeneration is the pine reforestation rate—defined as the area of harvested pine-site timberland that exhibits a high stocking of pine divided by the total area of harvested pine forest. In the absence of negative forces, such as drought or fusiform rust [*Cronartium quercum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme*], stands with high pine stocking following harvest will usually develop into pure pine stands. For all owners combined, the pine reforestation rate

increased from 65 percent to 86 percent between the two most recent inventory periods (fig. 31). Forest industry is now regenerating more acreage than is harvested (112) percent) because oak–pine and hardwood stands are being converted to pine. For nonindustrial owners, the reforestation rate went from 47 percent to 73 percent. Though still not optimal, conditions on nonindustrial private land have improved remarkably (McWilliams 1991). Conditions are worst on farmer-owned land but are being offset by planting of marginal croplands under the CRP.

TIMBER TREATMENT OPPORTUNITIES

Each SO-FIA sample location has been assigned a timber-related treatment opportunity based on existing stand conditions. The assessment was made by a computer algorithm solely on the basis of general guidelines designed to quantify opportunities for improving or enhancing overall timber quality and growth. The algorithm uses broad concepts that apply to a wide range of conditions found in timber stands in the South Central United States. Two points to remember when attempting to understand the treatment opportunities are: (1) basic soil-site-species relationships are not considered in the assessments, and (2) the assessment is made with no regard to specific owner objectives or the feasibility of implementing the treatment. Treatment opportunities are divided into three groups: stand establishment, intermediate treatments, and final harvest.

About half of the privately owned timberland in Alabama is in good condition with adequate stocking of growing-stock trees and is classified with no treatment opportunity (table XXII). Stand establishment was assigned to 28 percent of the timberland with opportunities (3.0 million acres) and was split between regeneration and stand conversion. Intermediate treatments comprised 22 percent of the timberland with opportunities (2.3 million acres). Almost two-thirds of the timberland in the intermediate treatment category was assigned to stocking improvements, such as cleaning, release, and cull-tree removal. Final harvest opportunities account for the remaining half of the timberland with treatment opportunities (5.5 million acres). But most of the opportunities for final harvest are assigned to salvage cuts, which are defined to include stands where at least 80 percent of the growing-stock volume is contributed by damaged or diseased trees or with at least 500 cubic feet of salvable dead volume. Regeneration cuts were an opportunity on only 0.7 million acres. (A stand must be sawtimber size, well stocked with trees, and contain at least 5,000 board feet per acre to be assigned a regeneration cut opportunity.)

Table XXII.—*Area of privately owned timberland by forest type, ownership, and treatment opportunity, Alabama, 1990**

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‡	Regeneration cut	Salvage cut
	Thousand acres								
Planted pines§									
Forest industry	1,544.7	853.9	16.9	109.7	22.5	270.4	40.6	73.0	157.7
Nonindustrial private¶	1,846.2	1,034.3	108.7	218.7	11.2	137.0	12.6	91.0	232.7
Total	3,390.9	1,888.2	125.6	328.4	33.7	407.4	53.2	164.0	390.4
Natural pine**									
Forest industry	865.2	435.2	27.1	16.0	...	30.2	33.4	34.7	288.5
Nonindustrial private	2,868.7	1,515.9	136.7	122.3	5.7	146.6	76.9	205.8	658.8
Total	3,733.9	1,951.1	163.8	138.3	5.7	176.7	110.4	240.6	947.3
Oak–pine									
Forest industry	956.9	456.1	39.1	128.9	...	29.5	80.2	45.1	178.1
Nonindustrial private	3,203.4	1,666.5	259.6	270.2	11.1	45.6	270.7	75.2	604.4
Total	4,160.3	2,122.6	298.7	399.1	11.1	75.1	350.9	120.3	782.5
Oak–hickory									
Forest industry	946.7	378.6	62.5	144.2	11.3	11.4	126.2	11.9	200.7
Nonindustrial private	6,333.1	2,872.6	548.3	567.3	12.1	63.9	679.4	45.4	1,544.1
Total	7,279.8	3,251.2	610.8	711.5	23.4	75.3	805.6	57.2	1,744.8
Bottomland hardwoods††									
Forest industry	475.8	150.4	34.7	27.0	...	5.7	36.0	60.5	161.3
Nonindustrial	1,718.1	556.1	103.6	63.2	...	53.7	106.8	55.8	779.1
Total	2,193.9	706.5	138.4	90.2	...	59.3	142.9	116.3	940.4
Total private									
Forest industry	4,789.3	2,274.2	180.3	425.8	33.9	347.2	316.4	225.2	986.3
Nonindustrial	15,969.5	7,645.3	1,156.9	1,241.8	40.1	446.7	1,146.5	473.2	3,819.1
Total	20,758.9	9,919.5	1,337.2	1,667.5	73.9	793.9	1,463.0	698.4	4,805.4

*Rows and columns may not sum to totals due to rounding.
†Stands containing a considerable stocking of damaged or diseased trees but with insufficient merchantable volume to warrant a salvage cut.
‡Clean, release, or cull-tree removal.
§Includes longleaf–slash and loblolly–shortleaf pine stands having evidence of artificial origin.
¶Includes timberland leased to forest industry.
**Includes longleaf–slash and loblolly–shortleaf pine stands having no evidence of artificial origin.
††Includes oak–gum–cypress and elm–ash–cottonwood forest types.

TIMBER PRODUCTS OUTPUT

Alabama's forests produced 1.2 billion cubic feet of timber products output in 1989 (table XXIII). The State's output was 68 percent softwood and 32 percent hardwood. Information on timber products output was compiled from severance tax records, except for pulpwood output, which is based on a report by Hutchins (1991).

Sawlog and veneer-log output increased by 32 percent between 1982 and 1989 (fig. 32) and now comprises 28 percent of the total industrial output. On a percentage basis, the increases were similar for both softwoods and hardwoods. Softwoods continue to contribute most of the sawlog and veneer-log output, with 82 percent of the total.

Pulpwood dominated timber products output with over half of the total output for 1989. Total pulpwood output did not change much between 1982 and 1989, increasing by only 2 percent. However, the species mix of pulpwood output changed considerably. In 1982, the breakdown was 70 percent softwood and 30 percent hardwood, compared to 59 percent softwood and 41 percent hardwood in 1989. The change was caused by a 15-percent decrease in softwood output and a 41-percent increase in hardwood output (fig. 33). This reflects a shift in the raw material demanded by pulp companies as the use of bleached pulp processes has become more widespread.

Sixteen percent of the timber products output was made up of green chips. The output of green chips increased by 22 percent between 1982 and 1989. The current output is 75 percent softwood and 25 percent hardwood. No long-term trend information for the major species groups is available from severance tax records because collection of these data did not begin until 1987. Since 1987, the output of hardwood chips has been fairly level.

Table XXIII.—*Output of primary timber products by product and species group, Alabama, 1989*

Product and species group	Standard units	Number	Million cubic feet
Sawlogs and veneer logs*			
Softwood	Million board feet†	1,660.2	280..7
Hardwood	Million board feet	362.7	62.0
Total	Million board feet	2,022.9	342.7
Poles and piling*			
Softwood	Million board feet	81.8	13.8
Hardwood	Million board feet	...	...
Total	Million board feet	81.8	13.8
Pulpwood‡			
Softwood	Standard cords	4,963,400	402.0
Hardwood	Standard cords	3,478,600	278.3
Total	Standard cords	8,442,000	680.3
Green chips*			
Softwood	Standard cords	1,795,800	145.5
Hardwood	Standard cords	605,349	48.4
Total	Standard cords	2,401,149	193.9
All products§			
Softwood			842.0
Hardwood			388.7
Total			1,230.7

*Based on severance tax records and common conversion factors; crossties, switch ties, and coal mine posts are included as hardwood output; poles and piling are included as softwood output; stump wood is excluded.

†International ¼-inch Rule.

‡Vissage, 1991

§Composed of products subject to severance tax.

