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Forest Resources of Louisiana, 1991

James F. Rosson, Jr.



FOREWORD

The USDA Forest Service, Southern Forest Experiment Station's Forest Inventory and Analysis (SO-FIA) unit headquartered at Starkville, Mississippi, inventories the forests in the States of Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas and the U.S. Commonwealth 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, and the Forest and Rangeland Renewable Resources Research Act of 1978.

ACKNOWLEDGMENTS

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HIGHLIGHTS

Important findings of the sixth Louisiana forest survey are presented below. Comparisons, unless otherwise noted, are based on estimates for January 1, 1984, and January 1, 1991.

- Timberland area decreased by only 89,600 acres. Louisiana currently has 13,783,000 acres of timberland.
- The predominant forest type group is still oak-gum-cypress, 4,349,900 acres. The loblolly-shortleaf pine type is continuing to close the gap.
- Sawtimber stands occupy 59 percent of Louisiana's timberland. Currently, 3,403,400 acres are in sapling-seedling, 2,161,500 acres are in poletimber, and 8,148,100 acres are in sawtimber stands.
- Some 248,200 acres of sapling-seedling stands, 122,200 acres of poletimber stands, and 344,100 acres of sawtimber stands are understocked. (Adequacy of stocking is based on the numbers and sizes of all live trees.)
- Softwood live-tree volume decreased by 9 percent since 1984. The current volume is 10,122.2 million cubic feet (ft³).
- Hardwood live-tree volume increased only slightly (1 percent) since 1984 to 10,616.1 million ft³.
- Softwood live-tree net growth decreased by 11 percent since 1984. Current net growth is 524.8 million ft³ per year. Removals have increased dramatically, leaving a removal-to-growth ratio of 1.27 to 1. Current removals are 669.0 million ft³ per year, up 49 percent since 1984.
- Hardwood live-tree net growth increased 8 percent since 1984. Current net growth is 325.4 million ft³. Hardwood removals increased 18 percent.

- Plantations occupy 2,735,700 acres of timberland, 16 percent more than 1984.
- Twenty-three percent of Louisiana's live-tree softwood volume (2,314.2 million ft³) is in plantations.
- A total of 4,373,500 acres of timberland underwent some form of commercial harvest since 1984. This is 32 percent of all Louisiana timberland.
- Louisiana had 2,402,500 acres that underwent some form of intermediate stand treatment, a 452,600-acre increase over that reported for 1984.

INTRODUCTION

The findings of the sixth Louisiana forest survey are summarized in this report. The survey is administered by the U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, headquartered in New Orleans, Louisiana. The Forest Inventory and Analysis (SO-FIA) work unit located in Starkville, Mississippi, is responsible for conducting the surveys. The following seven Midsouth States are under the administration of the Southern Forest Experiment Station (listed in the order the surveys are conducted): Alabama, Louisiana, Texas, Oklahoma, Mississippi, Arkansas, and Tennessee.

Louisiana is subdivided into five forest survey units (fig. 1): North Delta (Unit 1), South Delta (Unit 2), Southwest (Unit 3), Southeast (Unit 4), and Northwest (Unit 5). These divisions facilitate field work and data analysis because the unit boundaries are correlated fairly closely with the physiographic and vegetative regions of the State.

Tables and figures present data for January 1, 1991, as well as estimates of trends. Comparisons, unless otherwise noted, are made between estimates for January 1, 1984, and January 1, 1991. The appendix describes survey methods and data reliability, defines terms, lists common tree species, and provides 22 standard tables.

Numerous publications about the sixth Louisiana survey have already been published: five forest sur-

vey unit reports (Rosson and others 1991a, 1991b, 1991c, 1991d, 1992), a parish statistical report (Vissage and others 1992), a biomass report (Rosson 1993), a harvesting Research Paper (Rosson 1994a), and a Research Paper addressing the status of softwood trees of less than commercial size (Rosson 1994b). The five previous forest surveys of Louisiana were conducted in 1936 (Winters and others 1943), 1954 (USDA FS 1955), 1964 (Sternitzke 1965), 1974 (Murphy 1975), and 1984 (Rosson and others 1988).

The McSweeney-McNary Act of 1928 directed the Forest Service to conduct periodic assessments of the Nation's forest resources. The survey mission was to estimate forest area, timber volume, timber growth, and cut. The survey was charged with reporting the findings and aiding in formulating guiding principles and policies for sustained forest use. Recently, the mission was expanded by three major legislative actions: (1) the Forest and Rangeland Renewable Resources Planning Act of 1974, (2) the National Forest Management Act of 1976, and (3) the Forest and Rangeland Renewable Resources Research Act of 1978. The current mission includes all of the original McSweeney-McNary objectives plus the measurement of additional tangible items (such as wildlife and ecological parameters) and intangible items (such as esthetics, recreation, and human impact). These acts ensure the availability of adequate data for determining ways to balance the supply of and demand for forest land resources for the benefit and use of the American people.

Questions about the survey and requests for additional information may be directed to:

Forest Inventory and Analysis
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FOREST AREA

Louisiana has 29,312,500 acres of land. Because the focus here is on timberland, the forest survey excluded Cameron, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, where timberland is very rare. These exclusions reduced the total land base for this forest survey to 26,265,400 acres.

Of this total, 13,791,700 acres are classed as forest and 12,473,700 acres as nonforest land. Nonforest land uses include agricultural, urban, residential, and industrial sites; highways and other rights of way; water; and small wooded lots or wooded strips too small or narrow to meet forest survey definitions. Also excluded from the timberland total are 8,700 acres of

potentially productive public forests on which timber harvest is legally prohibited. The remaining 13,783,000 acres of forest land in Louisiana are classed as timberland.

The 1991 timberland estimate is only 89,600 acres below that of 1984. Historically, Louisiana has lost 2,372,900 acres of timberland since the first survey in 1936. Most of the loss (2,271,200 acres) was in the North Delta and South Delta units (table I). The latest survey shows timberland area stabilizing in all but the South Delta unit. There, 166,500 acres of timberland have been lost since 1984.

The net loss in timberland acreage does not reflect the dynamic changes in land use that have occurred over the last 7 years. Although timberland acreage decreased only slightly, a total of 921,600 acres shifted between forest and nonforest uses. Some 505,600 acres moved from a forest to a nonforest class, and 416,000 acres reverted to timberland from a nonforest class (table II). The majority of diversions went to non-agricultural uses (64 percent), whereas most of the new forest land had been agriculture land previously (73 percent).

Since the 1984 survey, only two units, the South Delta and Southwest, have lost timberland acreage. For the first time since the first survey, the Northwest unit has surpassed the Southwest unit in timberland acreage. Over the last 50 years, timberland in the Southwest unit has decreased whereas that in the Northwest unit has increased.

Four parishes each gained more than 20,000 acres of timberland since 1984 (fig. 2). Richland Parish had the highest gain, 35,600 acres. Six parishes lost more than 20,000 acres of timberland. Beauregard Parish had the largest loss of timberland, 52,700 acres, or 9 percent of its total.

The 1991 survey shows that the amount of land cleared for agriculture in the Mississippi Delta is declining. Only 31,000 acres of timberland in the North Delta unit were cleared since 1984. In the South Delta unit, most of the lost timberland (130,200 acres) went into nonagricultural land uses. Reversions in the North Delta unit resulted in a 32,000-acre net increase in timberland. There were fewer reversions in the South Delta unit, in which the area of timberland decreased by 166,500 acres. Large-scale clearing of delta timberland for agriculture peaked in the 1960's and early 1970's and appears to have settled into localized land-use shifts. This situation is expected to continue unless extreme shifts in agriculture markets or changes in land-use legislation encourage renewed land clearing.

Overall, 52 percent of the land in the surveyed parishes is timberland. Nineteen parishes have 61 to 80 percent of their land area in timberland (fig. 3). Nine parishes have less than 20 percent and eight have more than 80 percent of their land in timberland.

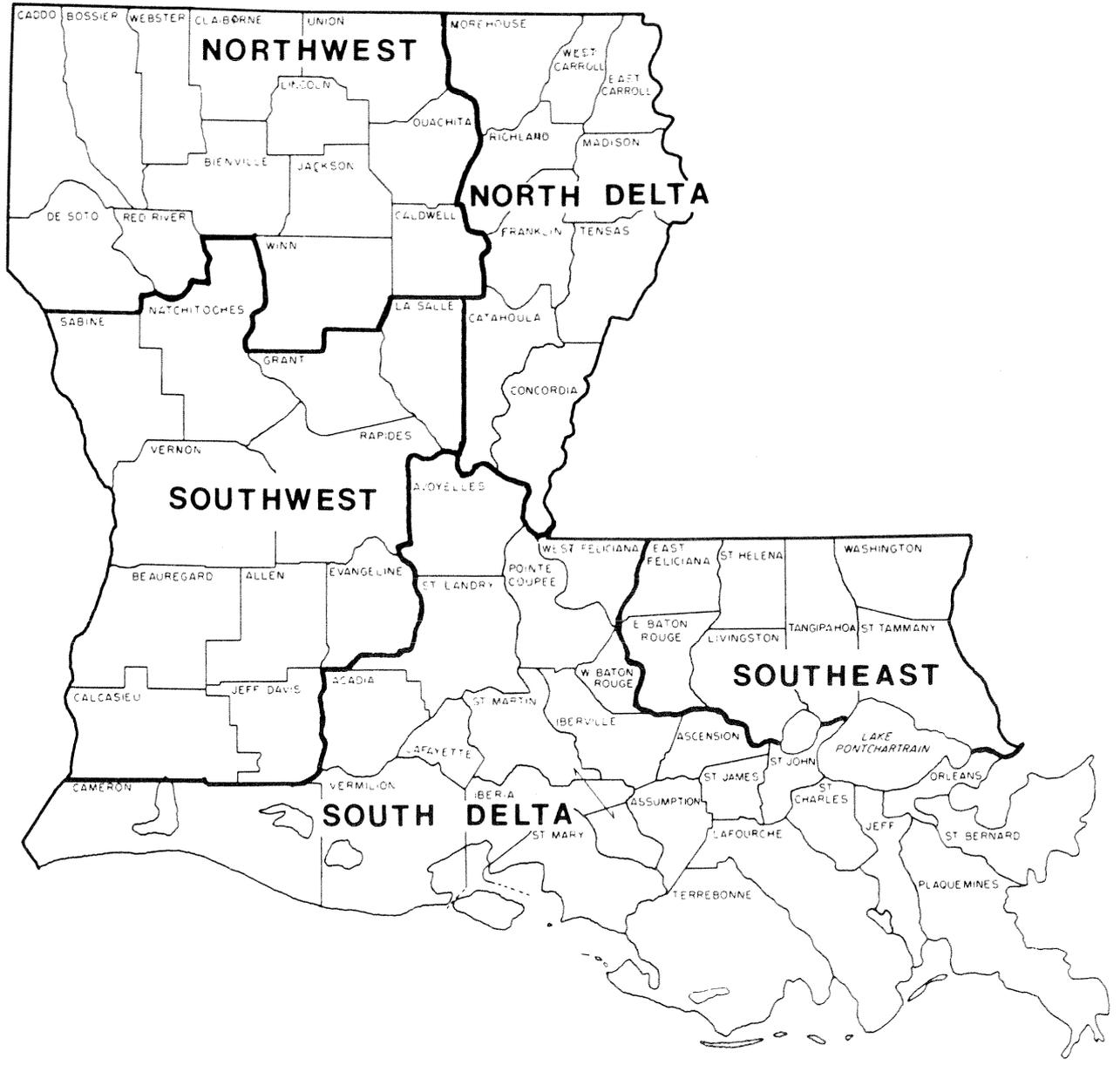


Figure 1.— Forest survey units of Louisiana.

Table I.—*Timberland area, Louisiana, 1936 to 1991**

Forest survey unit	Survey date					
	1936	1954	1964	1974	1984	1991
	-----Thousand acres-----					
North Delta	2,440.3	2,171.3	1,894.8	1,178.4	913.5	945.5
South Delta	3,001.2	2,819.6	2,750.9	2,573.1	2,391.3	2,224.8
Southwest	4,972.0	4,874.5	4,822.3	4,538.4	4,416.8	4,378.6
Southeast	2,086.1	2,002.8	1,884.4	1,786.3	1,751.2	1,763.7
Northwest	3,656.3	4,169.8	4,684.1	4,450.4	4,399.9	4,470.5
All units	16,155.9	16,038.0	16,036.5	14,526.6	13,872.6	13,783.0

*Numbers in columns may not sum to totals due to rounding.



Figure 2. — *Louisiana parishes with gains and losses in timberland, 1984 to 1991.*

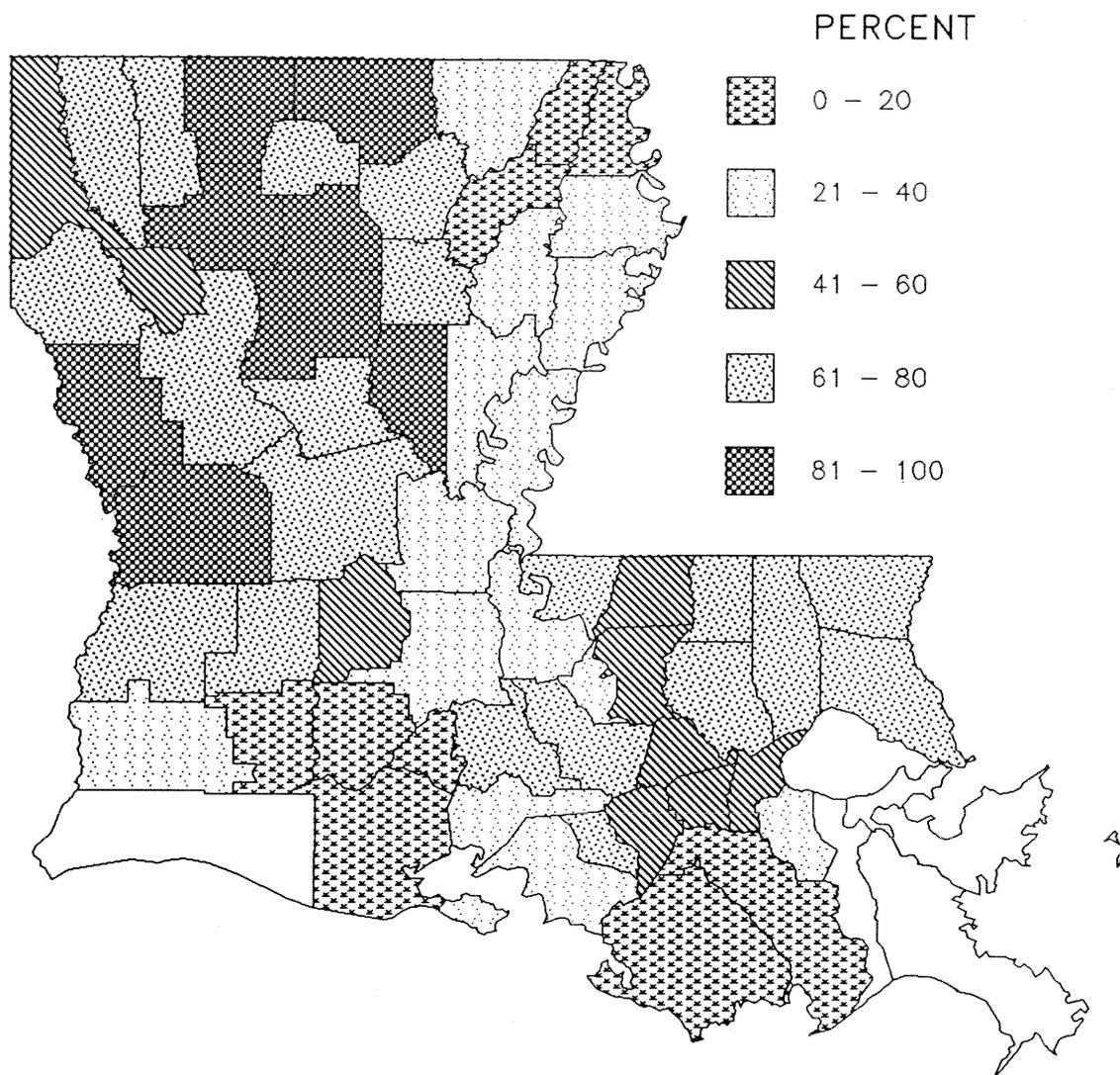


Figure 3. — Percentage of parish area in timberland, Louisiana, 1991. Parishes in white were not included in the survey.

Ownership

Nonindustrial private forest (NIPF) owners continue to be the dominant class of owners in the State. The NIPF category includes farmers, individuals, and corporations (see the appendix for definitions of these categories). The 1991 survey shows 8,578,400 acres of NIPF land, a 4-percent decrease since the 1984 survey (table III). Nevertheless, NIPF owners hold 62 percent of all timberland in the State (fig. 4). Regionally, the highest proportions of NIPF ownership are 83 percent in the South Delta and 70 percent in the Southeast unit. The lowest proportion of NIPF ownership is 49 percent in the Southwest unit.

In 26 parishes, more than 80 percent of timberland is in the NIPF category (fig. 5). In contrast, only one surveyed parish has less than 20 percent of timberland in the NIPF category.

Forest industry currently has 3,898,300 acres of timberland—28 percent of the State total. Its holdings increased by 295,200 acres since 1984. The greatest concentration of forest industry holdings is in the Southwest unit. There, 37 percent of timberland is held by forest industry. The other unit with large forest industry holdings is the Northwest where they cover 1,280,900 acres or 29 percent of the timberland. In 13 parishes, more than 40 percent of timberland is owned by forest industry (fig. 6).