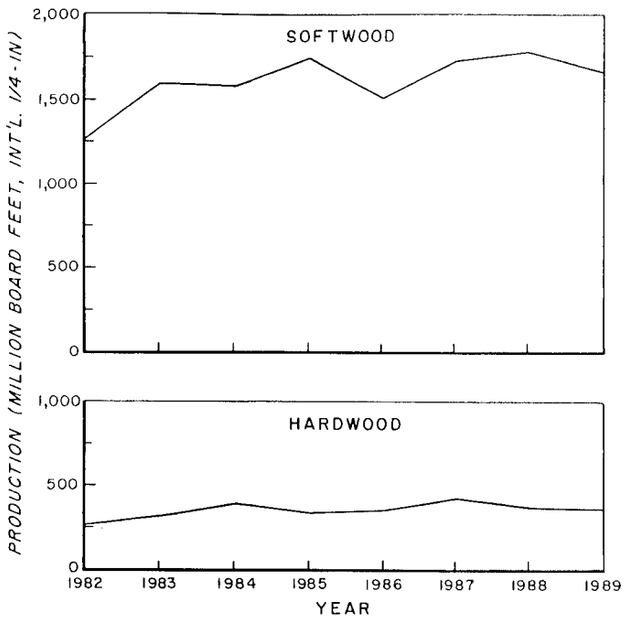


Figure 32. — *Sawlog and veneer log production, Alabama, 1982 to 1989 (source: Alabama Forestry Commission severance tax reports).*

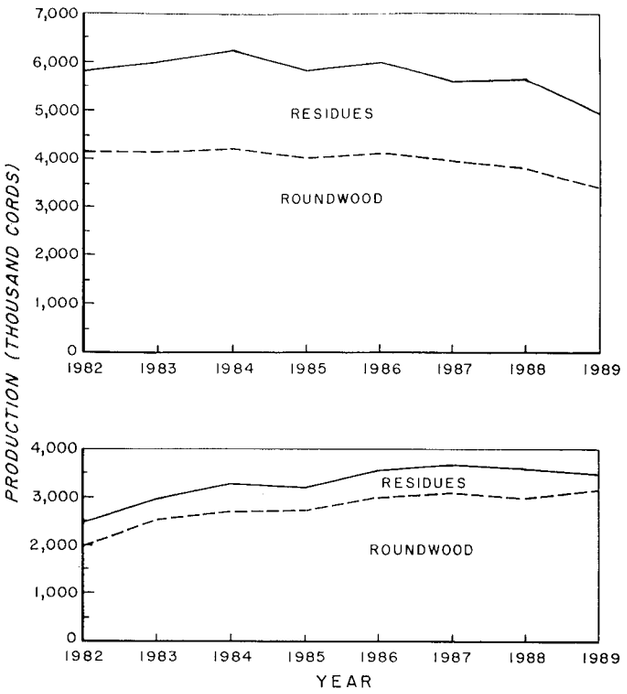


Figure 33. — *Pulpwood production from roundwood and residues, Alabama, 1982 to 1989 (source: USDA Forest Service, southern pulpwood production reports).*

FOREST RESOURCE OUTLOOK

The past 20 years have seen tremendous change in the character of Alabama's forest, and this change has accelerated rapidly over the last 8 years. The major force underlying change has been the impact of human interaction with the forest. A strong demand for Alabama's timber has led to increased harvesting of both softwoods and hardwoods. At the same time, management has intensified to a level unprecedented in Alabama's history. Most of the management intensification has been aimed at pine forests and is occurring on the more productive sites common in the Coastal Plain regions. Increased harvesting and intensified management have affected softwood and hardwood resources in different ways.

The period between 1972 and 1982 was characterized by the maturing of large areas of Alabama's pine stands, a more than doubling of softwood mortality, and a sharp increase in softwood harvest. New stands of pine were often established using intensive management systems. These developments have had a profound effect on the State's softwood resource. The positive effects of conversion to younger stands have shown up in statistics relating to timberland area, such as the increase in planted pine acreage, but are not apparent in statistics on timber volume. The increase in softwood growth between the 1982 and 1990 inventories was not enough to offset expanded removals, and consequently, the softwood inventory decreased. The situation that has unfolded in the two southwestern regions provides insight into potential developments elsewhere. Softwood inventory volume in those regions showed little change from 1972 to 1982 and then increased by 8 percent from 1982 to 1990 as a result of ingrowth from young pine stands that were previously premerchantable in size. This sort of improvement is possible in the West-Central region where reforestation has been widespread, although the degree of improvement will depend on the amount of ingrowth, as well as future trends in removals. It is questionable whether the overcut situation that has developed in the North-Central region will be overcome soon, as pine reforestation efforts may not be enough to offset the effect of expanded removals.

During the 1970's, Alabama's hardwood forests were showing signs of neglect and a general loss of vigor. Increased hardwood demand for utilization as chips, pulp, and paper has led to expansion of hardwood removals. So far, Alabama's hardwood resource has been resilient in the face of increased removals, even though there has been little change in management intensity. It is fortunate that, on a broad scale, some of the effects of increased hardwood removals mimic the effects of intensified manage-

ment. The impact of these effects is very much in line with the need for hardwood improvement discussed in the bulletin covering the 1972 inventory (Murphy 1973). For example, expansion of harvest has led to a general improvement in stocking. The result has been a significant increase in hardwood growth; however, it is unlikely that the increase will be sustained. In the previous inventory period, hardwood growth in Alabama was below levels found in some comparable regions of the South (on a per-acre basis). Current findings indicate that growth rates are now more comparable with those regions.

Decreased area of hardwood stands is another sign that expansion in hardwood volume could be temporary. There appear to be only limited sources of new quality hardwood stands. On upland sites of the Coastal Plain, hardwood forests often originate following the harvest of pines. Such sites usually contain an inferior manageable stand and are often converted to pine if operable for pine management. New sources of bottomland sites are rare.

Expansion of hardwood removals is likely to limit the availability of hardwood volume in some areas. Some counties near the Tennessee-Tombigbee Waterway are showing very tight growth-to-removal ratios. The future for hardwoods will depend on trends in harvest levels, changes in the area of hardwood forest types, regeneration quality, and management of existing stands. It is possible that increased demand for hardwoods will provide incentive for intensification of hardwood management.

LITERATURE CITED

Beltz, Roy C. 1975. Alabama's timber resources updated, 1975. Resour. Bull. SO-55. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 10 p.

Braun, E. Lucy. 1950. Deciduous forests of eastern North America. New York: Hafner Publishing Company. 596 p.

Clark, Alexander, III.; Phillips, Douglas R.; Frederick, Douglas J. 1985. Weight, volume, and physical properties of major hardwood species in the Gulf and Atlantic Coastal Plains. Res. Pap. SE-250. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 66 p.

Coleman, W. Dangerfield; Edwards, M. Boyd. 1991. Economic comparison of natural and planted regeneration of loblolly pine. Southern Journal of Applied Forestry. 15: 125–127.

Cruikshank, James W. 1940a. Forest resources in the Tennessee Valley of north Alabama. For. Sur. Rel. No. 49. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 39 p.

Cruikshank, James W. 1940b. Forest resources of north central Alabama. For. Sur. Rel. No. 50. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 36 p.

Eldredge, I.F. 1934. The forest survey in the South. For. Sur. Rel. No. 1. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 5 p.

Eldredge, I.F. 1938. Forest resources of southwest Alabama. For. Sur. Rel. No. 35. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 35 p.

Farrar, Robert M., Jr. ed. 1990. Proceedings of the symposium on management of longleaf pine; 1989 April 4-6; Long Beach, MS. Gen. Tech. Rep. SO-75. New Orleans, LA: U.S. Department of Agriculture, Southern Forest Experiment Station. 293 p.

Grosenbaugh, L.R. 1964. STX-FORTRAN 4 program for estimates of tree populations from 3-p sample-tree measurements. Res. Pap. PSW-13. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 49 p.

Hanks, Leland H. 1976. Hardwood tree grades for factory lumber. Res. Pap. NE-333. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 81 p.

Harper, Roland M. 1943. Forests of Alabama. Monograph 10. Geological Survey of Alabama. [Publishing city, State: publisher]. 230 p.

Hodgkins, Earl J.; Cannon, Timothy L.; Miller, W. Frank. 1976. Forest habitat regions from satellite imagery: States of Alabama and Mississippi. [Map.] Supplement to Southern Cooperative Series Bull. 210. Auburn, AL and Mississippi State, MS: Alabama Agricultural Experiment Station and Mississippi Agriculture and Forestry Experiment Station.

Hutchins, Cecil C., Jr. 1991. Southern pulpwood production, 1989. Resour. Bull. SE-119. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 28 p.

Kelly, John F. 1991. USDA Forest Service Survey Methods. In: Alabama's forest resources: past, present and future; 1991 May 29–30; Auburn University, AL. Montgomery, AL: Alabama Forest Resources Center p. 7–15.

Little, Elbert L., Jr. 1979. Checklist of United States trees (native and naturalized) Agric. Handb. No. 541. Washington, DC: U.S. Department of Agriculture. 375 p.

May, Dennis M. 1988. 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. 1990. Stocking, forest type, and stand size-the southern Forest Inventory and Analysis Unit's calculation of three important stand descriptors. Gen. Tech. Rep. SO-77. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 7 p.

May, Dennis M.; Ledoux, Chris B. [In press.] Assessing availability of upland forests in Tennessee. Southern Journal of Applied Forestry.

May, Dennis M.; Vissage, John S.; Few, D. Vince. 1990. New tree-classification system used by the Southern Forest Inventory and Analysis unit. Gen. Tech. Rep. SO-76. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 5 p.

McWilliams, William H. 1991. Recent trends in afforestation and reforestation of nonindustrial private pine forests in Alabama. Resour. Bull. SO-164. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 12 p.

McWilliams, William, H. 1991. Availability of yellow pine sawtimber in Alabama. In: Alabama's forest resources: past, present and future. 1991 May 29-30, Auburn University, AL. Montgomery, AL: Alabama Forest Resources Center. p. 115–131.

McWilliams, William H.; Birdsey, Richard A. 1984. Alabama survey points to a lack of regeneration on harvested lands. Forest Farmer. 43(10): 18.

McWilliams, William H.; Duncan, K.L.; Vissage, John S. 1990a. Forest statistics for north Alabama—1990. Resour. Bull. SO-149. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.

McWilliams, William H.; Duncan, K.L.; Vissage, John S. 1990b. Forest statistics for west-central Alabama—1990. Resour. Bull. SO-150. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.

McWilliams, William H.; Miller, Patrick E.; Vissage, John S. 1990c. Forest statistics for southwest-north Alabama—1990. Resour. Bull. SO-153. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.

McWilliams, William H.; Miller, Patrick E.; Vissage, John S. 1990d. Forest statistics for southwest-south Alabama—1990. Resour. Bull. SO-155. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.

McWilliams, William H.; Miller, Patrick E.; Vissage, John S. 1990e. Forest statistics for southeast Alabama—1990. Resour. Bull. SO-156. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.

McWilliams, William H.; Miller, Patrick E.; Vissage, John S. 1991. Forest statistics for north central Alabama—1990. Resour. Bull. SO-157. New Orleans, LA: U.S Department of Agriculture, Forest Service, Southern Forest Experiment Station. 31 p.

McWilliams, William H.; Rosson, James F., Jr. 1988. Hardwood supply and availability in the midsouth highlands. In: Availability of hardwoods in the upland south; 1988 January 7; Charlotte, NC. Series No. 7. Asheville, NC: Hardwood Research Cooperative: 47–95.

Murphy, Paul A. 1973. Alabama forests: trends and prospects. Resour. Bull. SO-42. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 36 p.

Rosson, James F., Jr.; Thomas, Charles E. 1986. The woody biomass resource of Alabama. Res. Pap. SO-228. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 31 p.

Rudis, Victor A.; Rosson, James F., Jr.; Kelly, John F.1984. Forest resources of Alabama. Resour. Bull. SO-98. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 55 p.

Spillers, A.R. 1939. Forest resources of southeast Alabama. For. Sur. Rel. No. 47. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 32 p.

Spillers, A.R. 1940. Forest resources of west central Alabama. For. Sur. Rel. No. 48. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.

Sternitzke, Herbert S. 1963. Alabama forests. Resour. Bull. SO-3. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 32 p.

U.S. Department of Agriculture, Forest Service. 1956–1990.U.S. forest planting reports. Washington, DC: U.S. Department of Agriculture.

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, Forest Service. 512 p.

Vissage, John S.; Miller, Patrick E. 1991. Forest statistics for Alabama counties—1990. Resour. Bull. SO-158. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 67 p.

Wheeler, Phillip R. 1953. Forest statistics for Alabama. For. Sur. Rel. No. 73. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 52 p.

Zahner, Robert. 1984. The soils and climate of the loblolly pine ecosystem, west region. In: Proceedings of the symposium on the loblolly pine ecosystem (West Region); 1984 March 20–22; Jackson, MS. Mississippi State University, MS: Mississippi State Cooperative Extension Service: 17–32.

APPENDIX

Late spring flooding in bottomland hardwood forest, 1991.

Inventory Methods

The SO-FIA uses a two-phase sample of temporary aerial-photo points and a systematic grid of permanent ground plots (Kelly 1991). The area of forested land was determined by photointerpretation of temporary points and field checks of permanent plots. Field measurements were conducted on a subset of permanent plots spaced 3 miles apart (fig. 34). Tree data were collected on plots that were forested at the time of the current inventory or at the time of the previous inventory.

Initial estimates of forest area were obtained by interpreting 145,109 photopoints using dot counts and the most recent aerial photography available. The dot counts provided an estimate of the proportion of forest to nonforest land that was used along with U.S. Census land area data to develop county-level forest area statistics. The photointerpretation estimate was then adjusted by ground checks of actual land use at all permanent ground plots.

Forest statistics were estimated from data collected at each forested plot. Measurement plots consist of 10 satellite points spread over an acre of forest. (In the 1982 inventory, five satellite points were used.) At each point, trees 5.0 inches in d.b.h. or greater are selected for measurement using a 37.5-factor prism—each tree represents 3.75 square feet of basal area per acre. The large-factor prism was used to ensure a representative sample of trees across all satellite points and thus reduce the effect of vegetation clumping or gaps that occur across the sampled acre. Trees between 1.0 and 4.9 inches in d.b.h. are tallied on a 1/275-acre circular fixed plot on the first three points and at any remaining points where fewer than two trees 5.0 inches in d.b.h. or larger are tallied. A tally of free-to-grow pine seedlings on 1/600-acre plots at each of the 10 points is used to assess pine regeneration for plots that: (1) reverted from nonforest land use, (2) were harvested or thinned, or (3) underwent other significant disturbance.

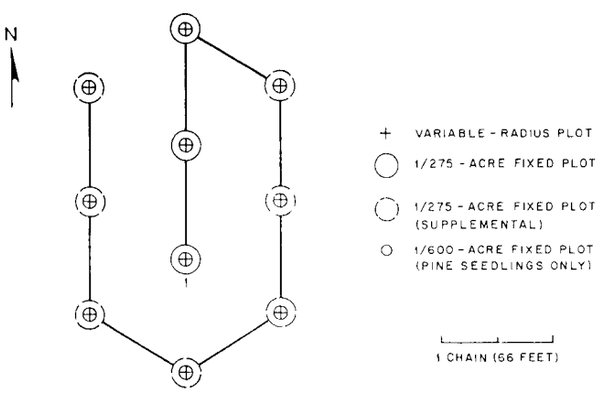


Figure 34. — *Measurement plot configuration.*

In order to achieve greater compatibility among Forest Inventory and Analysis units, a modified tree classification system has been in effect since the 1988 inventory of Arkansas (May and others 1990). Tree grade 5 was used to designate trees capable of producing at least one 12-foot log or two 8-foot logs in the sawlog portion but not capable of producing a gradeable 12-foot log in the first 16-foot section. These trees—formerly classed as rough or rotten—are now included in growing stock. An additional change in the definition of growing stock was made at the beginning of the 1990 inventory of Alabama. At that time, the 50-percent soundness criteria (for volume in the sawlog) was changed to 30 percent. Both of these changes were made to align SO-FIA's techniques with those used in other regions of the country and facilitate the use of inventory findings across regional boundaries. Any comparisons with previous estimates of growing stock were based on data that had been reprocessed to account for the change in definition. Because of the revised definition, and to better assess changes in whole-forest conditions, analysis of trends in inventory volume, growth, removals, and mortality has focused on live trees.

Tree volumes were obtained using Grosenbaugh's STX algorithm (1964). Total-tree dry weight was estimated using equations developed by Clark and others (1985) and other sources. Tree measurements include stump diameter and height, d.b.h., bark thickness, sawlog and midpoint length (sawtimber trees only), bole and midpoint length (for sawtimber trees, measured at the midpoint of the upper-stem section), diameter outside bark (d.o.b.) at each length measurement, and total height. Volume growth was computed using present and past volumes of remeasured trees (May 1988). Growth on trees that died, were cut, or were not tallied at the previous measurement was estimated from regression equations that were developed using data from the remeasured population. The total volume of trees that died or were cut was also determined using regression. Because five satellite points were measured in 1982, all estimates of growth, removals, and mortality were based on the five remeasured points.

Data collected at each measurement plot included information on site productivity, stand origin, size of forest tract, distance from road, slope, aspect, disturbance, management, evidence of other use, and nontimber resources. Ownership information was ob-

tained for each plot from county tax assessors records and contact with owners in the field. Other public agencies were consulted when classifying absentee owners as farmers, individuals, corporations, or lessors.

Field work was started June 1989 and completed October 1990. A total of 8,625 permanent ground plots were visited by inventory personnel. The sample included 3,917 timberland plots, 8 productive reserved plots, and 1,882 nonforest plots (see Definition of Terms section). Also, 2,818 "intensification" plots were field checked for status as forest or nonforest.

Reliability of Data

Reliability of SO-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 SO-FIA through comprehensive training, supervision, quality control programs, and emphasis on careful work.

The second type of error, sampling error, is associated with natural and expected deviation of the sample mean from the true population mean. 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 XXIV). 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. In addition, 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 XXV, which shows the sampling error to which the estimates are liable, two chances out of three.

Table XXIV.—*Sampling errors for estimates of total timberland area (1990), volume (1990), average net annual growth (1982 to 1989), and average annual removals (1982 to 1989), Alabama*

Item	Total	Units	Percent sampling error
Timberland area	21,932.0	Thousand acres	0.3
Live trees			
Volume	24,736.0	Million cubic feet	1.3
Average net annual growth	1,211.7	Million cubic feet	1.5
Average annual removals	1,116.6	Million cubic feet	3.2
Sawtimber			
Volume	76,175.6	Million board feet*	1.9
Average net annual growth	4,493.8	Million board feet	2.0
Average net annual removals	3,934.8	Million board feet	3.6

*International 1/4-inch Rule.

Table XXV.—*Sampling error to which estimates are liable, two chances out of three, Alabama, 1990**

Sampling error	Timberland area	Live trees			Sawtimber		
		Volume	Average net annual growth	Average annual removals	Volume	Average net annual growth	Average annual removals
Percent	*Thousand acres*	*Million cubic feet*			*Million board feet*†		
1.0	1,973.9	...	...	...	...	...	...
2.0	493.5	10,451.0	681.6	...	68,748.5	4,490.0	...
3.0	219.3	4,644.9	302.9	...	30,554.9	1,995.5	...
4.0	123.4	2,612.7	170.4	714.6	17,187.1	1,122.5	3,157.6
5.0	79.0	1,672.2	109.1	457.4	10,999.8	718.4	2,020.9
10.0	19.7	418.0	27.3	114.3	2,749.8	179.6	505.2
15.0	8.8	185.8	12.1	50.8	1,222.2	79.8	224.5
20.0	4.9	104.5	6.8	28.6	687.5	44.9	126.3
25.0	3.2	66.9	4.4	18.3	440.0	28.7	80.8

*By random sampling formula.
†International 1/4-inch Rule.