The public owns 1,306,300 acres or 9 percent of all timberland in Louisiana. A large portion of this timberland (568,500 acres) is in national forests. All of the national forest acreage is in the Southwest and Northwest units—427,000 and 141,500 acres, respectively. There are six ranger districts on one national forest, the Kisatchie, in Louisiana. National forest timberland acreage was obtained differently in 1991 than

Table II.—Changes in timberland by forest survey unit, Louisiana, 1984 to 1991*

Forest survey unit	Total land [†]	Timberland	Change	Additions			Diversions		
				Total	Agriculture	Other [‡]	Total	Agriculture	Other [‡]
-----Thousand acres-----									
North Delta	3,515.5	945.5	32.0	83.6	57.9	25.7	51.6	31.0	20.6
South Delta	7,398.9	2,224.8	-166.5	28.7	23.0	5.7	195.2	65.1	130.2
Southwest	6,667.5	4,378.6	-38.4	72.1	61.0	11.1	110.2	28.8	81.5
Southeast	2,762.6	1,763.7	12.5	113.2	89.4	23.8	100.7	33.6	67.2
Northwest	5,920.6	4,470.5	70.6	118.4	73.3	45.1	47.8	23.9	23.9
All units	26,265.4	13,783.0	-89.6	416.0	304.5	111.5	505.6	182.3	323.3

*Numbers in rows and columns may not sum to totals due to rounding.

[†]United States Department of Commerce, Bureau of the Census, 1980 (issued October 1981). The following parishes, totaling 3,047.1 thousand acres of total land, were not included in the sixth Louisiana forest survey because of the infrequent occurrence of timberland: Cameron, Jefferson, Orleans, Plaquemines, and St. Bernard.

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

in 1984. In 1984, the national forest area was derived from sampling estimates and a standard error was assigned. The 1991 survey used census figures supplied by the Southern Region of the National Forest System. These figures for timberland on the Kisatchie National Forest were the most current and, for our purposes, they are assumed to be free of error. Therefore, 1984 and 1991 figures for national forest timberland are not directly comparable.

The other 737,800 acres of public holdings (other Federal, State, parish, and municipal timberland) are distributed fairly evenly across the State. The Northwest unit has the most acreage (fig. 4). The area with the highest proportion of timberland in other public holdings is the North Delta unit with 17 percent.

Forest Type Groups

The SO-FIA unit aggregates forest types into forest type groups (FTG's) to facilitate reporting of results. See Eyre (1980) for a discussion and listing of the forest types that are categorized into these SO-FIA forest type groups (also called major forest types in the Eyre publication). The forest survey assigns a Society of American Foresters (SAF) forest type name (Eyre 1980) based on the predominance of one, two,

or sometimes three tree species according to the relative species majority (or plurality if a species majority is not present) in the stand sample. The SAF guidelines suggest using basal area as the importance value in assigning forest type (Eyre 1980). In this instance, however, SO-FIA uses the relative stocking contributed by each tree to determine the degree of species importance on each sample plot.

The predominant FTG in Louisiana is still oak-gum-cypress, but the gap between it and the loblolly-shortleaf pine type is narrowing (table IV). The bottomland types (oak-gum-cypress and elm-ash-cottonwood) are the predominant FTG's in the North Delta and South Delta units (fig. 7). Even in the other three units, the bottomland types occupy a substantial proportion of timberland.

Second in dominance is the loblolly-shortleaf pine FTG; it is predominant in the Southwest and Northwest units. More than 82 percent of Louisiana's loblolly-shortleaf pine type is in these two units (fig. 7). The longleaf-slash pine FTG continues to decline, losing another 63,500 acres since the last survey. The Southwest unit has more than 83 percent of the State's longleaf-slash pine FTG.

The oak-hickory FTG declined by 63,300 acres since the last survey. A large decline in the Northwest unit

Table III.—Area of timberland by forest survey unit, ownership, and change, Louisiana, 1984 to 1991*

Forest survey unit	All owners			Forest industry	Nonindustrial private [†]		
	Public	Change	Change		Change	Change	Change
-----Thousand acres-----							
North Delta	945.5	158.1	-10.1	248.0	-111.6	539.4	153.7
South Delta	2,224.8	118.7	-18.9	258.4	122.2	1,847.7	-269.9
Southwest	4,378.6	611.4	-27.7	1,639.5	269.0	2,127.7	-279.4
Southeast	1,763.7	53.1	10.9	471.5	6.5	1,239.1	-4.9
Northwest	4,470.5	365.0	26.9	1,280.9	9.1	2,824.6	34.6
All units	13,783.0	1,306.3	-18.9	3,898.3	295.2	8,578.4	-365.9

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Includes 524,200 acres leased to forest industry.

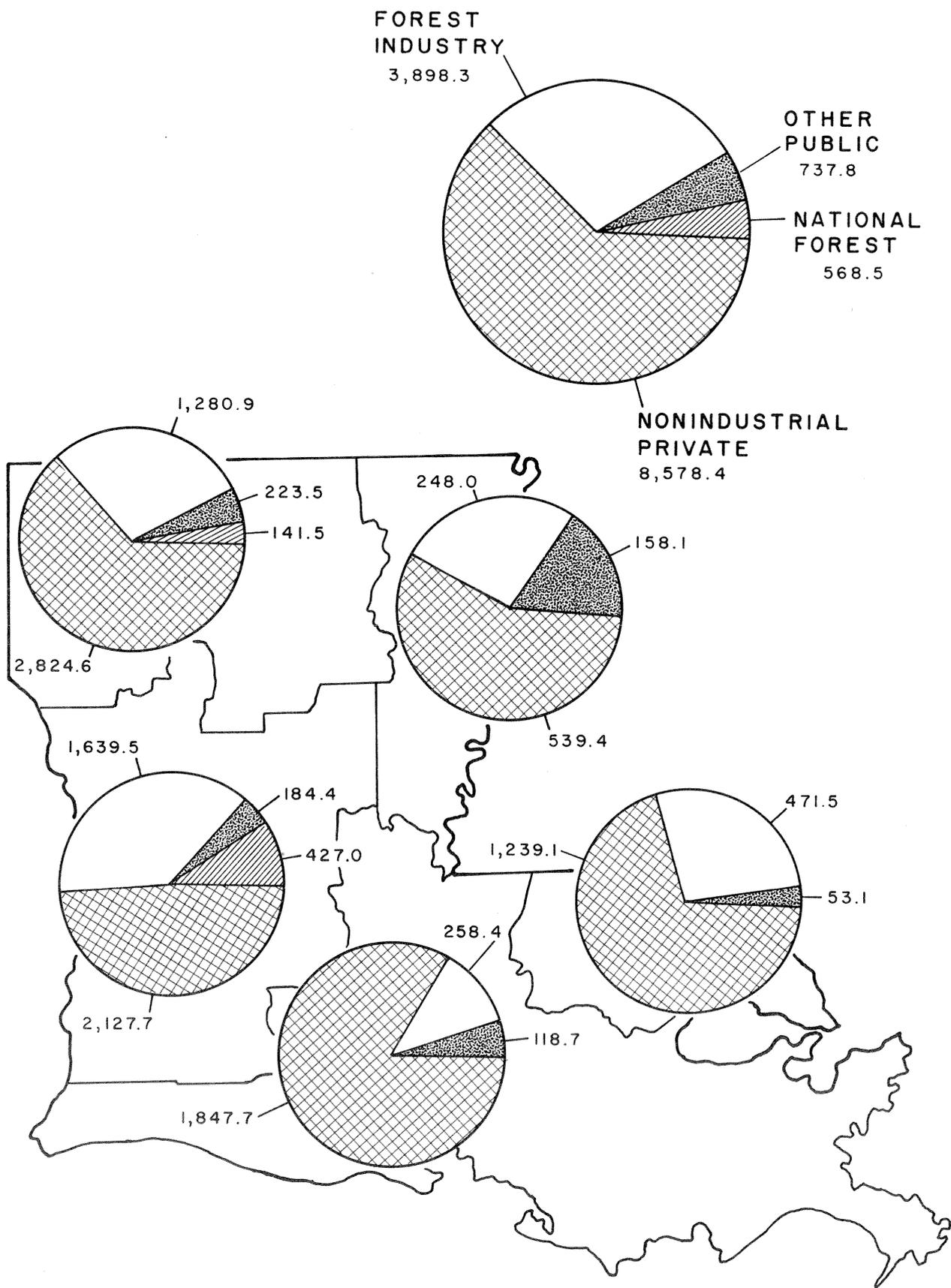


Figure 4. — Proportion of timberland, in thousand acres, by ownership, Louisiana, 1991.

Table IV.—Area of timberland by forest survey unit, forest type group, and change, Louisiana, 1984 to 1991*

Forest survey unit	All types		Longleaf-slash		Loblolly-shortleaf		Oak-pine		Oak-hickory		Oak-gum-cypress		Elm-ash-cottonwood		Nontyped [†]	
	Area	Change	Area	Change	Area	Change	Area	Change	Area	Change	Area	Change	Area	Change	Area	Change
North Delta	945.5	-6.1	0.0	0.0	147.3	49.2	53.5	-27.5	37.4	-18.1	614.9	59.1	92.3	-16.5	0.0	0.0
South Delta	2,224.8	0.0	0.0	0.0	31.2	-24.6	26.2	14.7	108.2	13.4	1,786.0	-191.7	268.7	25.3	4.5	4.5
Southwest	4,378.6	-56.9	722.5	-56.9	1,566.4	18.6	666.2	-0.2	717.5	44.7	694.9	-27.6	11.1	-16.7	0.0	0.0
Southeast	1,763.7	-7.5	123.9	-7.5	566.7	2.4	188.0	-72.1	375.1	24.1	492.9	53.9	6.7	6.7	10.4	10.4
Northwest	4,470.5	23.3	23.3	7.0	1,841.9	45.7	952.7	75.2	868.9	-127.4	761.3	95.6	22.4	-14.7	0.0	0.0
All units	13,783.0	869.7	869.7	-63.5	4,153.6	91.2	1,886.6	-10.0	2,107.2	-63.3	4,349.9	-10.7	401.3	-15.9	14.9	14.9

*Numbers in rows and columns may not sum to totals due to rounding.

[†]No live trees, saplings, or seedlings.

was partially offset by gains in the South Delta, Southwest, and Southeast units. The oak-pine FTG has changed little at the State level because a 72,100-acre loss in the Southeast unit was offset by a 75,200-acre gain in the Northwest unit.

Figure 8 (a through e) illustrates the species that are dominant in the SO-FIA FTG's, ranked by dominance according to volume of all trees ≥ 1.0 inch in diameter at breast height (d.b.h.). In the longleaf-slash pine FTG, slash pine clearly dominates in the three survey units where the type occurs (fig. 8, c through d). Longleaf pine contributes less than 30 percent of total volume for the type in all three units.

The loblolly-shortleaf pine FTG occurs in all five of Louisiana's forest survey units. Loblolly pine is dominant in the type in all five units, containing more than 60 percent of the volume. Shortleaf pine occurrence is substantial only in the Northwest survey unit, where it makes up slightly more than 14 percent of the volume in the type.

Loblolly pine also dominates the oak-pine FTG in all five forest survey units. Sweetgum is a major member of this type in all the units.

Sweetgum is dominant in the oak-hickory FTG in the South Delta, Southeast, and Northwest units. Loblolly pine is dominant in the North Delta and water oak, in the Southeast unit. Even in these units, sweetgum is an important contributor to volume in this type.

In the bottomland hardwood FTG's, sweetgum is dominant in three of the five survey units (North Delta, Southwest, and Northwest). Baldcypress is dominant in the South Delta and Southeast units.

STAND VOLUME

Timber volume in all live trees ≥ 5.0 inches in d.b.h. totals 20,738.3 million ft^3 . This total is 876.6 million ft^3 (4 percent) less than in 1984. All of the inventory decline was softwood. Fifty-nine percent of the timber inventory is in the Southwest and Northwest units.

Ninety-one percent of the timber is in growing-stock trees (18,844.4 million ft^3). Of total growing-stock volume, 4,185.5 million ft^3 are in poletimber trees, and 14,659.0 million ft^3 are in sawtimber trees. Sixty-four percent of the growing-stock volume (12,161.3 million ft^3) is on NIPF land. Forest industry owns 4,633.1 million ft^3 , and the public owns 2,050.0 million ft^3 (25 and 11 percent of total growing-stock volume, respectively).

Sawtimber volume totals 75,526 million board feet (fbm). Sixty-four percent of this volume is on NIPF land; the remaining 23 and 13 percent are on forest industry and public land, respectively. The ownership proportions of sawtimber volume are approximately the same as the ownership of growing-stock volume.

Sound wood in cull trees totals 1,894.0 million ft³. An additional 33.2 million ft³ of sound wood are in salvable dead trees. Cull tree and salvable dead volumes, together, represent only 9 percent of the State's gross volume of 20,771.7 million ft³.

Louisiana's timberland contains 239.1 million dry tons of softwood and 411.1 million dry tons of hardwood woody biomass in live trees. Eighty-five percent of the softwood biomass is in the stem portion of trees, whereas 74 percent of the hardwood biomass is in hardwood stems. For a more detailed analysis of the biomass on Louisiana's timberland see Rosson (1993).

Softwood Volume

The softwood live tree inventory in Louisiana is 10,122.2 million ft³ (table V). This total is 965.7 million ft³ (9 percent) less than in 1984. The largest decreases were in the Southwest (442.5 million ft³) and Northwest (320.9 million ft³) survey units. These two

Table V.—Change in live-tree volume by forest survey unit, Louisiana, 1984 to 1991*

Forest survey unit	Softwood		Hardwood	
	Volume	Change	Volume	Change
	----- Million cubic feet -----			
North Delta	272.3	26.1	1,203.6	7.1
South Delta	1,293.5	-79.5	3,265.8	-32.8
Southwest	3,541.9	-442.5	2,208.0	150.0
Southeast	1,270.6	-148.9	1,286.3	151.8
Northwest	3,744.0	-320.9	2,652.3	-187.0
All units	10,122.2	-965.7	10,616.1	89.1

*Numbers in columns may not sum to totals due to rounding.

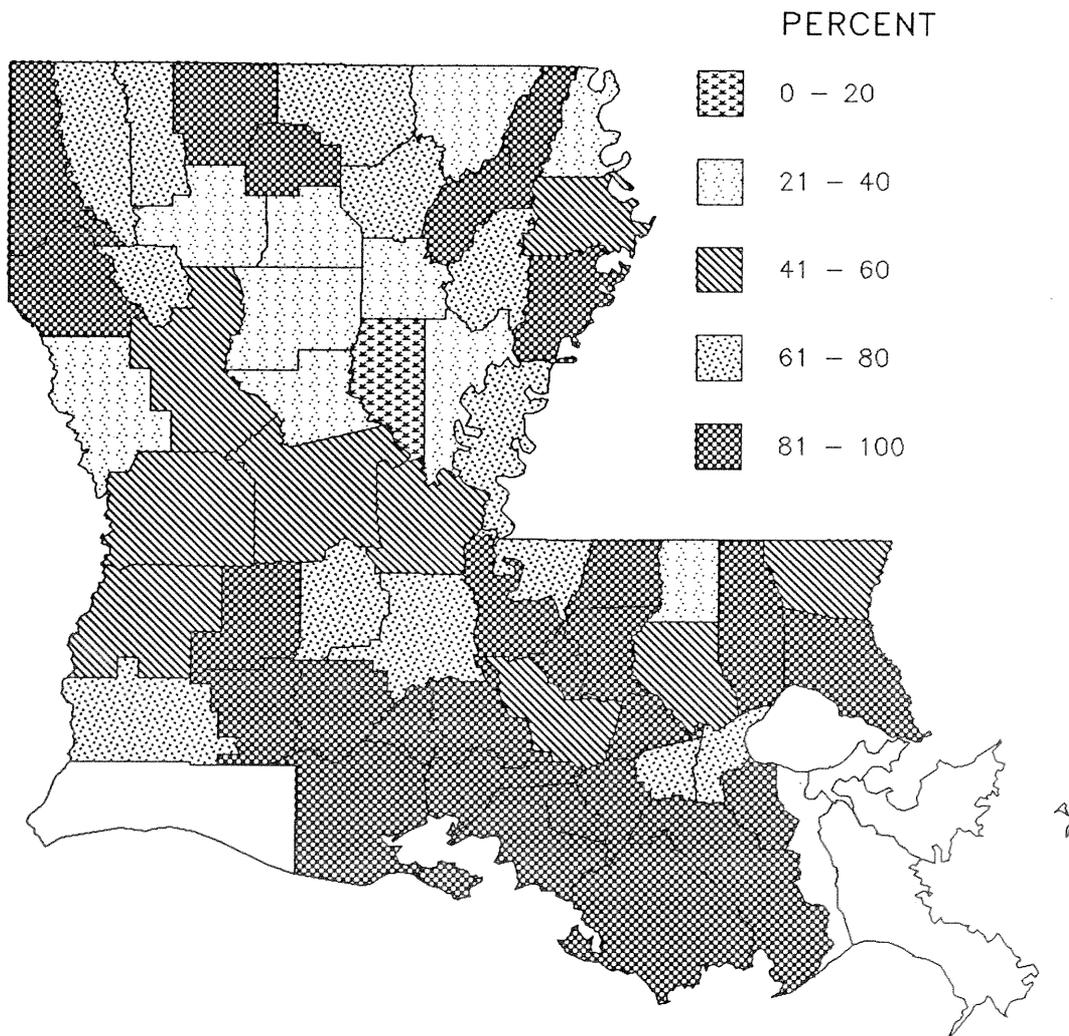
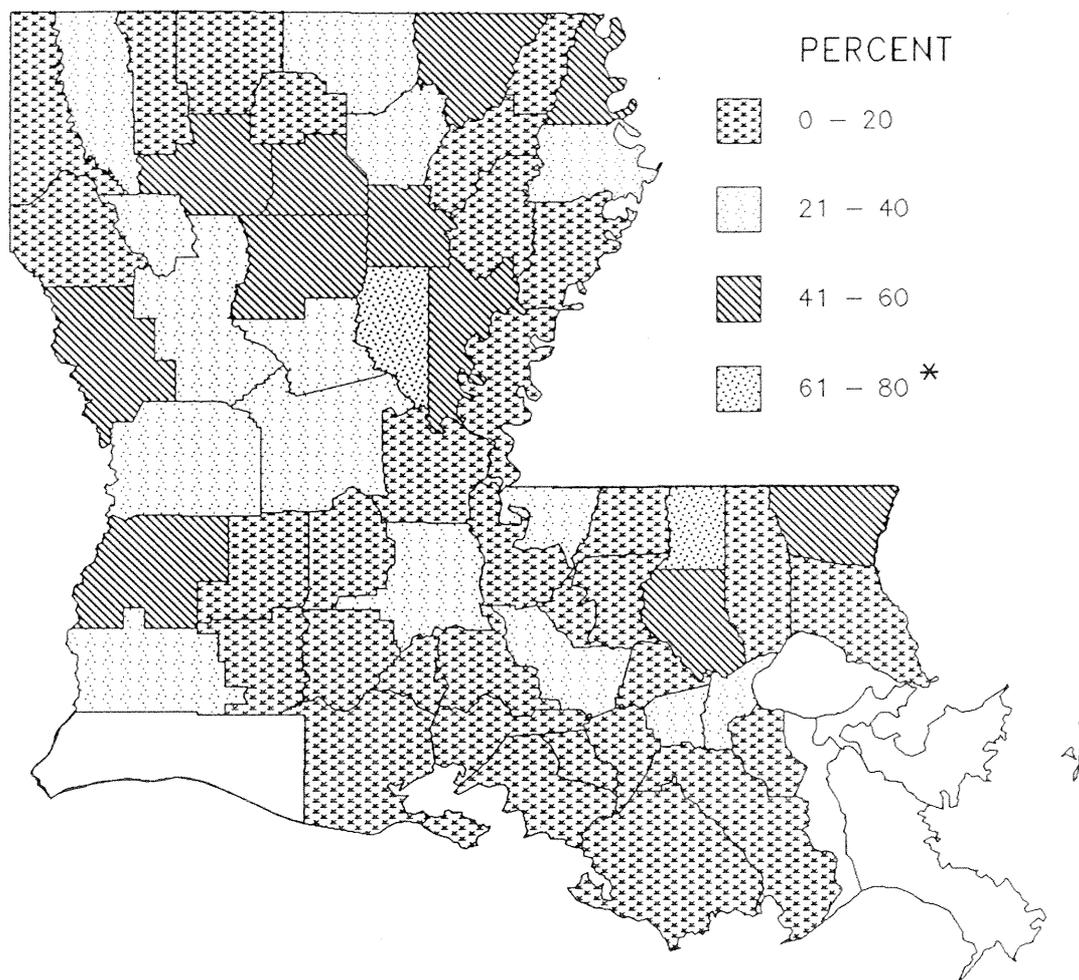