Definition of Terms

Forest Land Classes

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

Forest land—Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area considered for classification is 1 acre. Forest land is divided into commercial categories (timberland and deferred timberland) and noncommercial categories (productive-reserved and unproductive).

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

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 inventories.

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).

Cull trees—Rough or rotten trees.

Growing-stock trees—Live trees of commercial species classified as sawtimber, poletimber, sapling, and seedlings. Trees must contain at least one 12-foot log or two 8-foot logs in the sawlog portion now or prospectively to be classed as growing stock.

Hardwoods—Dicotyledonous trees, usually broadleaved and deciduous.

Live trees—All commercial and noncommercial trees that are alive and of sapling size or larger.

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).

Rotten trees—Live trees of commercial species that are unmerchantable for sawlogs currently or potentially because of rot deduction in the sawlog portion.

Rough trees—Live trees of commercial species that are unmerchantable for sawlogs currently or potentially because of roughness or poor form in the sawlog portion. Also included are live trees of noncommercial species.

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

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

Forest Types

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.

Loblolly–shortleaf pine—Forests in which yellow pines (except longleaf or slash pine), singly or in combination, comprise a plurality of the live-tree stocking. Common associates include oak, hickory, and gum.

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

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

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

Oak–pine—Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking but in which pines comprise 25 to 49 percent of the live-tree stocking. Common associates include gum, hickory, and yellow-poplar.

Maple–beech–birch—Forest in which maples, beech, yellow birch, or sweet birch, singly or in combination, comprise a plurality of the live-tree stocking.

Nontyped—Timberland currently unoccupied by any live trees or seedlings; for example, very recent clearcut areas.

White pine–hemlock—Forests in which white pine or hemlock, singly or in combination, comprise a plurality of the live-tree stocking.

Dimension Classes of Trees

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

Rough, rotten, and salvable dead trees—See "tree classes."

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

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

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

Stand Size Classes

Nonstocked stands—Stands less than 10 percent stocked with live trees.

Poletimber stands—Stands at least 10 percent stocked with live 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 10 percent stocked with live trees, more than half of this in saplings or seedlings.

Sawtimber stands—Stands at least 10 percent stocked with live trees, half or more of this stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

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 (see May 1990). Therefore, full stocking is 100 percent of the stocking standard.

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

D.b.h.	Number of trees	D.b.h.	Number of trees
Inches		*Inches*	
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

Arbitrarily defined stocking categories are defined as follows:

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.

Fully stocked—Stands 101 to 130 percent stocked. These stands make full utilization of growing space, but variation of stocking within stands, or clumping, is common.

Overstocked—Stands greater than 130 percent stocked. These stands will become stagnant with mortality of individuals increasing as stocking increases over 130 percent.

Volume

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

Volume of growing stock—The cubic-foot volume of sound wood in growing-stock trees at least 5.0 inches in d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. of the central stem or to a point where the central stem breaks into limbs. Rough, rotten, and noncommercial species are excluded.

Volume of sawtimber—Net volume in the sawlog portion of live sawtimber trees in board feet of the International Rule (¼-inch kerf). Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber. Rough, rotten, and noncommercial trees are excluded.

Volume of live trees—The cubic-foot volume of sound wood in live trees at least 5.0 inches in d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. of the central stem or to a point where the central stem breaks into limbs. (In some instances, volume of live trees includes the total-tree volume of saplings.)

Volume of timber—Definition is identical to the "volume of live trees" but includes salvable dead trees.

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 a 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 or decrease in stand volume computed on growing-stock or live trees. Gross growth equals survivor growth plus ingrowth plus growth on removals plus growth on mortality plus cull increment. Cull increment is not a component of live-tree growth.

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

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

Classes of Trees Used in Growth Computations

Ingrowth trees—Submerchantable-and-in at time 1 (previous inventory) and merchantable-and-in at time 2 (current inventory).

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

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

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

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

Survivor trees—Merchantable-and-in at time 1 and time 2.

Ownership Classes

Forest industry land—Land owned by companies or individuals operating primary wood-using plants.

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

Nonindustrial private land:

Corporate-owned land—Land privately owned by private corporations other than forest industry and incorporated farms.

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

Individual-owned land—Land privately owned by individuals other than forest industry, farmers, or miscellaneous private corporations.

Other Federal land—Federal land other than national forests and land administered by the Bureau of Land Management.

State, county, and municipal land—Land owned by States, counties, and local public agencies or municipalities or land leased to these governmental units for 50 years or more.

Miscellaneous Definitions

Average net annual growth—Change in average net annual volume of growing-stock or live trees for the intersurvey period.

Average annual mortality—Average annual sound-wood volume of growing-stock or live trees dying from natural causes.

Average annual removals—Average net annual volume of growing-stock or live 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 4.5 feet above the 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.

D.o.b. (diameter outside bark)—Tree diameter in inches, outside bark.

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.

Planted pine—Longleaf-slash pine and loblolly-shortleaf pine stands with evidence of regeneration from planting or direct seeding.

Sawlog portion—The point on the bole of a sawtimber tree between a 1-foot stump and the sawlog top.

Sawlog top—The portion of the bole of a sawtimber tree above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches in d.o.b. for softwoods and 9.0 inches for hardwoods.

Select red oaks—A group of select species in the red oak subgenus *(Erythrobalanus);* may include one or more of the following species: cherrybark oak *(Quercus falcata* var. *pagodifolia),* 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 subgenus *(Leucobalanus);* 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.

SO-FIA—The U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Forest Inventory and Analysis Unit located in Starkville, Mississippi.

Timber removals—The net volume of growing-stock or live 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 classification of the volume of the sawlog portion of sawtimber trees based on: (1) the log grade of the first 16-foot section or (2) the ability to produce at least one 12-foot or two 8-foot logs anywhere in the sawlog portion. 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 sawlog top to a 4.0-inch d.o.b. or to the point where the main stem or fork breaks into limbs.

Species List

Scientific and common names of tree species (Little 1979) sampled in Alabama (trees less than 1.0-inches in d.b.h. are excluded):

Commercial Species

Scientific name	Common Name
Softwoods	
Chamaecyparis thyoides	Atlantic white-cedar
Juniperus silicicola	Southern redcedar
J. virginiana	Eastern redcedar
Pinus clausa	Sand pine
P. echinata	Shortleaf pine
P. elliottii	Slash pine
P. glabra	Spruce pine
P. palustris	Longleaf pine
P. serotina	Pond pine
P. strobus	Eastern white pine
P. taeda	Loblolly pine
P. virginiana	Virginia pine
Taxodium distichum	Baldcypress and pondcypress
Tsuga canadensis	Eastern hemlock
Hardwoods	
Acer barbatum	Florida maple
A. negundo	Boxelder
A. rubrum var. *rubrum*	Red maple
A. saccharinum	Sliver maple
A. saccharum	Sugar maple
Aesculus glabra	Ohio buckeye
A. octandra	Yellow buckeye
Betula alleghaniensis	Yellow birch
B. lenta	Sweet birch
B. nigra	River birch
Carya sp.	Hickory
C. aquatica	Water hickory
C. illinoensis	Pecan
Castanea dentata	American chestnut
C. pumila	Allegheny chinkapin
Catalpa sp.	Catalpa
Celtis laevigata	Sugarberry
C. occidentalis	Hackberry
Cornus florida	Flowering dogwood
Diospyros virginiana	Common persimmon
Fagus grandifolia	American beech
Fraxinus americana	White ash
F. pennsylvanica	Green ash
F. quadrangulata	Blue ash
Gleditsia aquatica	Water locust
G. triacanthos	Honey locust
Ilex opaca	American holly
Juglans cinerea	Butternut
J. nigra	Black walnut
Liquidambar styraciflua	Sweetgum
Liriodendron tulipifera	Yellow-poplar
Magnolia acuminata	Cucumbertree
M. grandiflora	Southern magnolia
M. virginiana	Sweetbay
Morus rubra	Red mulberry
Nyssa aquatica	Water tupelo
N. sylvatica var. *biflora*	Swamp tupelo
N. sylvatica var. *sylvatica*	Blackgum
Persea borbonia	Redbay
Plantanus occidentalis	American sycamore
Populus sp.	Cottonwood
Prunus serotina	Black cherry
Quercus alba	White oak
Q. bicolor	Swamp white oak
Q. coccinea	Scarlet oak
Q. durandii	Durand oak
Q. falcata	Southern red oak
Q. falcata var. *pagodifolia*	Cherrybark oak
Q. laurifolia	Laurel oak
Q. lyrata	Overcup