Figure 5.—Percentage of parish timberland held by nonindustrial private forest landowners, Louisiana, 1991. Parishes in white were not included in the survey.



* THERE WERE NO PARISHES WITH MORE THAN 78 PERCENT OF TIMBERLAND IN FOREST INDUSTRY OWNERSHIP.

Figure 6. —Percentage of parish timberland held by forest industries, Louisiana, 1991. Parishes in white were not included in the survey.

units account for 79 percent of the softwood inventory decline.

A striking contrast to the 1984 Louisiana survey is that softwoods are no longer the predominant species group (fig. 9). Because of high amounts of softwood removals, hardwoods now make up 51 percent of live-tree volume. Together, the Southwest and Northwest units hold 72 percent of the State's softwood volume.

The decrease in softwood volume is spread across the entire range of diameter classes (fig. 10), but the biggest decreases are in the 10- through 16-inch diameter classes. This pattern may translate into a decline in the supply of large sawlogs in the next 10 to 20 years.

Loblolly pine is the dominant softwood in the State, with 6,350.0 million ft³ (fig. 11). Ranked second is baldcypress, with 1,597.1 million ft³. Baldcypress was predominant early in this century, but the old-growth stands were cut long ago. Baldcypress is still dominant in the South Delta unit. All the pine species have either declined in volume or held even since the 1984 survey (fig. 11).

The majority of the softwood volume (61 percent) is held by NIPF owners (table VI). Forest industry owns 28 percent, and the public owns the remaining 11 percent. These proportions do not carry over to the decline in softwood volume (table VI). Here, 96 percent of the softwood decline was on NIPF timberland. Only

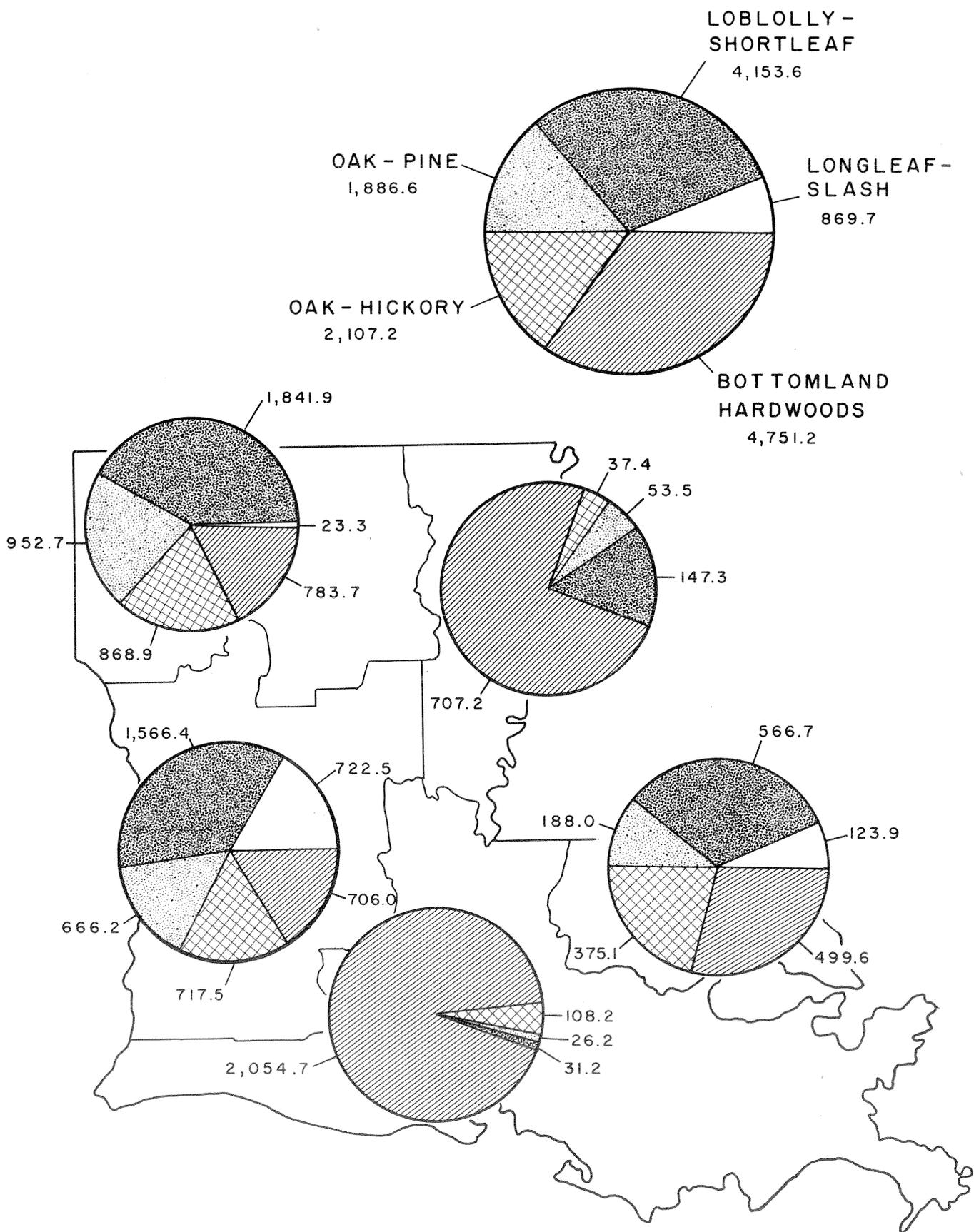


Figure 7. — Proportion of timberland, in thousand acres, by forest type group, Louisiana, 1991. Bottomland hardwoods include the oak-gum-cypress and elm-ash-cottonwood forest type groups.

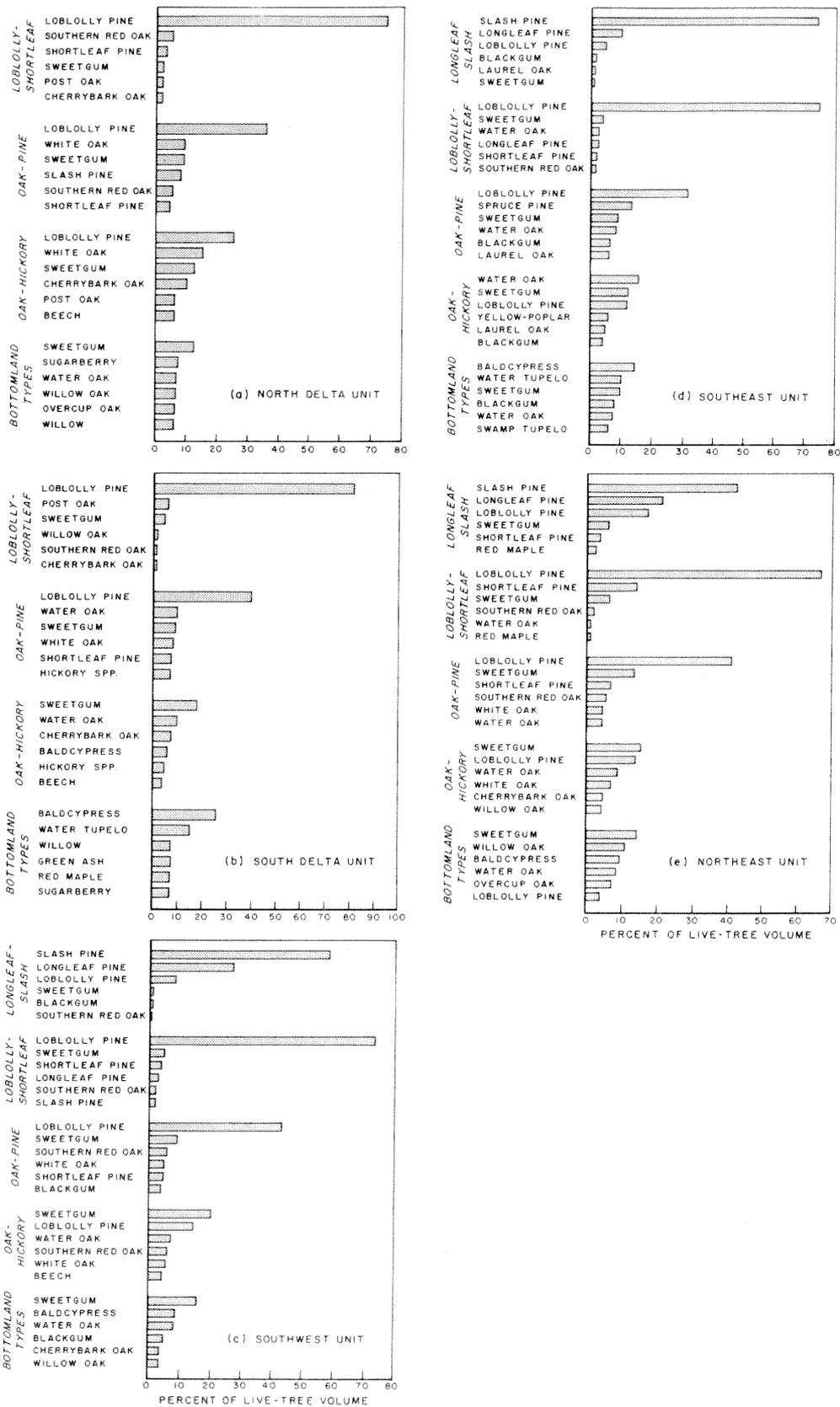


Figure 8. — Relative species importance by forest type group, based on species volume, Louisiana, 1991.

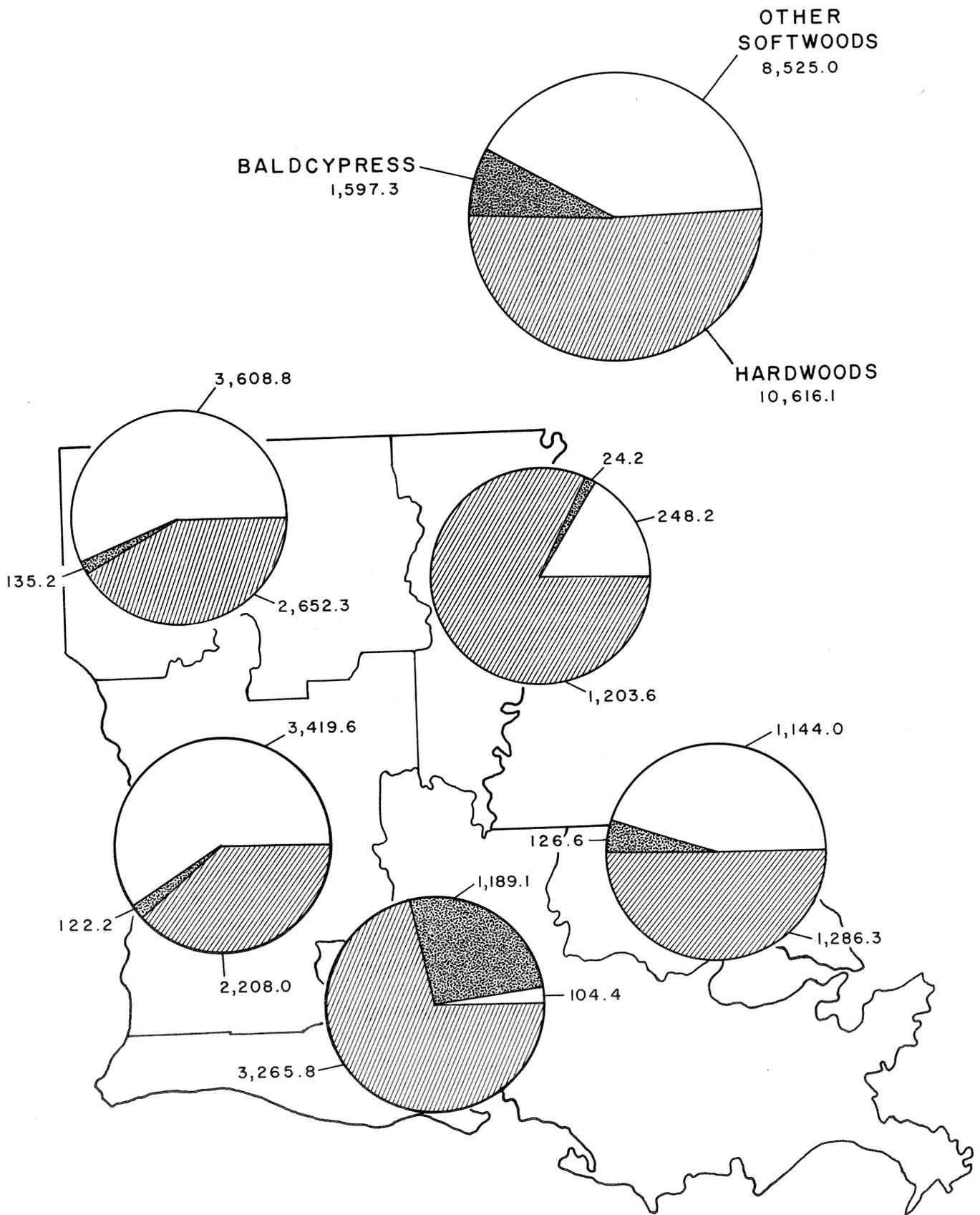


Figure 9. — Proportion of live-tree volume, in million cubic feet, by species group (and baldcypress), Louisiana, 1991.

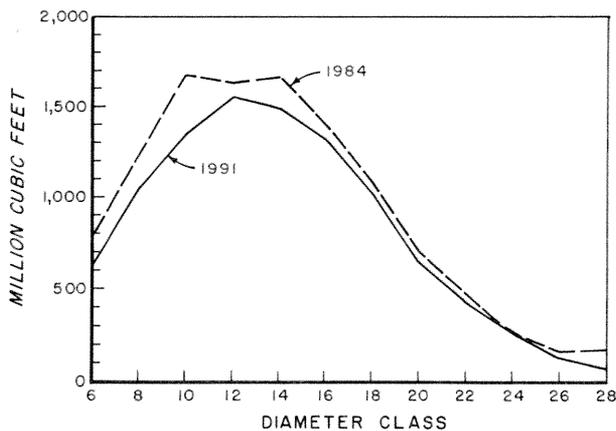


Figure 10. — Softwood live-tree volume by diameter class, Louisiana, 1984 and 1991.

other public timberland showed an increase in softwood inventory since the 1984 survey.

One way to illustrate the spatial distribution of softwood volume is by the amount of timberland acreage in arbitrarily defined yield classes (fig. 12, a through f). There is a trend that is noticeable across all survey units and at the State level (fig. 12f). A large proportion of Louisiana timberland has less than 500 ft³/acre in softwood volume. A total of 7,643,800 acres are in such a condition for reasons ranging from recovery since harvesting (small trees that have not yet crossed the 5.0-inch volume threshold) to poor stocking levels (lack of measures to ensure adequate regeneration, especially after harvest). Only 8 percent of Louisiana's softwood volume is in this class of timberland. In contrast, 1,507,800 acres of timberland (11 percent) have

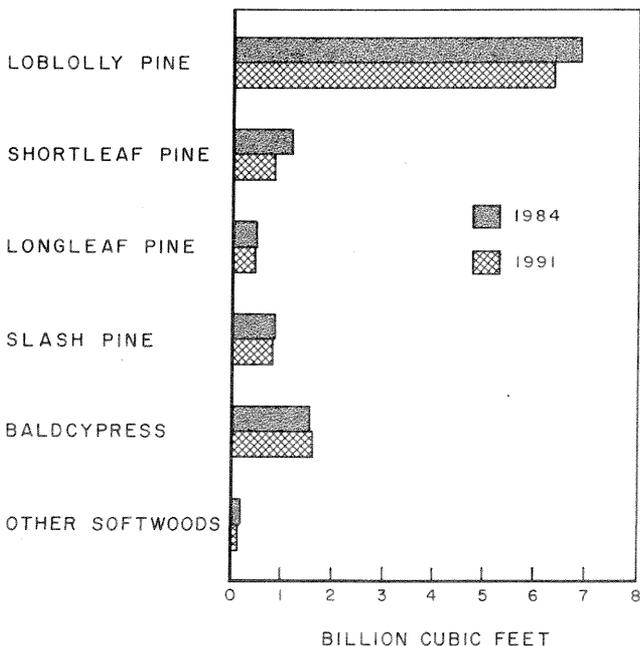


Figure 11. — Softwood live-tree volume by species, Louisiana, 1984 and 1991.

more than 2,000 ft³ of softwood volume per acre. Forty-one percent of Louisiana's softwood volume is in this class of timberland. Figure 12f shows that Louisiana's softwood volume is not evenly distributed across the State's timberland. Rather, 41 percent of the State's softwood volume is situated on only 11 percent of its timberland.

Softwood Sawtimber

Slightly over half of Louisiana's sawtimber is pine (fig. 13), and another 9 percent is baldcypress. Eighty-two percent of the pine sawtimber is in the Southwest and Northwest units, and 75 percent of the baldcypress sawtimber is in the South Delta unit.

Louisiana's softwood sawtimber inventory currently

Table VI.—Change in live-tree volume by ownership, Louisiana, 1984 to 1991*

Ownership	Softwood		Hardwood	
	Volume	Change	Volume	Change
	----- Million cubic feet -----			
National forest	742.4	-66.4	362.5	-29.4
Other public	354.0	73.2	769.8	44.9
Forest industry	2,891.7	-42.1	2,093.8	117.6
Nonindustrial private	6,134.1	-930.3	7,390.0	-44.0
All owners	10,122.2	-965.7	10,616.1	89.1

*Numbers in columns may not sum to totals due to rounding.

totals 44,944.2 million fbm, 3,255.2 million fbm less than in 1984 (table VII). Fifty-two percent of the softwood decline was in the Southwest unit, and another 43 percent was in the Northwest unit. The majority of softwood sawtimber (62 percent) is in NIPF ownership (table VIII), but 78 percent of the softwood sawtimber inventory decline was on NIPF land.

Sixty-three percent of Louisiana's softwood sawtimber volume, 28,292 million fbm, is loblolly pine. Baldcypress ranks second with 6,620 million fbm or 15 percent of the softwood sawtimber inventory. Following closely are shortleaf pine, slash pine, and longleaf pine representing 9, 7, and 5 percent of the softwood sawtimber resource.

Over half of the State's timberland contains less than 1,000 fbm/acre of softwood sawtimber (fig. 14, a through f). In contrast, the majority of Louisiana's softwood sawtimber volume (22,850 million fbm) occurs on about 12

Table VII.—Change in sawtimber volume by forest survey unit, Louisiana, 1984 to 1991*

Forest survey unit	Softwood		Hardwood	
	Volume	Change	Volume	Change
	----- Million board feet [†] -----			
North Delta	1,214.5	148.7	4,074.2	183.2
South Delta	5,540.0	404.1	9,113.0	853.8
Southwest	15,677.5	-1,692.2	6,540.1	1,259.3
Southeast	5,657.2	-716.6	3,537.6	944.9
Northwest	16,854.9	-1,399.3	7,316.4	-260.5
All units	44,944.2	-3,255.2	30,581.4	2,980.7

*Numbers in columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.

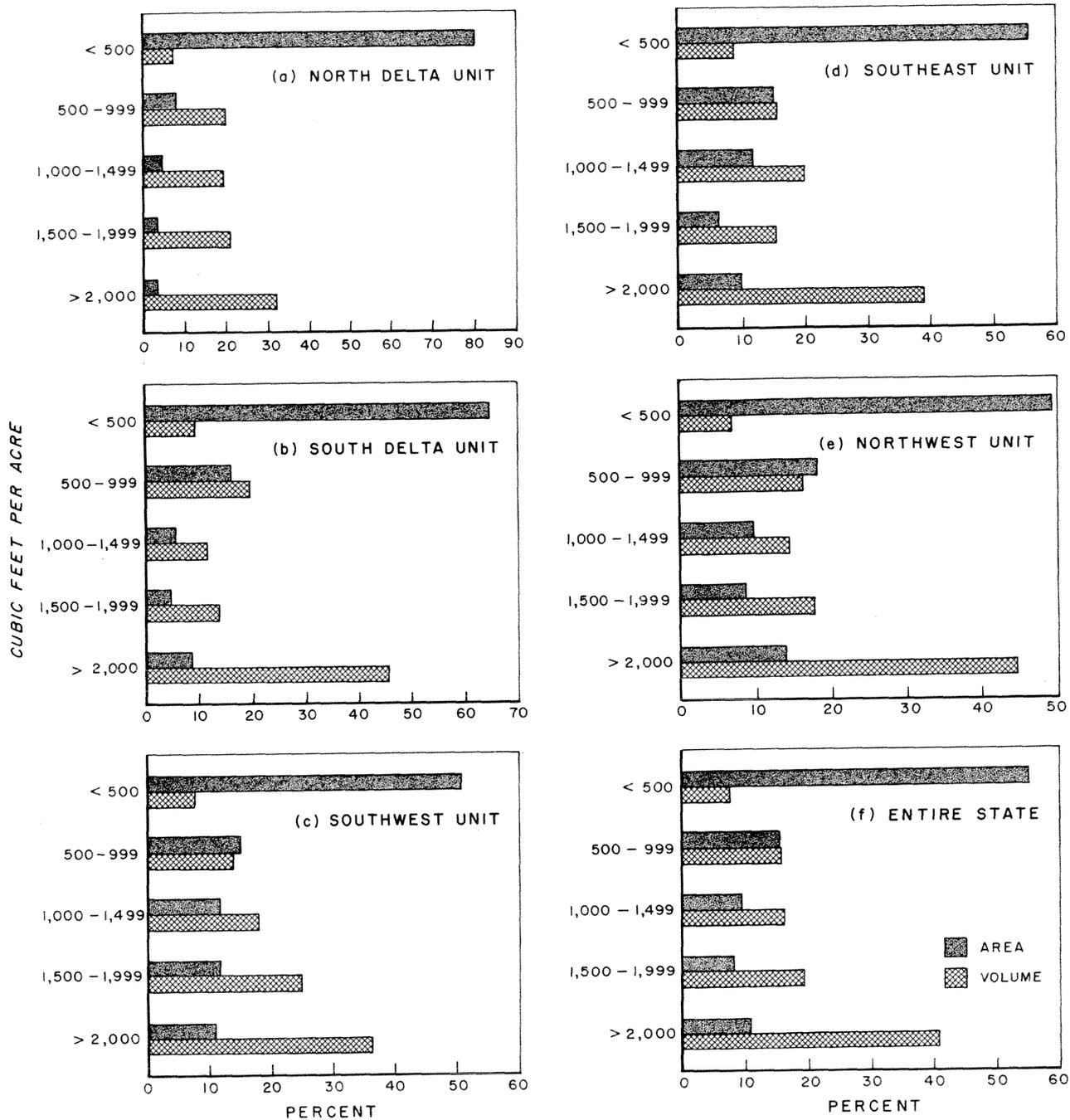


Figure 12. — Timberland area and live-tree volume of softwoods by stand volume class, Louisiana, 1991.

percent of timberland. These are stands that are averaging more than 9,000 fbm/acre. This pattern of volume distribution is similar for all the survey units.

Hardwood Volume

The hardwood live-tree inventory in Louisiana is 10,616.1 million ft³; the total is slightly higher than the softwood inventory (table V). Whereas the majority of softwood is in the Southwest and Northwest units, the South Delta unit holds the most hardwood

volume (31 percent). The Northwest and Southwest units also contribute sizeable amounts—25 and 21 percent, respectively. These three units account for 77 percent of the hardwood resource in Louisiana.

Moderate gains in the hardwood inventory in the Southwest and Southeast units were offset by losses in the South Delta and Northwest units (table V). Overall, the inventory increased by 89.1 million ft³ since 1984. Most of the inventory losses were in small diameter classes; all the larger diameter classes had slight gains (fig. 15).

The predominant hardwood species group in Louisiana is "other red oaks," which include scarlet, southern red, shingle, laurel, water, Nuttall, pin, willow, and black oaks. Trees of these species contain 2,235.0 million ft³ (fig. 16); and this group's volume increased since the 1984 survey. Among the 11 species groups illustrated in figure 16, total volumes for 6 decreased since 1984. The most common hardwood species in Louisiana is sweetgum with 1,811.2 million ft³ or 17 percent of hardwood volume. Together, seven species account for just over 50 percent of Louisiana's hardwood live-tree volume: sweetgum, water oak, water tupelo, green ash, willow, southern red oak, and sug-arberry, with 1,811.2, 937.6, 862.5, 487.4, 433.9, 430.9, and 421.7 million ft³, respectively.

Seventy percent of live-tree hardwood volume is on NIPF land (table VI). Twenty percent is held by forest industry and the remaining 10 percent by the public. On both national forest and NIPF holdings, volumes decreased slightly since 1984. These losses were offset by gains on forest industry and other public timberland.

Figure 17 (a through f) illustrates spatial distribution of the hardwood volume according to yield class. The State-level figure (fig. 17f) shows the same general characteristic as that for softwoods—a large proportion of hardwood timberland (50 percent) supports less than 500 ft³/acre, whereas a large proportion of the hardwood inventory (34 percent) is in stands that have more than 2,000 ft³/acre. However, all the survey units do not show the same characteristic. The North Delta and South Delta units do not have large proportions of their timberland supporting less than 500 ft³/acre (fig. 17, a and b). Only 27 percent of timberland in the North Delta and 14 percent in the South Delta units are in this class. This pattern is markedly different from those in other parts of the State, but the patterns in these two survey units were not enough to offset the overall averages at the State level (fig. 17f).

Hardwood Sawtimber

Louisiana's hardwood sawtimber inventory of 30,581 million fbm is 11 percent higher than in 1984 (table VII). Thirty percent of the hardwood sawtimber volume is in the South Delta unit, 21 percent is in the Southwest unit, and 24 percent is in the Northwest unit. Together, these three survey units have three-fourths of Louisiana's hardwood sawtimber. Since 1984, volumes increased in all but the Northwest unit. There, hardwood sawtimber decreased by 261 million fbm or slightly more than 3 percent.

Sixty-seven percent of the hardwood sawtimber volume is on NIPF land (table VIII). Forest industry owns 20 percent, and the public owns the remaining 13 percent. All classes of ownership had increases in sawtimber volume since 1984, with the largest increase (10 percent) on NIPF land.

Table VIII.—Change in sawtimber volume by ownership, Louisiana, 1984 to 1991*

Ownership	Softwood		Hardwood	
	Volume	Change	Volume	Change
----- Million board feet [†] -----				
National forest	4,063.2	-173.4	1,247.3	175.0
Other public	1,699.7	432.2	2,589.1	443.1
Forest industry	11,423.7	-967.4	6,137.7	550.9
Nonindustrial private	27,757.5	-2,546.6	20,607.2	1,811.7
All owners	44,944.2	-3,255.2	30,581.4	2,980.7

*Numbers in columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.

The spatial distributions of hardwood sawtimber volume by survey unit are shown in figure 18 (a through f). Fifty-four percent of Louisiana timberland has less than 1,000 fbm of hardwood sawtimber per acre. A relatively small proportion of timberland (16 percent) supports volumes greater than 5,000 fbm/acre, but 59 percent of all hardwood sawtimber volume is in these stands.

STAND STRUCTURE

Stand Size

Most of Louisiana's timberland is in sawtimber stands (59 percent). Every survey unit is dominated by sawtimber stands in proportions ranging from a high of 84 percent in the South Delta unit to a low of 53 percent in each of the Southwest, Southeast, and Northwest units (fig. 19).

The shifts in stand-size classes can be complex. Some poletimber stands grew into sawtimber size while some reverted to sapling-seedling stands through cutting. Likewise, some sawtimber stands may have reverted to poletimber through a thinning practice or to sapling-seedling through a clearcut harvest. Of course, many stands remained in the same stand-size class that they were in during the previous survey. It is important to know that many stands may shift into another size class without showing an increase or decrease in acreage between size classes because, as one stand moves into another size class (either through growth or attrition), a stand from a different size class may take its place.

The most dramatic shift of acreage in stand-size classes was in poletimber and sapling-seedling stands (table IX). Poletimber stands lost 357,200 acres whereas sapling-seedling stands gained 191,200 acres since 1984. The largest loss of poletimber stands was in the Southwest unit, whereas both the Southwest and Northwest units gained substantial acres of sapling-seedling timberland. Little change was noted in

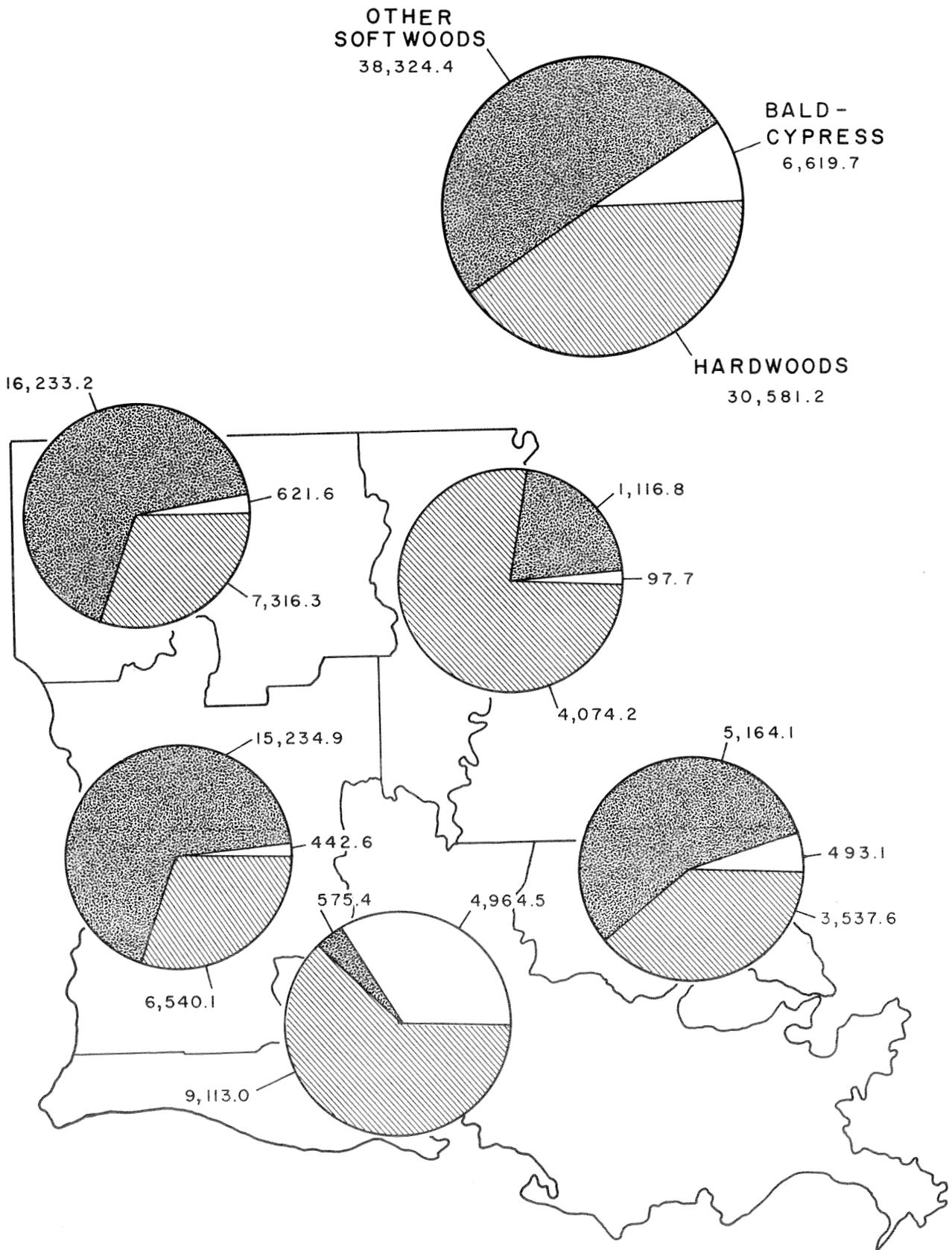


Figure 13. — Proportion of sawtimber volume, in million board feet, by species group (and baldcypress), Louisiana, 1991.