Q. macrocarpa	Bur oak
Q. michauxii	Swamp chestnut oak
Q. muehlenbergii	Chinkapin oak
Q. nigra	Water oak
Q. nuttallii	Nuttall oak
Q. phellos	Willow oak
Q. prinus	Chestnut oak
Q. rubra	Northern red oak
Q. shumardii	Shumard oak
Q. stellata var. *stellata*	Post oak
Q. stellata var. *mississippiensis*	Delta post oak
Q. velutina	Black oak
Robinia pseudoacacia	Black locust
Salix sp.	Willow
Sassafras albidum	Sassafras
Tilia americana	American basswood
T. heterophylla	White basswood
Ulmus alata	Winged elm
U. americana	American elm
U. crassifolia	Cedar elm
U. pumila	Siberian elm
U. rubra	Slippery elm
U. serotina	September elm

Noncommercial Species

Aesculus sp.	Buckeye
Ailanthus altissima	Tree-of-heaven
Albizia julibrissin	Mimosa
Amelanchier sp.	Serviceberry
Asimina triloba	Pawpaw
Bumelia sp.	Chittamwood
Carpinus caroliniana	American hornbeam
Castanea sp.	Chinkapin
Cercis canadensis	Eastern redbud
Cotinus obovatus	American smoketree
Crataegus sp.	Hawthorn
Cryilla racemiflora	Swamp cyrilla
Forestiera acuminata	Swamp privet
Ilex coriacea	Gallberry
Magnolia macrophylla	Bigleaf magnolia
Malus sp.	Apple
Melia azerdarach	Chinaberry
Morus alba	White mulberry
Ostrya virginiana	Easter hophornbeam
Oxydendrum arboreum	Sourwood
Paulownia tomentosa	Royal paulownia
Planera aquatica	Water elm
Prunus sp.	Plums, cherries, (other than black cherry)
Quercus incana	Bluejack oak
Q. laevis	Turkey oak
Q. marilandica	Blackjack oak
Q. virginiana	Live oak
Sapium sebiferrum	Chinese tallowtree
Symplocos tinctoria	Sweetleaf
Vaccinium arboreum	Sparkleberry
Viburnum rufidulum	Rusty blackhaw
Zanthoxylum clava-herculis	Hercules club

Standard Tables

Table 1.—*Area by land class, Alabama, 1990*

Land class	Area
	Thousand acres
Forest	
Commercial	
Timberland	21,932.0
Differed timberland	...
Noncommercial	
Productive-reserved	32.6
Unproductive	...
Total forest	21,964.6
Nonforest	
Cropland*	4,496.7
Other	6,030.0
Total nonforest	10,526.7
All land†	32,491.3

*U.S. Department of Commerce, Bureau of the Census, 1987 Census of Agriculture, Volume 1: State and County data, issued 1989.

†Bureau of Census, 1981.

Table 2.—*Area of timberland by ownership class, Alabama, 1990**

Ownership class	Area
	Thousand acres
Public	
National forest	605.4
Other Federal	249.6
State	211.7
County	95.4
Total public	1,162.1
Private	
Forest industry	4,794.9
Farmer	4,980.4
Miscellaneous private	
Individual	9,184.0
Corporate	1,810.7
Total private	20,769.9
All ownerships	21,932.0

*Columns may not sum to totals due to rounding.

Table 3.—*Area of timberland by stand size and ownership classes, Alabama, 1990**

Stand size class	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
	Thousand acres					
Sawtimber	7,639.4	381.2	250.6	1,414.1	1,919.8	3,673.7
Poletimber stands	5,912.5	116.1	152.8	1,351.3	1,253.5	3,038.8
Sapling and seedling	8,336.0	108.1	153.3	2,013.7	1,801.4	4,259.5
Nonstocked areas	44.1	...	...	15.7	5.7	22.7
All classes	21,932.0	605.4	556.7	4,794.9	4,980.4	10,994.7

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

Table 4.—*Area of timberland by stand volume and ownership class, Alabama, 1990**

Stand volume per acre	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
Board feet†	*Thousand acres*					
Less than 1,500	9,563.2	108.0	148.0	2,374.2	2,105.3	4,827.7
1,500 to 5,000	6,612.5	169.3	213.5	1,223.9	1,435.0	3,570.8
More than 5,000	5,756.3	328.2	195.2	1,196.7	1,440.0	2,596.1
All classes	21,932.0	605.4	556.7	4,794.9	4,980.4	10,994.7

*Rows and columns may not sum to totals due to rounding.
†International ¼-Rule.

Table 5.—*Area of timberland by percent growing-stock trees and cull trees, Alabama, 1990**

Growing-stock trees	Total	Cull trees (*Percent stocking*) 0–10	10–20	20–30	30–40	40–50	50–60	≥60
Percent stocking	*Thousand acres*							
0–10	99.1	33.6	27.3	...	11.0	10.8	5.8	10.5
10–20	66.1	33.5	5..1	11.4	4.9	...	...	11.2
20–30	215.1	73.3	33.3	285.4	16.5	28.8	17.0	17.8
30–40	360.2	61.7	33.8	76.3	25.2	35.9	46.1	81.3
40–50	660.9	102.8	68.5	105.0	107.9	125.3	80.2	71.2
50–60	1,200.2	200.2	185.7	245.8	241.1	176.8	105.1	45.6
60–70	1,888.1	295.4	373.8	483.5	398.5	204.0	67.9	65.0
70–80	2,839.7	483.4	757.9	763.6	500.0	252.5	52.7	29.4
80–90	3,509.8	975.5	1,076.9	916.9	412.3	101.9	8.5	17.9
90–100	3,619.0	1,291.8	1,224.6	773.3	245.5	74.9	6.0	...
100–110	2,956.0	1,326.3	1,060.0	410.7	129.4	23.8	5.7	...
110–120	2,181.7	1,266.6	675.4	173.3	50.0	16.5	...	...
120–130	1,202.4	883.1	257.1	56.4	5.8	...	...	...
130–140	708.0	625.7	76.5	5.7	...	...	...	...
140–150	306.4	271.0	35.4	...	...	...	...	...
150–160	91.4	91.4	...	...	...	...	...	...
160+	28.0	28.0	...	...	...	...	...	...
Total	21,932.0	8,043.2	5,891.4	4,053.3	2,148.1	1,051.0	395.0	350.0

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

Table 6. *Average basal area of live trees on timberland by ownership, tree class, species, and tree size class, Alabama, 1990**

Ownership and tree class	All species	Softwood			Hardwood		
		Sapling and seedling	Poletimber	Sawtimber	Sapling and seedling	Poletimber	Sawtimber
	Square feet per acre						
National forest							
Growing stock	77.9	3.1	8.3	27.5	9.7	14.4	14.9
Rough and rotten	14.4	0.7	0.4	0.2	6.2	4.6	2.3
Total	92.3	3.8	8.7	27.7	15.9	19.1	17.2
Other public							
Growing stock	66.9	2.4	5.3	13.1	6.8	16.9	22.4
Rough and rotten	16.1	0.5	0.3	0.9	6.5	3.5	4.4
Total	83.1	3.0	5.6	13.9	13.3	20.5	26.8
Forest industry							
Growing stock	63.9	7.5	14.6	15.0	7.3	9.7	9.8
Rough and rotten	9.9	0.6	0.5	0.2	4.4	2.3	1.8
Total	73.8	8.1	15.1	15.2	11.8	12.1	11.6
Farmer							
Growing stock	60.7	3.2	5.9	12.2	7.7	15.5	16.2
Rough and rotten	12.5	0.4	0.3	0.3	5.3	3.3	2.9
Total	73.2	3.6	6.2	12.5	13.0	18.8	19.1
Miscellaneous private							
Growing stock	60.4	4.2	8.1	12.6	8.2	14.1	13.2
Rough and rotten	12.8	0.7	0.3	0.4	5.2	3.1	3.1
Total	73.2	4.9	8.4	13.0	13.4	17.2	16.3
All owners							
Growing stock	61.9	4.6	9.0	13.4	7.9	13.5	13.4
Rough and rotten	12.2	0.6	0.3	0.3	5.1	3.0	2.8
Total	74.1	5.2	9.3	13.8	13.0	16.6	16.2

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

Table 7. *Area of timberland by site and ownership classes, Alabama, 1990**

Site class	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
	Thousand acres					
165 ft^3 or more	1,885.0	78.5	90.0	426.5	427.0	863.0
120 to 165 ft^3	5,381.4	110.4	116.5	1,265.2	1,219.5	2,669.7
85 to 120 ft^3	8,136.1	157.3	169.2	1,793.1	1,816.7	4,199.7
50 to 84 ft^3	5,710.3	217.2	141.4	1,193.0	1,346.8	2,811.9
Less than 50 ft^3	819.2	42.0	39.5	116.9	170.3	540.4
All classes	21,932.0	605.4	556.7	4,794.9	4,980.4	10,994.7

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

Table 8.—*Area of timberland by forest type and ownership class, Alabama, 1990**

Forest type	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
	Thousand acres					
White–red–jack pine	5.2	5.2	...	...	...	...
Longleaf–slash pine	1,197.4	93.2	39.5	428.2	163.7	472.7
Loblolly–shortleaf pine	6,259.9	138.8	60.9	1,981.7	1,209.1	2,869.4
Oak–pine	4,521.8	188.9	172.5	956.9	810.3	2,393.1
Oak–hickory	7,661.4	168.2	213.3	946.7	2,198.9	4,134.2
Oak–gum-cypress	2,258.9	11.0	70.3	469.5	593.5	1,114.6
Elm–ash-cottonwood	16.3	...	...	6.3	4.8	5.2
Nontyped	11.1	...	...	5.7	...	5.4
All types	21,932.0	605.4	556.7	4,794.9	4,980.4	10,994.7

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

Table 9.—*Area of noncommercial forest land by forest type, Alabama, 1990*

Forest type	All areas	Productive reserved areas	Unproductive areas
	Thousand acres		
Loblolly-shortleaf pine	12.2	12.2	...
Softwood total	12.2	12.2	...
Oak-pine	4.1	4.1	...
Oak-hickory	16.3	16.3	...
Hardwood total	20.4	20.4	...
All types	32.6	32.6	...

Table 10. *Number of growing-stock trees on timberland by species and diameter class, Alabama, 1990**

Species	All classes	Diameter class (*Inches at breast height*) 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
					Thousand trees						
Longleaf pine	79,398	23,600	18,632	14,279	11,118	6,971	3,169	1,146	369	115	...
Slash pine	107,707	53,069	29,247	11,619	6,189	4,018	2,064	870	370	260	...
Shortleaf pine	142,049	51,253	38,059	23,935	15,325	8,511	3,074	1,321	400	172	...
Loblolly pine	695,633	316,488	182,350	83,290	49,425	29,920	17,356	9,058	4,300	3,336	112
Virginia pine	68,890	27,082	22,873	10,298	5,626	2,258	561	157	37	...	...
Spruce pine	10,534	2,293	2,422	1,597	1,177	1,013	657	590	386	395	3
Pitch pine	239	105	103	32	...	...	...	...	...	...	...
Other southern pines	18	...	...	...	...	...	18	...	...	...	...
Eastern white pine	281	77	...	44	70	36	41	12	...	...	...
Redcedar	18,982	10,446	5,400	1,851	762	262	172	36	21	32	...
Hemlock spruce	1,528	446	395	273	252	115	...	22	10	15	...
Cypress	7,350	1,884	1,344	959	926	813	464	384	193	335	48
Total softwoods	1,132,610	486,743	300,824	148,176	90,870	53,916	27,574	13,596	6,087	4,661	163
Select white oaks[†]	97,497	35,995	21,539	15,344	9,417	6,317	4,315	1,929	1,289	1,200	150
Select red oaks[‡]	23,272	6,821	4,287	3,535	2,963	1,870	1,318	1,079	594	676	129
Other white oaks	96,798	33,775	25,889	16,714	8,783	5,480	2,901	1,506	890	778	82
Other red oaks	251,822	90,032	61,092	40,710	22,849	16,322	8,941	5,462	2,844	3,192	377
Sweet pecan	267	...	117	124	...	16	...	...	...	5	5
Water hickory	1,792	1,086	275	...	78	162	101	34	19	32	5
Other hickories	117,305	42,254	30,631	19,908	11,419	6,360	3,738	1,574	818	589	14
Persimmon	6,461	4,169	1,457	634	131	46	14	10	...	...	...
Hard maple	5,205	2,606	1,230	685	389	153	95	38	...	9	...
Soft maple	45,126	25,559	10,128	5,515	1,686	1,056	622	222	171	159	9
Boxelder	1,437	944	150	144	55	108	16	...	20	...	...
Beech	7,928	3,048	2,128	657	325	519	406	330	176	298	39
Sweetgum	243,414	116,806	62,166	34,380	14,266	8,297	3,802	1,805	1,112	729	50
Blackgum	65,474	27,254	15,229	11,652	5,915	2,830	1,410	521	303	285	4
Other gums/ tupelos	41,085	13,110	8,881	7,390	3,741	3,505	2,151	1,262	503	514	28
White ash	8,397	3,588	1,758	1,414	536	378	360	207	88	69	...
Other ashes	16,556	6,984	3,361	2,313	1,622	690	733	477	146	223	8
Sycamore	3,846	1,237	627	538	390	102	473	144	128	183	23
Cottonwood	583	...	120	113	117	86	65	39	10	27	6
Basswood	3,211	1,095	816	565	292	215	81	79	48	14	6
Yellow-poplar	62,884	18,979	13,811	8,741	7,115	5,218	3,958	2,291	1,259	1,404	109
Magnolia	5,069	2,241	1,192	1,011	229	231	62	39	20	44	...
Sweetbay	41,771	17,727	11,469	6,278	3,069	1,932	640	436	100	116	4
Willow	3,573	2,206	738	383	76	107	49	13	...	...	...
Black walnut	1,165	519	299	152	86	45	31	24	8	...	...
Black cherry	11,374	6,719	2,804	1,193	435	147	34	19	18	...	4
American elm	5,311	2,405	957	639	503	318	166	169	111	39	5
Other elms	15,958	7,166	4,659	2,011	1,104	582	171	146	69	51	...
River birch	5,578	2,072	1,193	944	511	385	252	107	68	45	...
Hackberry	13,981	4,153	3,285	2,626	1,509	1,058	653	375	155	165	4
Black locust	1,536	821	358	194	82	36	46	...	...	...	...
Other locusts	511	187	175	35	57	40	17	...	...	...	...
Sassafras	2,905	2,057	616	204	...	...	...	28	...	...	...
Dogwood	15,094	12,989	2,105	...	...	...	...	...	...	...	...
Holly	4,834	3,395	772	639	28	...	...	...	...	...	...
Other commercial	4,629	2,699	1,264	354	130	101	47	24	11	...	...
Total hardwoods	1,233,654	502,696	297,653	187,736	99,911	64,712	37,669	20,390	10,981	10,846	1,060
All species	2,366,264	989,439	598,477	335,912	190,781	118,628	65,243	33,986	17,068	15,506	1,224

*Rows and columns may not sum to totals due to rounding.
[†]Includes white, swamp chestnut, swamp white, chinkapin, and bur oaks.
[‡]Includes cherrybark, northern red, and Shumard oaks.

Table 11. *Volume of timber on timberland by class of timber and by softwood and hardwood, Alabama, 1990**

Class of timber	All species	Softwood	Hardwood
		Million cubic feet	
Sawtimber trees			
Sawlog portion	12,803.9	7,083.1	5,720.8
Upper-stem portion	2,304.4	995.5	1,308.9
Total	10,108.3	8,078.5	7,029.7
Poletimber trees	7,967.2	3,022.9	4,944.3
All growing stock	23,075.5	11,101.5	11,974.0
Rough trees	1,385.1	183.0	1,202.0
Rotten trees	275.5	8.6	266.9
Salvable dead trees	68.3	48.6	19.7
All timber	24,804.3	11,341.7	13,462.7

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

Table 12. *Volume of growing stock and sawtimber on timberland by ownership class and by softwood and hardwood, Alabama, 1990**

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Million cubic feet			*Million board feet*†		
National forest	931.3	562.2	369.0	3,740.8	2,639.9	1,100.9
Other public	733.2	269.7	463.6	2,727.5	1,252.7	1,474.8
Forest industry	4,920.1	2,998.6	1,921.5	15,875.6	10,450.7	5,424.9
Farmer	5,402.0	2,173.1	3,228.9	18,396.2	9,166.3	9,229.9
Miscellaneous private	11,089.0	5,097.9	5,991.1	35,435.5	19,304.5	16,131.0
All ownerships	23,075.5	11,101.5	11,974.0	76,175.6	42,814.1	33,361.6

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

Table 13. *Volume of growing stock on timberland by species and diameter class, Alabama, 1990**