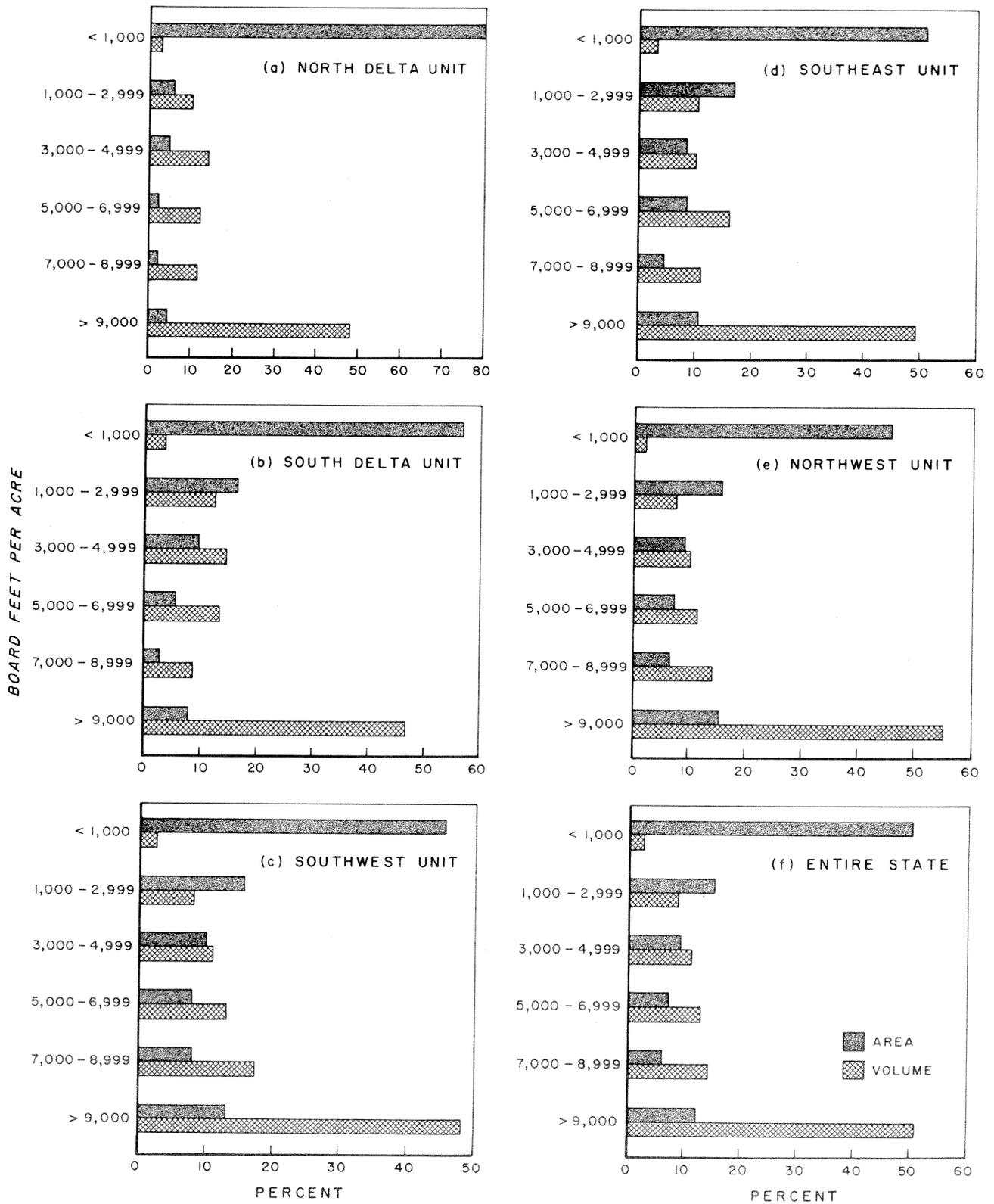


Figure 14. — Timberland area and sawtimber volume of softwoods by stand volume class, Louisiana, 1991.

sawtimber stands; they increased by only 95,200 acres, and there were no substantial shifts in any one survey unit.

Nonindustrial private forest owners hold 66 percent of the sawtimber stands, or 5,350,400 acres. Forest industry has 22 percent, and the public has the remaining 12 percent (table X). A 200,600-acre gain in sawtimber stands on forest industry land offset a 172,900-acre loss on NIPF land.

The difference in acreage of poletimber stands between NIPF and forest industry timberland is not as great as with sawtimber stands. With poletimber stands, 56 percent are on NIPF land and 39 percent are on forest industry land (versus 66 and 22 percent for sawtimber stands). Most of the decrease in poletimber stands can be accounted for by the 424,200-acre decline of NIPF land (table X).

Fifty-seven percent of the sapling and seedling acreage is on NIPF timberland, and 37 percent is on forest industry timberland. All of the increase in sapling-seedling stands was on NIPF timberland (table X).

Basal Area

The basal area of all live trees on all timberland in Louisiana averages 85.4 ft²/acre. This average is 5 percent lower than that reported in 1984. Most of the decline was in softwood sawtimber (49 percent) and hardwood poletimber (38 percent). Additionally, the majority of the basal-area decrease at the State level was on NIPF land.

Stand basal areas for all species combined are shown by diameter class and survey unit in figure 20 (a through f). Thirty-one percent of the State's basal area is in stems 15.0 inches in d.b.h. and larger. While 62 percent is in stems 3.0 to 14.9 inches in d.b.h., there were substantial decreases in basal area in the 6-through 14-inch diameter classes since the 1984 survey (fig. 20f).

All the survey units had decreases in basal area. The North Delta unit lost basal area in the larger diameter classes. Overall, the unit average dropped from 88.8 to 85.1 ft²/acre. The South Delta unit made substantial gains in the larger diameter classes but lost basal area in the 6- through 14-inch diameter classes; the overall change was from 117.5 to 115.1 ft²/acre. The Southwest unit average dropped from 79.1 to 75.5 ft²/acre. Most of the decreases were in the 6- to 18-inch diameter class range. The Southeast unit dropped from 87.9 to 82.1 ft²/acre. Every diameter class up to 20 inches had a decrease in basal area. The Northwest unit average dropped from 87.0 to 81.7 ft²/acre. All diameter classes from 4 inches to 18 inches had declines. The 10-, 12-, and 14-inch diameter classes had the sharpest declines.

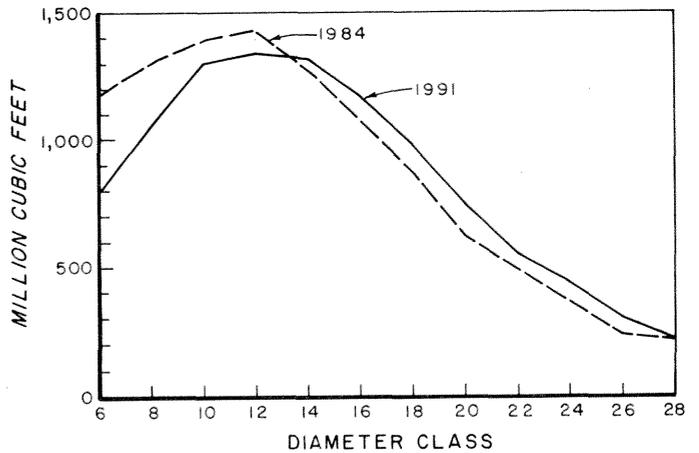


Figure 15. — Hardwood live-tree volume by diameter class, Louisiana, 1984 and 1991.

Basal areas in the important pine-producing areas are lower than the State average. The high basal areas for the Delta units pull up the State average. Averages for the Southwest, Northwest, and Southeast units are 75.5, 81.7, and 82.1 ft²/acre, respectively.

Tables XI through XIV illustrate the trends and shifts in timberland area by stand basal-area class and survey unit, ownership, stand size, and forest type, respectively. The most substantial change was a decrease in stands with more than 120 ft²/acre. The acre-

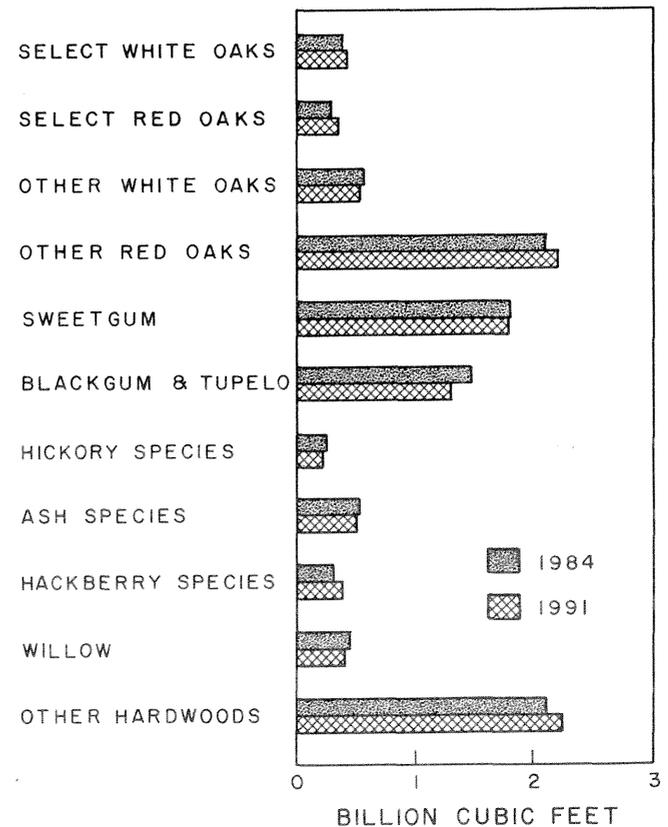


Figure 16. — Hardwood live-tree volume by species, Louisiana, 1984 and 1991.

Table IX.—Change in timberland by forest survey unit and stand size, Louisiana, 1984 to 1991*

Forest survey unit	Sawtimber		Poletimber		Sapling and seedling		Nonstocked	
	Area	Change	Area	Change	Area	Change	Area	Change
-----Thousand acres-----								
North Delta	622.7	55.9	155.0	-9.1	162.3	-4.0	5.4	-10.8
South Delta	1,879.2	-1.9	226.9	-107.3	114.3	-47.7	4.5	-9.6
Southwest	2,340.9	29.5	652.2	-227.5	1,367.4	159.9	18.1	-0.1
Southeast	940.1	51.2	366.1	4.6	425.6	-51.5	31.8	8.2
Northwest	2,365.3	-39.4	761.3	-17.9	1,333.7	134.4	10.2	-6.5
All units	8,148.1	95.2	2,161.5	-357.2	3,403.4	191.2	70.0	-18.8

*Numbers in columns may not sum to totals due to rounding.

age in these stands dropped by 739,400 acres, most shifting to the 0- to 20-ft²/acre class or to the classes ranging between 80 to 120 ft²/acre. Fifty-seven percent of the decrease occurred in the Southwest and Northwest survey units (table XI).

Almost four-fifths of the 739,400-acre decrease in high basal area stands occurred on NIPF timberland (table XII). Eighty-three percent of the decrease was in sawtimber stands (table XIII). Some of this acreage (271,100 acres) converted to sapling-seedling stands because of harvesting, but most of the acreage shifted to the 80- to 120-ft²/acre classes.

Most of the timberland stands with more than 120 ft²/acre basal area are occupied by mature bottomland hardwoods and the loblolly-shortleaf pine FTG, 1,528,000 and 1,003,000 acres, respectively (table XIV). These two types account for 84 percent of the timberland area in this high basal area range. Although the majority of acreage (51 percent) is in the bottomland hardwood types, most of the decrease in this high basal area range was in the loblolly-shortleaf pine FTG, 390,700 acres (53 percent).

Trend in volumes by basal area class and forest survey unit are shown in tables XV and XVI. Volumes decreased in the high basal area classes and increased in the midrange classes (40 to 120 ft²/acre). Specifically, the largest decrease was in the >140-ft²/acre class (1,828.1 million ft³ or 6,186 million fbm), while the greatest increase was in the 101- to 120-ft²/acre class

(923.7 million ft³ or 3,909 million fbm). Despite the loss of acreage in stands with more than 140 ft²/acre of basal area, 46 percent of all live-tree volume and 46 percent of all sawtimber volume occur in stands with more than 100 ft² of basal area.

Species Distribution

The spatial distribution of individual species across the State varies because of regional differences in ecological conditions. Occurrences of important southern pines are illustrated in figure 21. Loblolly pine has the widest ecological amplitude of the four predominant southern pines in Louisiana. It survives and grows well across all portions of the Southwest, Southeast, and Northwest survey units. The other three southern pines are not as widely distributed. Shortleaf, whose numbers and volume are declining, is most common in the Northwest survey unit (fig. 21). Longleaf and slash pine ranges overlap, and the Southwest unit is most favorable for these two species.

The oaks are a very important component of the hardwood resource in Louisiana. The volume distributions of the five most dominant oaks are illustrated in figure 22. Ecological requirements of oaks vary widely. Water oak and cherrybark oak volumes are concentrated in the southeast area of the State, and willow oak, in the north-central area.

Table X.—Change in timberland by ownership and stand size, Louisiana, 1984 to 1991*

Ownership	Sawtimber		Poletimber		Sapling and seedling		Nonstocked	
	Area	Change	Area	Change	Area	Change	Area	Change
-----Thousand acres-----								
National forest	400.1	-12.6	36.7	-14.8	131.7	-19.5	0.0	0.0
Other public	597.9	80.2	58.3	-27.4	81.6	-24.9	0.0	0.0
Forest industry	1,799.8	200.6	845.8	109.1	1,242.5	0.4	10.2	-14.9
Nonindustrial private	5,350.4	-172.9	1,220.7	-424.2	1,947.6	235.2	59.8	-3.9
All owners	8,148.1	95.2	2,161.5	-357.2	3,403.4	191.2	70.0	-18.8

*Numbers in columns may not sum to totals due to rounding.

Species Importance

In terms of volume, loblolly pine is the most dominant tree species in Louisiana (table XVII). It is the most dominant species in all but the South Delta unit. Statewide, loblolly makes up 30 percent of the volume in all live trees ≥ 1.0 inch in d.b.h. (saplings are included in this instance to reflect total stand at-

tributes). In the Northwest survey unit, loblolly accounts for 43 percent of total volume.

The second most dominant tree species in Louisiana is sweetgum. It ranks second behind loblolly pine in the North Delta, Southeast, and the Northwest survey units. Statewide, sweetgum contributes 9 percent of live-tree volume.

Baldcypress and water oak are two other species in

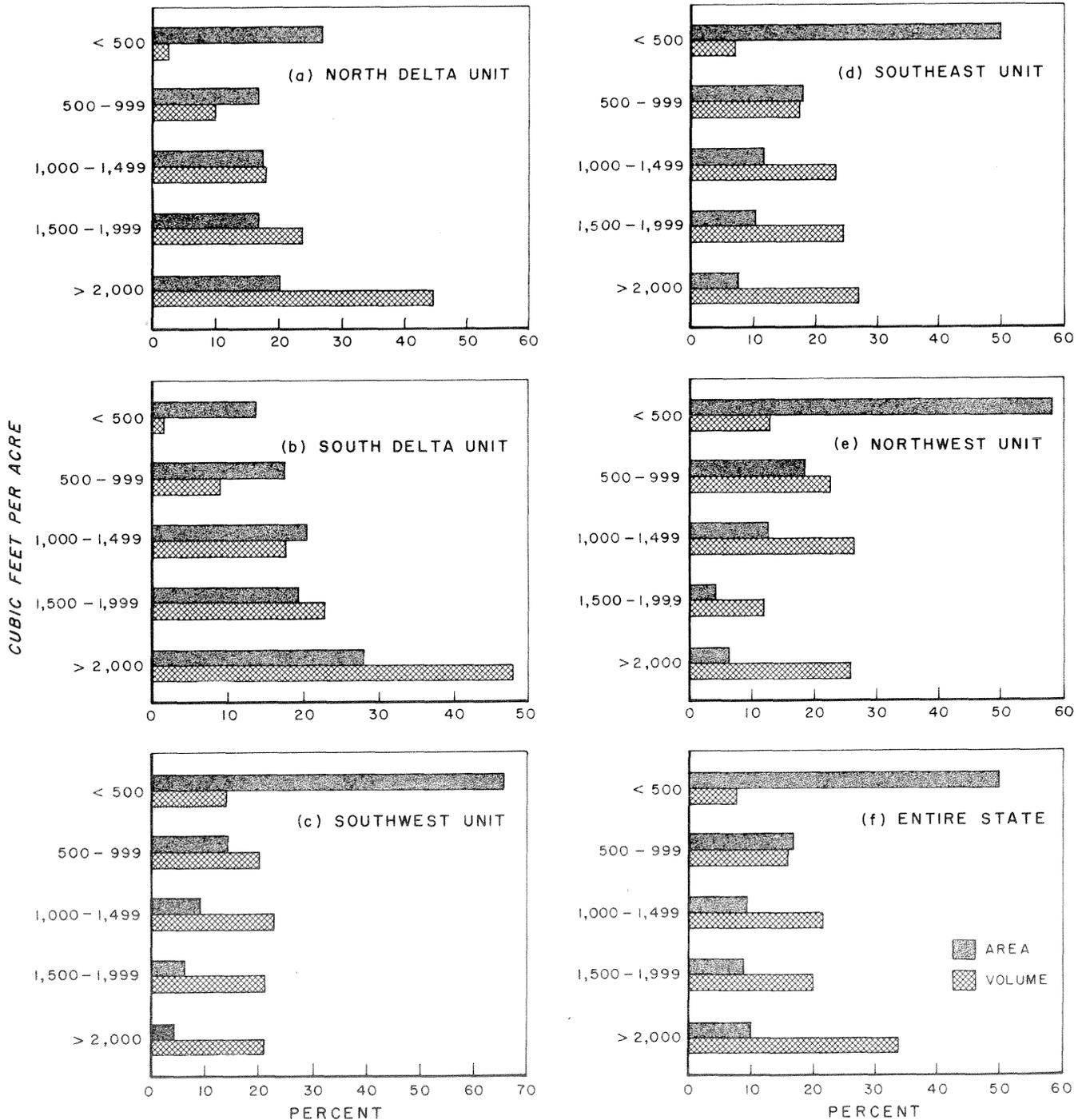


Figure 17. — Timberland area and live-tree volume of hardwoods by stand volume class, Louisiana, 1991.