Species	All classes	Diameter class (*Inches at breast height*) 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
					Million cubic feet						
Longleaf pine	1,058.1	74.2	131.4	194.4	232.5	207.5	129.4	58.4	23.5	9.7	...
Slash pine	894.7	135.7	178.2	144.3	128.9	120.1	87.8	47.3	26.1	26.5	...
Shortleaf pine	1,621.0	149.1	275.2	327.5	335.4	278.9	135.4	73.7	28.7	17.1	...
Loblolly pine	6,454.5	701.1	1,046.8	996.8	967.2	875.3	715.7	498.6	304.0	329.7	19.3
Virginia pine	569.1	86.0	158.8	129.9	103.7	61.1	20.3	6.8	2.3	...	...
Spruce pine	235.3	7.2	16.8	20.4	23.8	31.9	27.1	35.0	29.8	42.6	0.8
Pitch pine	1.0	0.2	0.5	0.3	...	...	...	...	...	...	...
Other southern pines	0.4	...	...	...	...	...	0.4	...	...	...	...
Eastern white pine	3.8	0.3	...	0.3	1.0	0.7	1.1	0.4	...	...	...
Redcedar	86.8	22.4	25.1	17.0	9.9	4.8	4.5	1.2	0.6	1.4	...
Hemlock spruce	16.6	1.5	2.3	2.8	4.6	2.5	...	0.6	0.7	1.5	...
Cypress	160.0	4.1	8.9	12.8	19.0	21.3	16.9	19.6	12.8	33.1	11.4
Total softwoods	11,101.5	1,179.0	1,843.9	1,846.5	1,826.0	1,604.2	1,138.6	741.7	428.5	461.6	31.5
Select white oaks[†]	1,109.1	87.3	132.4	165.4	166.6	156.3	145.8	81.2	67.0	88.9	18.1
Select red oaks[‡]	379.2	15.3	26.1	39.4	53.8	46.5	44.6	49.3	33.5	52.1	18.6
Other white oaks	875.1	78.8	142.9	159.1	138.3	116.9	86.4	55.2	40.1	48.1	9.4
Other red oaks	2,722.8	222.0	355.2	427.2	389.3	388.4	285.5	230.5	148.7	229.6	46.4
Sweet pecan	2.7	...	0.4	1.2	...	0.3	...	...	...	0.3	0.5
Water hickory	22.6	3.2	2.0	...	1.6	4.9	4.2	1.9	1.3	3.2	0.3
Other hickories	1,112.7	95.7	163.9	200.7	194.3	159.7	128.2	72.3	47.5	48.5	1.8
Persimmon	30.4	10.4	8.1	6.9	2.5	1.3	0.6	0.6	...	...	...
Hard maple	34.8	5.8	6.9	7.1	6.3	3.5	2.7	2.1	...	0.4	...
Soft maple	268.5	67.8	56.4	54.2	26.1	20.8	17.3	8.0	7.5	9.4	1.0
Boxelder	8.5	2.4	1.0	1.6	0.8	1.8	0.3	...	0.7	...	...
Beech	102.6	7.5	11.3	7.4	5.6	12.9	12.4	12.6	8.7	20.3	3.7
Sweetgum	1,934.2	272.1	367.8	402.8	285.1	230.3	146.8	92.0	68.7	62.3	6.3
Blackgum	530.4	64.0	86.5	123.1	98.2	66.4	43.0	18.6	14.6	15.8	0.2
Other gums/ tupelos	508.7	37.4	54.5	87.7	68.9	85.2	67.0	50.0	23.6	31.7	2.6
White ash	77.4	7.7	9.5	13.9	8.9	8.5	11.9	8.5	4.0	4.4	...
Other ashes	182.9	18.2	20.6	25.4	29.7	17.4	24.7	21.9	8.1	16.1	0.8
Sycamore	78.5	3.6	4.2	7.4	8.7	2.6	18.9	7.2	8.0	14.8	3.0
Cottonwood	15.1	...	0.8	1.2	2.0	1.9	2.5	2.0	0.5	2.9	1.2
Basswood	37.7	3.2	5.1	6.4	5.6	5.6	3.3	3.5	3.2	1.1	0.7
Yellow-poplar	1,009.6	51.6	88.7	104.8	140.6	149.4	147.5	112.2	77.6	121.5	15.6
Magnolia	38.6	5.8	6.6	9.9	4.0	5.4	2.2	1.0	1.3	2.4	...
Sweetbay	326.9	49.1	67.7	66.0	51.7	45.5	18.4	16.5	4.3	7.5	0.4
Willow	16.3	5.2	3.6	3.1	1.2	1.9	1.2	0.1	...	...	...
Black walnut	7.5	1.0	1.3	1.0	0.8	1.0	0.7	0.9	0.8	...	...
Black cherry	56.5	16.5	14.7	11.5	7.5	3.5	0.9	0.5	0.8	...	0.6
American elm	55.5	5.9	6.2	7.3	8.2	7.7	4.8	6.0	6.5	2.7	0.3
Other elms	117.1	16.4	25.2	22.3	20.5	14.5	4.8	6.0	3.6	3.8	...
River birch	58.5	7.2	6.8	9.1	8.2	8.9	7.9	4.0	2.9	3.6	...
Other birches	0.7	0.3	...	...	0.5	...	...	...	...	...	...
Hackberry	163.7	10.6	19.2	27.3	26.7	24.8	20.9	15.2	7.9	10.4	0.5
Black locust	8.0	1.7	1.4	1.7	1.2	0.6	1.5	...	...	...	...
Other locusts	4.3	0.6	1.6	0.3	0.9	0.6	0.3	...	...	...	...
Sassafras	8.8	3.8	2.2	1.7	...	...	...	1.2	...	...	...
Dogwood	29.5	23.1	6.4	...	...	...	...	...	...	...	...
Holly	17.7	7.6	3.8	5.7	0.5	...	...	...	...	...	...
Other commercial	21.6	6.2	6.2	2.4	1.8	2.3	1.2	1.0	0.5	...	...
Total hardwoods	11,974.0	1,214.6	1,717.4	2,012.3	1,766.2	1,579.1	1,258.5	882.1	592.0	801.8	132.1
All species	23,075.5	2,393.6	3,561.3	3,858.8	3,592.2	3,201.3	2,397.1	1,623.8	1,020.5	1,263.4	163.6

*Rows and columns may not sum to totals due to rounding.
†Includes white, swamp chestnut, swamp white, chinkapin, and bur oaks.
‡Includes cherrybark, northern red, and Shumard oaks.

Table 14.—*Volume of sawtimber on timberland by species and diameter class, Alabama, 1990**

Species	All classes	Diameter class (*Inches at breast height*) 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
		Million board feet†							
Longleaf pine	4,451.1	869.3	1,212.6	1,169.0	752.7	343.7	136.4	57.4	...
Slash pine	3,050.1	585.3	670.6	677.4	519.9	281.0	155.5	160.5	...
Shortleaf pine	6,383.7	1,467.9	1,795.4	1,609.6	795.6	440.3	167.3	107.5	...
Loblolly pine	25,168.5	4,168.1	4,965.9	4,898.2	4,182.5	2,964.8	1,834.8	2,039.9	114.3
Virginia pine	1,526.1	554.9	500.5	312.5	107.6	37.5	13.0	...	...
Spruce pine	1,178.1	84.8	117.0	178.6	150.4	205.7	172.2	264.4	5.0
Pitch pine	1.0	1.0	...	...	...	...	...	...	...
Other southern pines	1.4	...	...	...	1.4	...	...	...	...
E. white pine	16.0	1.3	4.1	3.3	5.1	2.1	...	...	...
Redcedar	169.1	68.1	44.1	21.3	20.7	6.1	2.4	6.4	...
Hemlock-spruce	57.7	10.1	22.1	11.2	...	2.6	4.3	7.5	...
Cypress	721.4	47.1	84.2	96.7	82.7	104.0	68.2	178.7	59.8
Total softwoods	42,814.1	7,857.8	9,416.4	8,977.8	6,618.7	4,387.8	2,553.9	2,822.3	179.2
Select white oaks‡	3,487.9	...	674.3	722.4	729.6	421.5	351.2	492.7	96.3
Select red oaks§	1,489.6	...	217.9	222.4	225.4	260.7	179.4	280.2	103.7
Other white oaks	2,337.9	...	568.1	542.8	430.8	283.4	208.6	252.9	51.3
Other red oaks	8,197.3	...	1,547.2	1,794.4	1,424.5	1,187.2	787.7	1,212.1	244.2
Sweet pecan	4.9	...	...	1.7	...	...	...	1.0	2.1
Water hickory	91.3	...	7.4	24.2	22.6	9.5	8.0	18.8	0.9
Other hickories	3,164.2	...	802.9	772.5	664.9	385.6	258.7	271.4	8.1
Persimmon	24.7	...	11.2	7.0	3.0	3.5	...	...	...
Hard maple	69.0	...	27.7	16.4	12.8	10.8	...	1.2	...
Soft maple	388.3	...	99.9	89.2	80.7	35.7	34.7	44.0	4.2
Boxelder	17.1	...	3.4	8.3	1.9	...	3.5	...	...
Beech	387.9	...	23.7	64.9	61.8	71.5	42.9	102.7	20.4
Sweetgum	4,179.9	...	1,111.9	1,077.4	755.2	494.4	369.2	342.8	29.0
Blackgum	1,136.0	...	377.8	301.7	208.3	95.5	76.4	75.6	0.7
Other gums/tupelos	1,368.0	...	243.1	342.3	289.3	230.7	104.0	147.1	11.5
White ash	225.0	...	33.9	41.2	61.4	44.2	19.9	24.5	...
Other ashes	564.2	...	116.4	79.1	124.2	112.9	42.1	86.0	3.5
Sycamore	317.9	...	34.3	11.2	93.2	37.4	41.5	82.9	17.4
Cottonwood	69.4	...	7.7	8.9	13.8	10.8	2.6	17.1	8.5
Basswood	111.9	...	24.1	27.6	16.1	16.7	18.4	6.0	3.0
Yellow-poplar	3,798.6	...	557.3	733.4	752.3	592.5	421.9	664.4	76.8
Magnolia	75.0	...	16.0	23.9	11.6	4.9	5.8	12.9	...
Sweetbay	619.6	...	195.4	201.6	87.6	76.2	20.3	35.8	2.7
Willow	18.4	...	4.6	7.0	6.1	0.7	...	...	...
Black walnut	22.0	...	3.3	4.0	3.8	5.0	6.0	...	...
Black cherry	62.4	...	32.9	16.1	4.0	2.8	3.9	...	2.7
American elm	168.4	...	31.5	34.9	24.0	28.4	33.2	14.6	1.7
Other elms	247.1	...	88.4	67.1	22.7	29.6	19.6	19.6	...
River birch	166.2	...	30.0	41.7	38.7	21.2	14.6	20.1	...
Other birches	1.9	...	1.9	...	...	...	...	...	...
Hackberry	489.2	...	102.6	107.9	98.3	79.1	43.0	55.2	3.1
Black locust	14.1	...	4.5	2.5	7.1	...	...	...	...
Other locusts	6.5	...	3.0	2.3	1.2	...	...	...	...
Sassafras	5.0	...	...	...	...	5.0	...	...	...
Holly	2.3	...	2.3	...	...	...	...	...	...
Other commercial	32.3	...	7.4	11.8	6.0	4.8	2.4	...	...
Total hardwoods	33,361.6	...	7,013.7	7,409.7	6,282.8	4,562.1	3,119.7	4,281.5	692.0
All species	76,175.6	7,857.8	16,430.1	16,387.5	12,901.6	8,950.0	5,673.6	7,103.8	871.2

*Rows and columns may not sum to totals due to rounding.
†International ¼ inch Rule.
‡Includes white, swamp chestnut, swamp white, chinkapin, and bur oaks
§Includes cherrybark, northern red, and Shumard oaks.