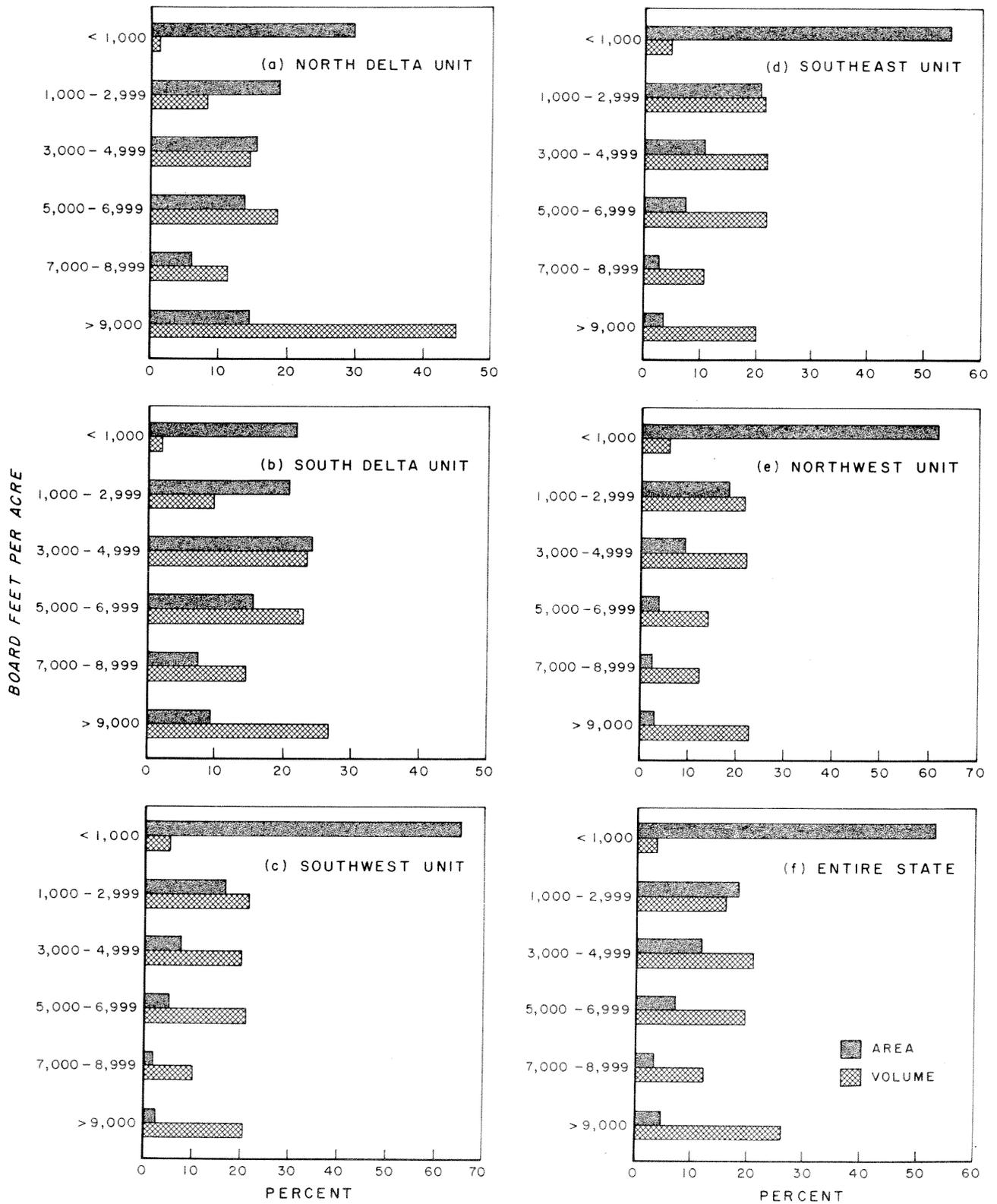


Figure 18. — Timberland area and sawtimber volume of hardwoods by stand volume class, Louisiana, 1991.

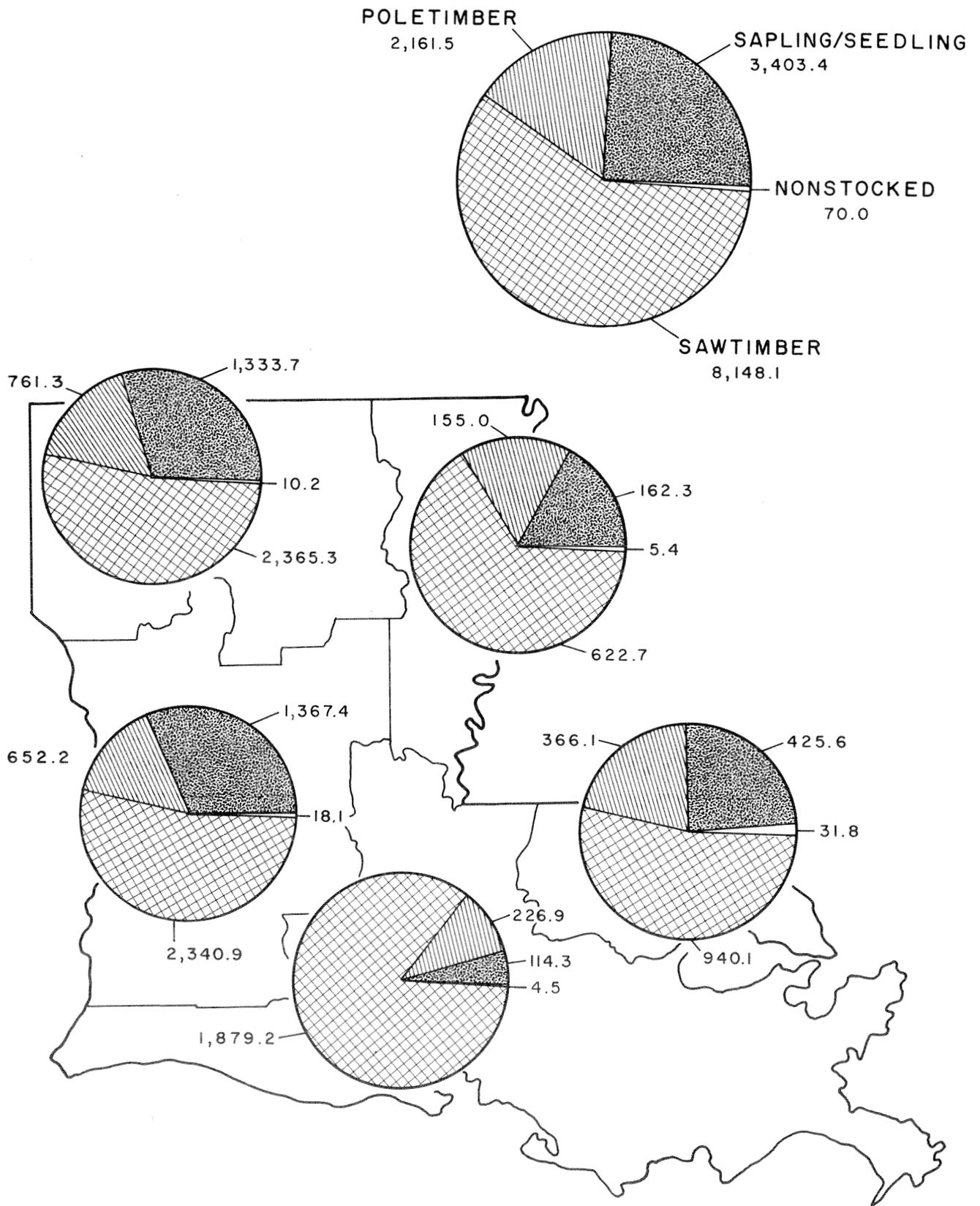


Figure 19. — Proportion of timberland, in thousand acres, by stand size class, Louisiana, 1991.

Table XI.—Area of timberland by forest survey unit and basal area class of live trees, Louisiana, 1984 and 1991*

Forest survey unit	Basal area class (Square feet per acre)															
	>140		121 - 140		101 - 120		81 - 100		61 - 80		41 - 60		21 - 40		0 - 21	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
	-----Thousand acres-----															
North Delta	121.1	60.4	100.6	137.9	143.9	145.7	198.9	228.5	103.9	131.0	129.7	109.5	57.9	24.3	57.4	108.2
South Delta	776.0	630.7	349.6	337.5	287.9	429.2	344.5	359.4	346.6	244.8	133.5	94.8	117.3	82.8	35.9	45.5
Southwest	393.1	297.7	456.7	371.0	601.0	617.7	735.9	754.0	768.2	804.1	507.2	509.9	442.0	434.2	512.7	590.0
Southeast	265.2	187.3	217.4	160.5	216.7	294.8	284.2	312.7	258.9	208.3	141.5	184.5	186.2	179.4	181.1	236.1
Northwest	533.9	400.0	545.9	437.0	679.3	770.1	713.3	780.1	719.7	708.4	483.8	547.1	325.4	356.4	398.5	471.4
All units	2,089.3	1,576.1	1,670.1	1,443.9	1,928.9	2,257.5	2,276.8	2,434.7	2,197.3	2,096.8	1,395.8	1,445.8	1,128.9	1,077.0	1,185.7	1,451.2

*Numbers in columns may not sum to totals due to rounding.

Table XII.—Area of timberland by ownership and basal area class of live trees, Louisiana, 1984 and 1991*

Ownership	Basal area class (Square feet per acre)															
	>140		121 - 140		101 - 120		81 - 100		61 - 80		41 - 60		21 - 40		0 - 21	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
	-----Thousand acres-----															
Public	135.4	89.2	185.5	157.3	178.2	225.9	240.7	317.4	245.0	256.3	150.8	102.7	91.4	86.0	98.4	71.5
Forest industry	395.5	323.9	369.6	362.8	477.3	549.8	623.2	727.9	472.6	593.1	457.4	467.4	340.9	333.4	466.5	540.2
Nonindustrial private	1,558.4	1,163.0	1,114.9	923.9	1,273.4	1,481.7	1,412.8	1,389.5	1,479.7	1,247.4	787.6	875.7	696.6	657.7	620.9	839.5
All owners	2,089.3	1,576.1	1,670.1	1,443.9	1,928.9	2,257.5	2,276.8	2,434.7	2,197.3	2,096.8	1,395.8	1,445.8	1,128.9	1,077.0	1,185.7	1,451.2

*Numbers in columns may not sum to totals due to rounding.

Table XIII.—Area of timberland by size class and basal area class of live trees, Louisiana, 1984 and 1991*

Size class	Basal area class (Square feet per acre)															
	>140		121 - 140		101 - 120		81 - 100		61 - 80		41 - 60		21 - 40		0 - 21	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
	-----Thousand acres-----															
Sapling and seedling	12.2	5.5	55.0	44.9	65.3	51.5	190.1	194.7	382.1	322.7	584.1	615.0	837.5	812.2	1,085.8	1,356.9
Poletimber	270.6	195.6	262.3	230.3	444.8	440.1	588.5	477.9	497.0	458.7	292.4	261.2	157.5	84.7	5.7	13.0
Sawtimber	1,806.4	1,375.0	1,352.8	1,168.7	1,418.8	1,765.9	1,498.2	1,762.1	1,318.1	1,315.3	519.3	569.6	133.9	180.1	5.4	11.3
Nonstocked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.8	70.0
All classes	2,089.3	1,576.1	1,670.1	1,443.9	1,928.9	2,257.5	2,276.8	2,434.7	2,197.3	2,096.8	1,395.8	1,445.8	1,128.9	1,077.0	1,185.7	1,451.2

*Numbers in columns may not sum to totals due to rounding.

Louisiana with individual volumes of over 1.0 billion ft³. Baldcypress is most dominant in the South Delta unit, where 74 percent of its total State volume is concentrated. Water oak is not dominant in any one unit but contributes substantially to the volume of all the units. This even distribution results in water oak ranking fourth in volume at the State level.

Species rankings for individual units and for the State as a whole are shown in table XVII. Only a few species are important in making up most of the volume in the State, however. Loblolly pine, sweetgum, baldcypress, and water oak make up half of the total volume of all live trees ≥ 1.0 inch in d.b.h.

Change in Number of Trees

The number of softwood trees 5.0 to 23.0 inches in d.b.h. declined substantially since 1984 (fig. 23). However, the number of softwood trees in the 2- and 4-inch diameter classes increased. These changes reflect harvesting and subsequent regeneration activity in the smaller diameters.

The number of hardwoods decreased across all diameter classes up to 20 inches. This change also reflects harvesting, but, in contrast to the softwoods, hardwoods are not favored in regeneration schemes. That is why numbers in the 2- and 4-inch diameter classes have declined.

There has been some concern in recent years about the fate of hardwood stands in regard to conversions to pine stands. Since the 1984 survey, no appreciable decline has occurred. In fact, timberland with 90 to 100 percent of stand basal area in pines or 90 to 100 percent of stand basal area in hardwoods have both declined (fig. 24). Respective hardwood stands dropped by 4 percent while pine stands dropped 8 percent.

Much of the State's timberland (4,146,000 acres) is in stands composed of 90 to 100 percent hardwoods. This total is high because of the predominance of the bottomland types. Figure 25 shows trends for upland sites where pines are most likely to be planted. On such sites, stands with 90 to 100 percent of basal area in hardwoods decreased slightly since 1984 as did stands with 90 to 100 percent of basal area in pines (8 percent).

Where hardwoods are more than 50 percent of stand basal area, two decile classes decreased and three decile classes increased in acreage since the 1984 survey (fig. 25). For stands with softwood plurality, two classes decreased and three classes increased. However, the classes that decreased did so by large margins. The net change for Louisiana is a 95,800-acre increase of upland stands with a hardwood majority and a 176,100-acre decrease of upland stands with a softwood majority.

GROWTH, REMOVALS, AND MORTALITY

In these forest inventories, three major components of change in timber volume are monitored: growth, removals, and mortality. Complex interactions among these components result in a decrease or increase in the inventory volume. Because of the dynamic nature of these components, estimates are given as the periodic annual average; i.e., the average over the survey period and not over the life of the trees being sampled.

Softwoods

Growth of live softwoods has decreased slightly since the last survey. Gross growth is 612.8 million ft³/yr and net growth is 524.8 million ft³/yr. These values have decreased by 5 and 11 percent, respectively, since 1984. The most dramatic change in Louisiana's inventory balance, however, was in the removals category. Softwood removals increased from 450.3 million to 669.0 million ft³/yr. This 49-percent increase resulted in a removal-to-growth ratio of 1.27 to 1 and a net change in softwood inventory of -144.4 million ft³/yr (table XVIII). Most of the gross growth (49 percent) came from the nongrowth trees (see definitions in the appendix). Other components contributing substantially to gross growth were growth on cut trees (19 percent) and growth on survivor trees (13 percent). The majority of gross growth came from the Southwest and Northwest survey units, 39 and 41 percent of the State's growth, respectively. Likewise, most of the State's removals (82 percent) came from these two survey units.

Softwood mortality is 88.0 million ft³/yr for the survey period. The Southwest and Northwest units, together, account for 80 percent of softwood mortality. Most of the mortality (62 percent) was on NIPF land. Additionally, 17 percent of mortality was in plantations.

Fifty-five percent of the State's gross growth and 55 percent of its removals were on NIPF land (table XIX). Forest industry land provided 39 percent of gross growth, and public land, 6 percent.

Gross growth in softwood plantations is 217.9 million ft³/yr, net growth is 202.9 million ft³/yr, and net change is -54.7 million ft³/yr (table XX). Approximately one-third of Louisiana's softwood gross growth is in plantations. Fifty-nine percent of gross growth is on forest industry land followed by 37 percent on NIPF land. Only 4 percent of softwood gross growth from plantations is on public land.

Approximately 39 percent of Louisiana's total softwood removals came from plantations. More than half of plantation removals (54 percent) were from forest industry land. Forty-one percent came from NIPF land and 5 percent from public land.

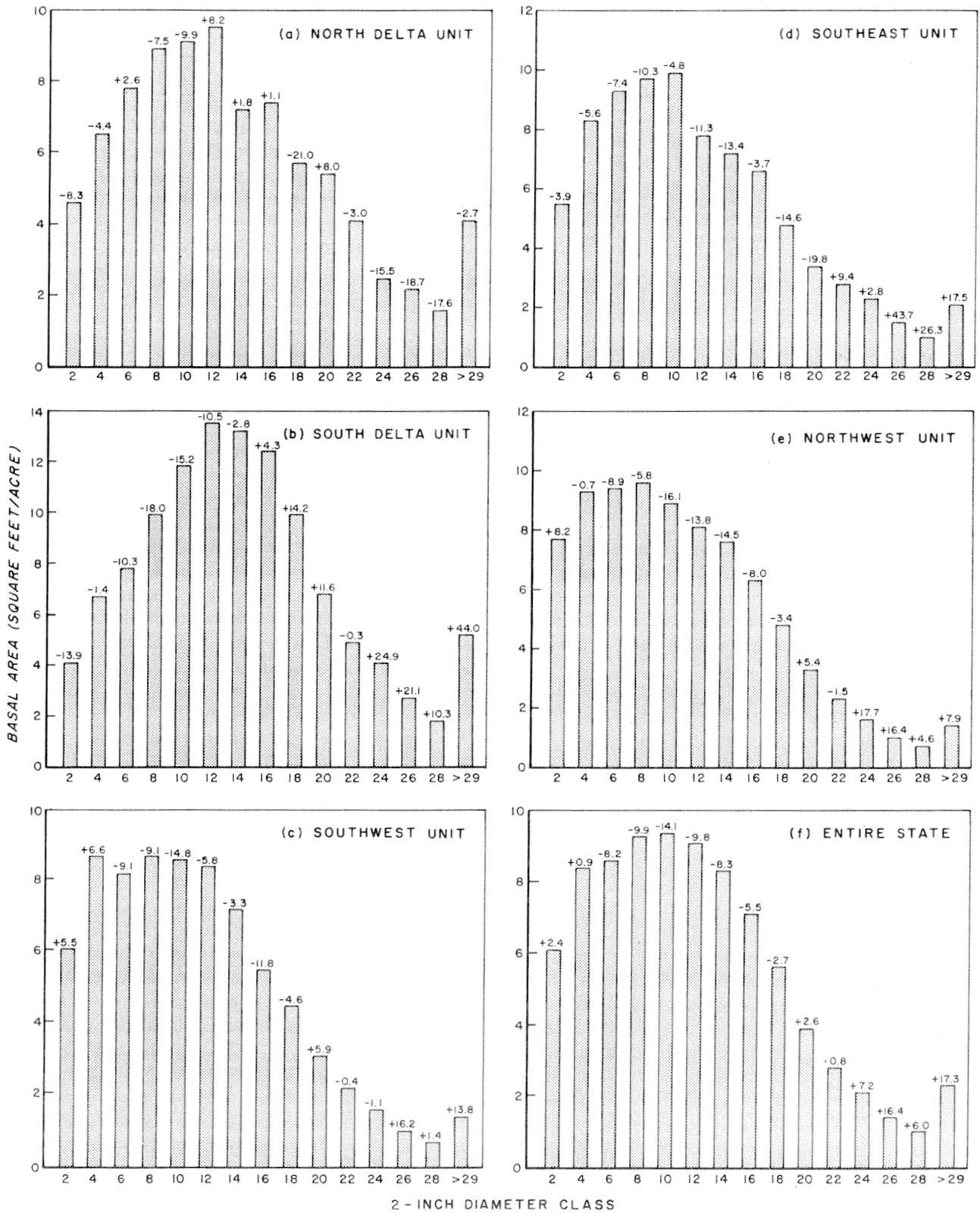


Figure 20. — Basal area of all live trees by diameter class, Louisiana, 1991. Numbers above bars are percentage changes since the 1984 survey.

Table XIV.—Area of timberland by forest type group and basal area class of live trees, Louisiana, 1984 and 1991*

Forest type group	Basal area class (Square feet per acre)															
	>140		121 - 140		101 - 120		81 - 100		61 - 80		41 - 60		21 - 40		0 - 21	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
	-----Thousand acres-----															
Longleaf-slash	29.2	15.8	65.6	20.3	94.9	76.7	166.8	193.0	185.6	184.8	126.7	188.0	110.8	109.1	153.5	81.9
Loblolly-shortleaf	698.5	464.2	695.2	538.8	582.4	741.6	631.9	686.0	602.6	633.3	355.6	359.8	255.2	338.3	240.9	391.7
Oak-pine	152.7	132.8	205.8	179.4	279.9	266.1	356.1	316.0	319.3	387.0	185.6	201.0	148.3	149.2	248.7	255.1
Oak-hickory	89.1	59.8	105.6	81.1	266.8	333.2	355.3	350.2	352.8	282.7	317.4	320.5	304.1	207.1	379.2	472.6
Oak-gum-cypress†	1,119.8	903.6	597.7	624.4	704.8	839.8	766.6	889.5	736.9	608.9	410.4	376.5	310.4	273.4	131.1	235.0
All types	2,089.3	1,576.1	1,670.1	1,443.9	1,928.9	2,257.5	2,276.8	2,434.7	2,197.3	2,096.8	1,395.8	1,445.8	1,128.9	1,077.0	1,185.7	1,451.2

*Numbers in columns may not sum to totals due to rounding.

†Includes elm-ash-cottonwood type.

Table XV.—Volume of all live trees by forest survey unit and basal area class of live trees, Louisiana, 1984 and 1991*

Forest survey unit	Basal area class (Square feet per acre)															
	>140		121 - 140		101 - 120		81 - 100		61 - 80		41 - 60		21 - 40		0 - 21	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
	-----Million cubic feet-----															
North Delta	364.5	188.0	262.8	354.4	280.8	287.3	291.9	373.6	130.1	158.2	86.0	95.6	22.0	10.7	4.6	8.2
South Delta	2,551.4	2,036.9	708.3	788.2	490.9	840.5	433.5	529.3	328.1	264.8	95.8	69.2	40.7	28.8	3.0	1.6
Southwest	1,260.3	844.9	1,100.5	865.3	1,163.2	1,285.2	1,135.1	1,170.6	817.9	1,020.9	365.1	381.6	175.9	143.3	24.3	38.1
Southeast	835.5	597.4	489.3	381.0	390.4	598.2	387.7	521.5	287.1	245.2	104.1	137.8	54.5	57.2	5.4	18.5
Northwest	1,715.1	1,231.3	1,414.2	1,005.6	1,372.4	1,610.2	1,114.5	1,217.5	830.8	814.7	329.1	370.2	105.5	122.8	22.6	23.9
All units	6,726.7	4,898.6	3,975.0	3,394.5	3,697.7	4,621.4	3,382.8	3,812.6	2,394.1	2,503.8	980.1	1,054.4	398.5	362.9	60.0	90.2

*Numbers in columns may not sum to totals due to rounding.

Table XVI.—Volume of all sawtimber by forest survey unit and basal area class of live trees, Louisiana, 1984 and 1991*

Forest survey unit	Basal area class (Square feet per acre)															
	>140		121 - 140		101 - 120		81 - 100		61 - 80		41 - 60		21 - 40		0 - 21	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
	-----Million board feet-----															
North Delta	1,503.3	788.4	871.2	1,283.5	916.7	997.0	874.6	1,263.0	504.4	564.2	221.9	343.4	52.3	30.8	12.3	18.4
South Delta	7,596.8	6,672.0	2,031.9	2,627.1	1,457.0	2,722.4	1,206.4	1,669.6	747.6	700.3	287.6	181.0	67.7	76.8	0.0	3.8
Southwest	5,184.5	3,166.4	4,371.1	3,509.8	4,245.5	4,981.3	3,986.6	4,684.3	3,007.2	4,015.3	1,235.1	1,351.9	532.1	433.4	88.3	75.3
Southeast	2,913.9	2,245.4	1,849.1	1,314.6	1,431.5	2,053.7	1,169.9	2,018.7	1,058.4	861.6	382.3	464.8	147.9	175.9	13.5	60.0
Northwest	6,680.6	4,821.0	5,585.9	3,953.0	5,112.8	6,318.7	4,193.5	4,481.2	2,987.9	3,020.4	966.1	1,148.8	221.1	386.5	82.9	41.5
All units	23,879.1	17,693.2	14,709.2	12,688.0	13,163.6	17,073.0	11,431.0	14,116.9	8,305.6	9,161.8	3,093.0	3,489.9	1,021.2	1,103.4	197.0	199.0

*Numbers in columns may not sum to totals due to rounding.

†International 1/4-inch Rule.

Hardwoods

Growth of live hardwood trees has changed only slightly since the 1984 survey. Gross growth is up 2 percent to 471.5 million ft³/yr, and net growth is up 8 percent to 325.4 million ft³/yr. Most of the State's gross growth is in the Northwest (29 percent) and South Delta (26 percent) survey units (table XVIII).

The net change in inventory volume has decreased since the 1984 survey from +60.3 to +39.8 million ft³/yr. The result is a growth-to-removal ratio of 1.14 to 1 versus 1.25 to 1 for the 1984 survey. This difference was because net growth increased by only 9 percent while removals increased by 18 percent. Two-fifths of the hardwood removals were from the Northwest survey unit.

Seventy percent of gross growth, 69 percent of net growth, and 66 percent of removals occur on NIPF land. Forest industry had a net change in inventory of -16.8 million ft³/yr, most likely a result of management favoring pines over hardwoods. The contrast between NIPF land and forest industry land is obvious. Growth is balanced between softwoods and hardwoods on NIPF land, whereas growth on forest industry land is primarily softwood. The majority of removals on both forest industry and NIPF land are softwood.

Hardwood mortality for the survey period was 146.1 million ft³/yr. The South Delta unit accounted for 39 percent of all hardwood mortality in the State. Seventy percent of mortality was on NIPF land.

Hardwood Sawtimber

Gross growth of hardwood sawtimber is 1,386 million fbm/yr, net growth is 1,166 million fbm/yr, and net change is +304.0 million fbm/yr. Twenty-five percent of the net growth is in the South Delta unit, 22 percent is in the Northwest unit, and 21 percent is in the Southwest unit (table XXI).

Since 1984, 69 percent of Louisiana's hardwood sawtimber growth—806.5 million fbm/yr—has occurred on NIPF land (table XXII). Forest industry land accounted for 21 percent of hardwood net growth, and public land, for 10 percent. The share of hardwood growth from forest industry land is well below the percentage for softwood sawtimber net growth. The difference demonstrates forest industry's emphasis on softwood production.

PLANTATIONS

Plantations were analyzed for the 1991 survey by examining sample plots classified as plantations in the 1984 survey and had no commercial harvesting

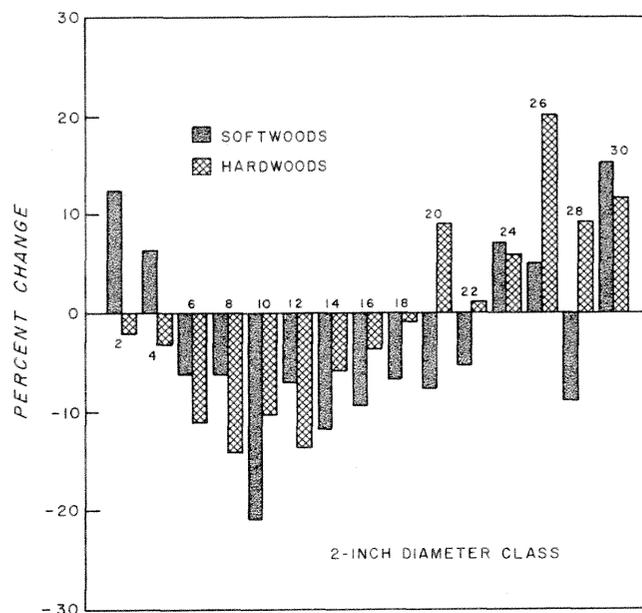


Figure 23. — Percentage change in number of live trees between 1984 and 1991, Louisiana.

activity between 1984 and 1991. This method was used so that failed plantations (those with low stocking) would be identified. Otherwise, only the successful plantations would have been included in the analysis. Additionally, sample plots that had changed to a plantation status (from either land use reversions to timberland or previously harvested natural stands) by the time of the 1991 survey were also included in the analysis.

Area

Currently, Louisiana has 2,735,700 acres of timberland in plantations (20 percent of all timberland in the State) (table XXIV). New plantation acreage from land use reversions to timberland was only 96,600 acres, some of this probably coming from the Conservation Reserve Program. Additionally, 24,900 acres of plantations were lost to diversions of timberland to other land uses. Overall, after accounting for additional timberland shifts to and from plantation status, there was a 386,700-acre increase (16 percent) of timberland in plantations over that reported for 1984.

More than half of the plantation area (1,534,300 acres) is on forest industry land (table XXIV). Plantations account for 39 percent of all forest industry timberland. They occupy only 12 percent of NIPF timberland.

The loblolly-shortleaf pine FTG is the prevailing type on plantation timberland (table XXIV). Loblolly pine is planted on most of the 1,644,500 acres in this type. The longleaf-slash pine FTG occupies 600,600

Table XVII.—*Ranking of tree species* (by volume) for each forest survey unit and the State, Louisiana, 1991*

North Delta		South Delta	
Species	Volume [†]	Species	Volume [†]
Loblolly pine	259.1	Baldcypress	1,208.3
Sweetgum	229.1	Water tupelo	706.8
Sugarberry	95.8	Green ash	358.9
Water oak	93.9	Willow	355.6
Willow oak	89.1	Red maple	344.9
Overcup oak	82.2	Sugarberry	335.8
Willow	81.1	Sweetgum	315.7
Water hickory	76.9	Water oak	181.5
Green ash	62.6	Water hickory	128.8
Cottonwood	56.2	American elm	123.0
Nuttall oak	49.5	Nuttall oak	109.0
Cedar elm	43.0	Loblolly pine	101.4
American elm	40.1	Boxelder	81.9
Cherrybark oak	27.9	Cottonwood	71.0
Pecan	27.7	Overcup oak	63.1
Southern red oak	27.6	American sycamore	53.6
American sycamore	26.3	Pecan	39.1
Baldcypress	24.3	Blackgum	31.3
White oak	22.7	Slippery elm	29.7
Winged elm	21.5	Cherrybark oak	26.8
Boxelder	19.4	Swamp tupelo	22.1
Honeylocust	18.7	Laurel oak	20.3
Water tupelo	17.4	Hickory spp.	19.6
Shortleaf pine	15.2	Willow oak	17.1
Post oak	10.0	Other species [†]	14.8
Slippery elm	9.9	Chinese tallowtree	14.6
Hickory spp.	9.1	Honeylocust	14.6
Laurel oak	8.7	Winged elm	14.5
American beech	8.5	Live oak	13.4
White ash	8.1	Water-elm	12.6
Delta post oak	7.7	Blue-beech	12.3
Slash pine	7.0	Swamp chestnut oak	9.5
Ironwood	6.8	Common persimmon	9.3
Waterlocust	5.0	White ash	9.2
Common persimmon	4.7	American beech	9.0
Blackgum	4.7	Waterlocust	8.7
Flowering dogwood	4.4	Hawthorn	7.4
Blue-beech	4.2	White oak	7.3
Swamp chestnut oak	3.7	Shortleaf pine	5.9
Red maple	2.6	Post oak	5.7
Hawthorn	2.5	Yellow-poplar	5.6
Shumard oak	1.9	Shumard oak	4.3
Water-elm	1.8	Ironwood	4.1
Black oak	1.8	Southern magnolia	3.8
Florida maple	1.1	Southern red oak	2.6
Black cherry	1.0	Spruce pine	2.4
Yellow-poplar	0.9	Florida maple	2.3
Sourwood	0.9	Flowering dogwood	2.2
Other species [†]	0.8	Red mulberry	2.1
Swamp tupelo	0.6	Redbay	1.7
Sassafras	0.6	Northern red oak	1.7
Turkey oak	0.5	Sourwood	1.6
Chinaberry	0.4	Cedar elm	1.3
Red mulberry	0.3	Hackberry	1.1
Serviceberry	0.2	Black locust	1.1
Blackjack oak	0.2	Black cherry	0.9
Plums and cherries [§]	0.1	Black oak	0.9
Eastern redbud	†	Sassafras	0.7
American holly	†	Pin oak	0.5
Osage-orange	†	River birch	0.4
Sparkleberry	†	American holly	0.4
White mulberry	†	Plums and cherries [§]	0.3
		Durand oak	0.3
		White mulberry	0.2
		Turkey oak	0.2
		Sweetbay	†
		Serviceberry	†

Table XVII.—*Ranking of tree species* (by volume) for each forest survey unit and the State, Louisiana, 1991—Continued*

Southwest		Southeast	
Species	Volume [†]	Species	Volume [†]
Loblolly pine	2,496.6	Loblolly pine	940.1
Slash pine	682.1	Sweetgum	224.2
Sweetgum	600.4	Water oak	203.8
Longleaf pine	384.1	Baldcypress	139.3
Water oak	229.0	Blackgum	136.5
Southern red oak	186.0	Slash pine	123.6
Blackgum	176.8	Laurel oak	106.6
Shortleaf pine	171.2	Water tupelo	99.4
White oak	154.8	Spruce pine	92.5
Baldcypress	131.6	Swamp tupelo	66.1
Cherrybark oak	111.9	Red maple	61.1
Post oak	103.9	Yellow-poplar	55.1
American beech	100.7	Cherrybark oak	52.7
Hickory spp.	87.2	Blue-beech	44.6
Laurel oak	85.3	Longleaf pine	41.5
Red maple	83.5	Sweetbay	38.7
Willow oak	72.9	Southern red oak	35.3
Blue-beech	62.4	Shortleaf pine	33.6
Green ash	58.4	American beech	32.9
Water tupelo	48.7	White oak	29.8
Sweetbay	44.2	Swamp chestnut oak	29.6
Overcup oak	43.3	Post oak	25.3
Water hickory	39.9	Southern magnolia	24.7
Flowering dogwood	38.6	Green ash	24.5
Swamp chestnut oak	36.9	Hickory spp.	23.6
Nuttall oak	31.3	Willow oak	19.6
Winged elm	31.2	American elm	17.9
Ironwood	26.0	Water hickory	16.9
American elm	22.8	Flowering dogwood	12.8
Hawthorn	20.3	Black cherry	12.8
Pecan	20.1	Winged elm	11.0
Blackjack oak	19.6	American sycamore	10.0
Sugarberry	18.9	Overcup oak	9.1
Chinese tallowtree	17.2	Chinese tallowtree	8.8
American holly	16.8	Sourwood	8.0
Southern magnolia	15.4	Ironwood	6.9
Slippery elm	14.0	Willow	6.8
Honeylocust	12.6	American holly	5.9
Shumard oak	11.1	Live oak	5.8
Sourwood	8.5	Other species [†]	4.3
Black cherry	8.5	Redbay	3.8
Swamp tupelo	7.7	River birch	3.7
White ash	7.0	Honeylocust	3.5
Redbay	6.9	Slippery elm	3.4
American sycamore	6.8	Nuttall oak	3.2
Common persimmon	6.8	Blackjack oak	3.0
Sassafras	6.3	Sassafras	2.8
Willow	5.4	Pecan	2.8
Black oak	5.3	Hawthorn	2.7
Water-elm	4.7	Common persimmon	2.6

acres of plantation timberland. These plantations account for 69 percent of the total longleaf-slash pine acreage in the State. Table XXIV shows 490,600 acres in the oak-pine, oak-hickory, and bottomland hardwood types. Most of this acreage was probably intended to be pine plantations, but the hardwood stocking component was so dominant that the samples were classified as hardwood types.

Fifty-eight percent of Louisiana's plantations are less than 20 years old (table XXV). Very few plantations are over 40 years old. Among plantations classed as sawtimber stands, 372,700 acres are on forest industry land and 257,400 acres are on NIPF land.

Unfortunately, 584,800 acres of plantations in Louisiana have low softwood stocking (<60 percent stocked) (table XXVI). Most of this acreage (53 percent) is on

forest industry land. It is important to note that 2,150,900 acres of Louisiana's plantation timberland (79 percent) are adequately stocked.

Softwood Volume

Twenty-three percent of Louisiana's total live-tree softwood volume (2,314.2 million ft³) is on plantation timberland. Forest industry has 52 percent of this volume, NIPF owners have 40 percent, and the public has 8 percent (table XXVII).