Table 15. *Volume of sawtimber on timberland by species and tree grade, Alabama, 1990**

Species	All grades	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
	Million board feet†					
Yellow pines	41,849.9	9,532.1	8,010.3	23,266.1	...	1,041.3
Cypress	721.4	404.0	140.3	160.7	...	16.5
Redcedar	169.1	167.1	...	...	...	2.0
Other softwoods	73.7	26.1	4.3	37.3	...	6.0
Total softwoods	42,814.1	10.129.3	8,154.9	23,464.1	...	1,065.8
Select white and red oaks‡	4,977.5	662.0	1,140.6	2,040.6	809.6	324.7
Other white and red oaks	10,535.2	572.1	1,468.9	3,940.7	3,494.0	1,059.5
Hickory	3,260.3	178.8	600.5	1,592.5	673.6	214.9
Hard maple	69.0	...	5.6	32.4	23.2	7.8
Sweetgum	4,179.9	405.7	876.3	1,883.1	684.9	329.9
Tupelo and blackgum	2,504.0	324.3	643.2	1,176.6	214.5	145.4
Ash, walnut, and black cherry	873.6	144.0	211.1	354.9	73.7	90.0
Yellow-poplar	3,798.6	473.7	676.6	1,340.3	963.4	344.7
Other hardwoods	3,163.5	241.0	422.3	1,262.7	851.8	385.7
Total hardwoods	33,361.6	3,001.6	6,045.0	13,623.9	7,788.6	2,902.5
All species	76,175.6	13,130.9	14,199.9	37,087.9	7,788.6	3,968.3

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.
‡Includes white, swamp chestnut, swamp white, chinkapin, bur, cherrybark, northern red, and Shumard oaks.

Table 16. *Average net annual growth and average annual removals of growing stock on timberland, by species, Alabama, 1982 to 1989**

Species	Average net annual growth	Average annual removals
	Million cubic feet	
Yellow pines	649.5	718.3
Cypress	3.5	0.3
Redcedar	3.9	1.0
Other softwoods	1.0	...
Total softwoods	657.8	719.5
Select white and red oaks†	67.8	40.3
Other white and red oaks	198.1	136.0
Hickory	39.5	28.2
Hard maple	1.6	0.5
Sweetgum	89.6	67.9
Tupelo and blackgum	35.9	18.3
Ash, walnut and black cherry	15.6	8.2
Yellow-poplar	48.7	25.8
Other hardwoods	69.1	41.8
Total hardwoods	565.9	370.1
All species	1,223.6	1,089.6

*Columns may not sum to totals due to rounding.
†Includes white, swamp chestnut, swamp white, chinkapin, bur, cherrybark, northern red, and Shumard oaks.

Table 17.—*Average net annual growth and average annual removals of growing stock on timberland by ownership class and by softwood and hardwood, Alabama, 1982 to 1989**

Ownership class	Average net annual growth			Average annual removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Million cubic feet					
National forest	28.6	14.4	14.1	15.5	12.0	3.6
Other public	26.3	7.3	19.1	14.7	10.5	4.2
Forest industry	303.0	210.0	93.0	289.7	205.2	88.3
Farmer	269.4	118.3	151.1	219.2	128.0	91.2
Miscellaneous private	596.4	307.8	288.6	546.6	363.8	182.8
All ownerships	1,223.6	657.8	565.9	1,089.6	719.5	370.1

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

Table 18.—*Average net annual growth and average annual removals of sawtimber on timberland by species, Alabama, 1982 to 1989**

Species	Average net annual growth	Average annual removals
	Million board feet†	
Yellow pines	2,745.3	2,856.2
Cypress	18.4	1.4
Redcedar	10.8	3.1
Other softwoods	5.2	...
Total softwoods	2,779.6	2,860.7
Select white and red oaks‡	248.7	136.1
Other white and red oaks	631.9	422.6
Hickory	118.5	85.4
Hard maple	2.8	2.4
Sweetgum	222.3	142.5
Tupelo and blackgum	105.4	45.1
Ash, walnut, and black cherry	35.1	28.3
Yellow-poplar	196.3	93.1
Other hardwoods	153.0	118.6
Total hardwoods	1,714.2	1,074.1
All species	4,493.8	3,934.8

*Columns may not sum to totals due to rounding.
†International ¼-inch Rule.
‡Includes white, swamp chestnut, swamp white, chinkapin, bur, cherrybark, northern red, and Shumard oaks.

Table 19. *Average net annual growth and average annual removals of sawtimber on timberland by ownership class and by softwood and hardwood, Alabama, 1982 to 1989**

Ownership class	Average net annual growth			Average annual removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Million board feet†					
National forest	127.9	76.7	51.3	63.7	55.6	8.1
Other public	100.1	41.7	58.4	60.9	49.9	10.9
Forest industry	1,025.8	728.3	297.5	1,063.2	807.4	255.8
Farmer	1,076.9	593.0	484.0	805.6	541.4	264.2
Miscellaneous private	2,163.0	1,340.0	823.1	1,941.4	1,406.3	535.1
All ownerships	4,493.8	2,779.6	1,714.2	3,834.8	2,860.7	1,074.1

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

Table 20. *Average annual mortality of growing stock and sawtimber on timberland by species, Alabama, 1982 to 1989**

Species	Growing stock	Sawtimber
	Million cubic feet	*Million board feet*†
Yellow pines	103.6	278.6
Cypress	0.8	2.2
Redcedar	1.6	2.7
Other softwoods	0.2	...
Total softwoods	106.2	283.5
Select white and red oaks‡	6.3	18.4
Other white and red oaks	27.5	66.9
Hickory	7.4	17.6
Hard maple	0.1	...
Sweetgum	17.2	30.1
Tupelo and blackgum	5.6	14.3
Ash, walnut, and black cherry	4.2	12.4
Yellow-poplar	7.2	20.2
Other hardwoods	16.4	34.6
Total hardwoods	91.9	214.5
All species	198.1	498.0

*Columns may not sum to totals due to rounding.
†International ¼-inch Rule.
‡Includes white, swamp chestnut, chinkapin, bur, cherrybark, northern red, and Shumard oaks.

Table 21. *Average annual mortality of growing stock and sawtimber on timberland by ownership class and by softwood and hardwood, Alabama, 1982 to 1989**

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Million cubic feet			*Million board feet*†		
National forest	5.9	4.5	1.4	17.6	14.0	3.6
Other public	6.0	2.9	3.1	17.9	10.6	7.3
Forest industry	42.3	24.8	17.5	97.1	60.3	36.8
Farmer	48.4	22.3	26.0	118.7	59.0	59.7
Miscellaneous private	95.5	51.7	43.8	246.6	139.5	107.1
All ownerships	198.1	106.2	91.9	498.0	283.5	214.5

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

Table 22. *Average annual mortality of growing stock and sawtimber on timberland by cause of death and by softwood and hardwood, Alabama, 1982 to 1989**

Cause of death	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Million cubic feet			*Million board feet*†		
Bark beetles	18.7	18.7	...	63.8	63.8	...
Other insects	2.4	1.9	0.5	4.6	3.0	1.6
Disease	132.4	66.0	66.4	321.0	169.7	151.3
Fire	4.2	2.4	1.9	6.1	4.7	1.3
Beaver	1.9	0.4	1.5	4.4	1.0	3.4
Other animals	0.6	0.6	...	0.7	0.7	...
Weather	22.0	8.5	13.5	79.8	32.9	46.9
Hurricane	0.8	0.5	0.3	1.8	0.9	0.9
Suppression	5.3	3.6	1.7	2.9	0.9	1.9
Other	9.7	3.7	6.0	12.9	5.7	7.2
All causes	198.1	106.2	91.9	498.0	283.5	214.5

*Rows and columns may not sum to totals due to rounding.
†International ¼-inch Rule.

McWilliams, William H. 1992. Forest resources of Alabama. Resour. Bull. SO-170. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 71 p.

The principal findings of the sixth forest inventory of Alabama (1990) and changes that have occurred since earlier inventories are presented in this report. Topics include the status and trends in forest area, biomass, timber volume, growth, removals, mortality, and timber products output.

Keywords: Forest inventory, nonindustrial private landowner, pine plantation, pine regeneration, timberland, timber supply.