Most of the plantation volume (1,898.5 million ft³) is in poletimber and small sawtimber trees. Only 71.0 million ft³ are in trees >20.0 inches in d.b.h. (table XXVII). Information about softwood growth on plan-

Table XVII.—*Ranking of tree species* (by volume) for each forest survey unit and the State, Louisiana, 1991—Continued*

Southwest		Southeast	
Species	Volume [†]	Species	Volume [†]
Florida maple	3.8	Water-elm	2.5
Red mulberry	3.6	Sugarberry	2.5
Yellow-poplar	3.3	Plums and cherries [§]	2.4
Sparkleberry	3.2	Shumard oak	2.2
American basswood	3.0	Black oak	2.1
Eastern redcedar	2.8	Tung-oil-tree	1.6
Bluejack oak	2.4	Turkey oak	0.9
Other species [†]	2.2	Boxelder	0.9
River birch	2.1	Cottonwood	0.8
Scarlet oak	1.9	Apple	0.6
Northern red oak	1.9	Black walnut	0.6
Waterlocust	1.8	Pin oak	0.6
Chestnut oak	1.8	Scarlet oak	0.5
Plums and cherries [§]	1.7	White ash	0.5
Black locust	1.1	Chestnut oak	0.4
White mulberry	0.9	Cucumbertree	0.4
Swamp white oak	0.8	Sparkleberry	0.4
Serviceberry	0.8	Northern red oak	0.4
Chinaberry	0.7	Royal paulownia	0.3
Black walnut	0.6	Hackberry	†
Delta post oak	0.5	White basswood	†
Bigleaf magnolia	0.5		
Osage-orange	0.5		
Chinkapin oak	0.4		
Live oak	0.3		
Boxelder	0.3		
Durand oak	0.3		
Turkey oak	0.2		
Eastern redbud	0.1		
Chinkapin	0.1		
Hackberry	0.1		
Pin oak	†		
Allegheny chinkapin	†		
September elm	†		
Cucumbertree	†		
White basswood	†		

tations can be found in the growth, removals, and mortality section of this paper.

Harvesting and Stand Treatment

A total of 711,700 acres of Louisiana plantations underwent a commercial harvest between 1984 and 1991 (table XXVIII). Sixteen percent of all commercial harvests in the State took place on plantation timberland. This harvesting activity was evenly divided between NIPF and forest industry timberland. There was very little harvesting in publicly owned plantations.

Stand treatments, other than final harvests, were imposed on 629,100 acres of Louisiana plantations between 1984 and 1991 (table XXVIII). Such treatments include thinnings and timber stand improvement efforts. Fifty-five percent of this activity was on forest industry timberland, 38 percent was on NIPF timberland, and 7 percent was on public timberland.

DISTURBANCE

Harvesting

A total of 4,373,500 acres of timberland underwent

some form of commercial harvest between 1984 and 1991 (table XXIX). Most of the harvesting activity consisted of partial harvests (2,844,700 acres). Included in this category are group-selection methods, single-tree selection, and diameter-limit cutting. Some of this timberland will undergo site preparation and be planted in pine. Out of 2,383,900 acres classed as partial harvest in 1984, 311,500 acres were planted by 1991. Field crews visit the sample plots on a single day during the survey, which may be at the beginning or end of harvesting, during site preparation, or during planting. Therefore, final disposition of some plots may not be known until the next survey period.

At their best, partial cut strategies can improve species composition and tree quality in uneven-aged stand management. In contrast, partial cut strategies may result in only the best and highest quality species being harvested and leaving inferior trees to make up the next stand generation.

Forty-two percent of the partial cutting was in the loblolly-shortleaf pine FTG. Another 18 percent was in the oak-pine FTG, and 15 percent was in bottomland hardwood types.

A total of 1,646,200 acres of partial harvesting (58 percent of the total) was done on NIPF land. Almost 1

Table XVII. —Ranking of tree species* (by volume) for each forest survey unit and the State, Louisiana, 1991—Continued

Northwest			
Species	Volume [†]	Species	Volume [†]
Loblolly pine	3,209.3	Water-elm	8.1
Sweetgum	775.4	Eastern redcedar	7.3
Shortleaf pine	641.4	Honeylocust	7.2
Water oak	318.8	Florida maple	7.2
Willow oak	238.8	Slippery elm	7.1
Southern red oak	224.0	Red mulberry	6.3
White oak	193.9	Pecan	5.6
Cherrybark oak	143.9	Boxelder	5.4
Baldcypress	139.2	Plums and cherries [§]	5.2
Hickory spp.	125.6	Blackjack oak	4.2
Red maple	117.8	Yellow-poplar	4.1
Post oak	114.2	White basswood	3.9
Overcup oak	113.3	Black locust	3.6
Blackgum	103.3	Sourwood	3.6
Winged elm	85.0	Northern red oak	3.3
American beech	77.6	Other species [†]	3.3
Water hickory	66.6	Delta post oak	3.0
Blue-beech	63.1	River birch	3.0
Green ash	54.4	American basswood	2.9
Ironwood	49.5	Chinaberry	2.2
Flowering dogwood	42.8	Waterlocust	2.0
Slash pine	36.5	Sparkleberry	1.9
Laurel oak	34.0	Scarlet oak	1.8
Longleaf pine	30.2	Redbay	1.8
Sugarberry	30.0	Black walnut	1.2
American elm	29.0	Swamp white oak	1.1
Nuttall oak	23.6	Southern magnolia	1.0
Water tupelo	20.7	Bluejack oak	0.8
American holly	20.0	Butternut	0.5
Sweetbay	19.3	Chestnut oak	0.5
Cedar elm	19.2	Eastern redbud	0.4
Black cherry	18.5	Sugar maple	0.4
White ash	17.1	Southern redcedar	0.4
Black oak	16.5	White mulberry	0.2
Swamp chestnut oak	14.6	Bigleaf magnolia	0.2
Cottonwood	13.2	Chinkapin oak	0.2
Willow	12.4	Catalpa	0.2
Swamp tupelo	11.9	Hackberry	0.2
American sycamore	11.6	September elm	0.1
Hawthorn	11.1	Osage-orange	0.1
Sassafras	10.2	Serviceberry	†
Common persimmon	9.6	Kentucky coffeetree	†
Shumard oak	8.7		

million acres of forest industry lands were partially harvested.

Since 1984, 1,528,800 acres of Louisiana timberland have been clearcut (table XXIX). Forty percent of that clearcut acreage is in the loblolly-shortleaf pine FTG. Nonindustrial private forest owners held 53 percent and forest industry held 43 percent of the clearcut acreage.

The high level of harvesting activity initiated a special study that analyzed harvesting since 1975 (Rosson 1994a). A total of 6,888,000 acres of timberland has undergone some form of commercial harvest since 1975. Of this, 4,106,100 acres were partially harvested (Rosson 1994a). During the recent survey period, the majority of commercial harvesting was done between 1987 and 1990 (table XXX). During the peak year of 1989, 62 percent of commercial harvests took place on NIPF land.

Since 1975, 2,781,900 acres of Louisiana's upland timberland have been clearcut (Rosson 1994a). The heaviest clearcut harvesting since the 1984 survey was

from 1987 through 1990, with the highest amount of clearcut harvested acreage peaking in 1990 at 295,800 acres (table XXXI). Most of the clearcut acreage in 1990 was in the loblolly-shortleaf pine FTG.

Management

A total of 3,092,700 acres of Louisiana timberland underwent some form of stand treatment or site preparation between 1984 and 1991. Table XXXII shows the acreage distribution of treatments by forest type and ownership. Thinning operations include commercial and precommercial thinning. Stand improvement totals are for cleaning, release and other intermediate cuttings, and girdling, poisoning, or burning in existing stands to remove undesirable trees or other inhibiting vegetation. Site preparation includes clearing, burning, draining, chopping, disking, girdling, poisoning, or other practices designed to prepare a site for future artificial or natural regeneration.

Table XVII.—*Ranking of tree species* (by volume) for each forest survey unit and the State, Louisiana, 1991—Continued*

State			
Species	Volume [†]	Species	Volume [†]
Loblolly pine	7,006.4	Shumard oak	28.3
Sweetgum	2,144.8	Blackjack oak	27.0
Baldcypress	1,642.6	Black oak	26.5
Water oak	1,026.9	Other species [‡]	25.3
Water tupelo	893.0	Sourwood	22.6
Shortleaf pine	867.3	Sassafras	20.6
Slash pine	849.2	Live oak	19.6
Red maple	609.9	Waterlocust	17.4
Green ash	558.7	Florida maple	14.4
Sugarberry	483.0	Redbay	14.1
Southern red oak	475.5	Red mulberry	13.2
Willow	461.3	Delta post oak	11.3
Longleaf pine	455.8	Eastern redcedar	10.1
Blackgum	452.6	Plums and cherries [§]	9.7
Willow oak	437.6	River birch	9.2
White oak	408.5	Northern red oak	7.2
Cherrybark oak	363.3	American basswood	5.8
Water hickory	329.1	Black locust	5.7
Overcup oak	311.0	Sparkleberry	5.5
Hickory spp.	265.2	Scarlet oak	4.3
Post oak	259.2	White basswood	3.9
Laurel oak	254.9	Chinaberry	3.3
American elm	232.8	Bluejack oak	3.3
American beech	228.6	Chestnut oak	2.7
Nuttall oak	216.5	Black walnut	2.4
Blue-beech	186.7	Swamp white oak	1.9
Winged elm	163.3	Turkey oak	1.9
Cottonwood	141.2	Tung-oil-tree	1.6
Swamp tupelo	108.4	Hackberry	1.3
American sycamore	108.3	White mulberry	1.3
Boxelder	107.9	Pin oak	1.1
Sweetbay	102.3	Serviceberry	1.0
Flowering dogwood	100.9	Bigleaf magnolia	0.7
Pecan	95.3	Apple	0.6
Spruce pine	95.0	Durand oak	0.6
Swamp chestnut oak	94.3	Eastern redbud	0.6
Ironwood	93.3	Osage-orange	0.6
Yellow-poplar	69.0	Chinkapin oak	0.6
Slippery elm	64.1	Butternut	0.5
Cedar elm	63.5	Cucumbertree	0.4
Honeylocust	56.6	Sugar maple	0.4
Southern magnolia	44.9	Southern redcedar	0.4
Hawthorn	44.0	Royal paulownia	0.3
American holly	43.2	Catalpa	0.2
White ash	41.8	September elm	0.1
Black cherry	41.7	Chinkapin	0.1
Chinese tallowtree	40.6	Allegheny chinkapin	†
Common persimmon	32.9	Kentucky coffeetree	†
Water-elm	29.6		

*Scientific names can be cross referenced in species list in appendix.

[†]Values are net cubic-foot volume in million cubic feet for all live trees ≥ 1.0 inch in diameter at breast height.

[‡]Other species includes noncommercial and unidentified species.

[§]Other than black cherry.

[†]Volume >0.0 but <0.1 million cubic feet.

More than half of the thinning (350,500 acres) was done on forest industry land, and 86 percent of these forest industry thinnings were in the loblolly-shortleaf and longleaf-slash pine FTG's (table XXXII). Since 1984, therefore, forest industry had thinned a higher portion of its timberland (9 percent) than NIPF or public land managers (3 and 4 percent, respectively).

Stands were improved on 1,739,400 acres. Again, forest industry led with 43 percent of the improved acreage. Nonindustrial private forest owners had 40 percent and the public had 17 percent of the improved stands. The longleaf-slash, loblolly-shortleaf, and

oak-pine FTG's together had 71 percent of the stand improvement operations.

Between 1984 and 1991, 690,200 acres of timberland were treated to prepare them for regeneration. Again, forest industry led with 56 percent of the site-prepared acreage. The loblolly-shortleaf pine FTG contained 44 percent of the prepared sites. Since 1984, however, 19 percent of site preparation has been in the oak-pine and 20 percent has been in the oak-hickory FTG. The obvious purpose was to greatly increase the pine component of new stands after harvests. Approximately 45 percent of the timberland

Table XVIII.—Components of annual change in the volume of live trees by forest survey unit and species group, Louisiana, 1984 to 1991*

Forest survey unit	Species group	Growth component							Net change [§]
		Survivor growth [†]	Ingrowth [‡]	Growth on removals	Growth on mortality	Mortality	Timberland removals	Land-clearing removals	
-----Million cubic feet-----									
North Delta	Softwood	11.4	2.3	1.7	0.6	2.4	10.7	0.2	2.8
	Hardwood	51.8	4.9	4.7	1.8	12.7	38.6	3.8	8.2
	Total	63.2	7.1	6.4	2.4	15.1	49.2	3.9	11.0
South Delta	Softwood	19.3	0.8	1.4	0.5	4.6	10.1	4.6	2.7
	Hardwood	102.8	10.0	2.5	5.8	56.9	33.8	16.9	13.5
	Total	122.0	10.8	3.9	6.3	61.5	43.9	21.4	16.2
Southwest	Softwood	143.0	26.8	57.7	9.8	37.5	257.6	14.9	-72.7
	Hardwood	71.9	11.0	7.7	4.8	24.4	58.4	3.2	9.4
	Total	214.9	37.8	65.5	14.6	61.9	316.0	18.1	-63.3
Southeast	Softwood	49.3	10.5	24.5	3.2	10.3	93.9	3.7	-20.3
	Hardwood	45.4	5.5	2.4	2.6	17.5	14.3	3.5	20.7
	Total	94.7	16.1	26.9	5.8	27.7	108.2	7.2	0.4
Northwest	Softwood	157.9	33.2	51.7	6.9	33.3	271.8	1.6	-56.9
	Hardwood	99.9	14.0	17.0	4.9	34.6	111.2	2.1	-12.0
	Total	257.8	47.2	68.8	11.9	67.9	383.0	3.6	-68.9
All units	Softwood	381.0	73.6	137.2	21.0	88.0	644.2	24.8	-144.4
	Hardwood	371.8	45.4	34.3	20.0	146.1	256.2	29.4	39.8
	Total	752.7	119.0	171.5	41.0	234.1	900.4	54.3	-104.5

*Numbers in columns may not sum to totals due to rounding.

[†]Includes nongrowth trees.

[‡]Includes ongrowth trees.

[§]Net change = (survivor growth + ingrowth + growth on removals + growth on mortality) - (mortality + timberland removals + land-clearing removals).

Table XIX.—Components of annual change in the volume of live trees by ownership and species group, Louisiana, 1984 to 1991*

Ownership	Species group	Growth component							Net change [§]
		Survivor growth [†]	Ingrowth [‡]	Growth on removals	Growth on mortality	Mortality	Timberland removals	Land-clearing removals	
-----Million cubic feet-----									
Public	Softwood	27.5	4.7	5.7	1.6	7.0	34.5	0.0	-2.1
	Hardwood	37.9	3.5	1.4	2.2	16.8	9.9	0.1	18.4
	Total	65.4	8.2	7.1	3.8	23.8	44.4	0.1	16.3
Forest industry	Softwood	130.1	41.1	60.8	5.9	26.2	258.9	7.2	-54.5
	Hardwood	71.7	10.5	12.1	4.3	26.8	87.8	0.9	-16.8
	Total	202.9	51.6	72.9	10.2	53.1	346.7	8.1	-71.3
Nonindustrial private	Softwood	223.4	27.8	70.7	13.5	54.8	350.7	17.7	-87.8
	Hardwood	262.1	31.3	20.9	13.5	102.5	158.6	28.5	38.3
	Total	485.5	59.1	91.6	27.0	157.3	509.3	46.1	-49.5
All owners	Softwood	381.0	73.6	137.2	21.0	88.0	644.2	24.8	-144.4
	Hardwood	371.8	45.4	34.3	20.0	146.1	256.2	29.4	39.8
	Total	752.7	119.0	171.5	41.0	234.1	900.4	54.3	-104.5

*Numbers in columns may not sum to totals due to rounding.

[†]Includes nongrowth trees.

[‡]Includes ongrowth trees.

[§]Net change = (survivor growth + ingrowth + growth on removals + growth on mortality) - (mortality + timberland removals + land-clearing removals).

Table XX.—Components of annual change in the volume of live trees in plantations by ownership and species group, Louisiana, 1984 to 1991*

Ownership	Species group	Growth component							
		Survivor growth [†]	Ingrowth [‡]	Growth on removals	Growth on mortality	Mortality	Timberland removals	Land-clearing removals	Net change [§]
-----Million cubic feet-----									
Public	Softwood	5.2	1.7	2.0	0.1	0.4	14.2	0.0	-5.4
	Hardwood	0.9	0.1	0.4	0.1	0.5	2.3	0.0	-1.3
	Total	6.1	1.9	2.4	0.2	0.8	16.4	0.0	-6.7
Forest industry	Softwood	64.2	27.9	34.2	2.6	8.7	138.6	0.0	-18.4
	Hardwood	6.9	1.6	3.5	0.2	1.0	26.3	0.0	-15.2
	Total	71.0	29.5	37.7	2.8	9.7	164.9	0.0	-33.6
Nonindustrial private	Softwood	44.5	11.7	22.7	1.6	5.9	105.4	0.0	-30.8
	Hardwood	5.8	2.1	2.7	0.1	0.8	18.7	0.0	-8.8
	Total	50.3	13.8	25.4	1.7	6.7	124.1	0.0	-39.6
All owners	Softwood	113.9	41.3	58.4	4.3	15.0	258.2	0.0	-54.7
	Hardwood	13.5	3.8	6.5	0.4	2.3	47.3	0.0	-25.3
	Total	127.5	45.1	65.0	4.7	17.3	305.5	0.0	-80.0

*Numbers in columns may not sum to totals due to rounding.

[†]Includes nongrowth trees.

[‡]Includes ongrowth trees.

[§]Net change = (survivor growth + ingrowth + growth on removals + growth on mortality) - (mortality + timberland removals + land-clearing removals).

Table XXI.—Components of annual change in the volume of sawtimber by forest survey unit and species group, Louisiana, 1984 to 1991*

Forest survey unit	Species group	Growth component								
		Survivor growth [†]	Ingrowth [‡]	Growth on removals	Growth on mortality	Cull increment	Mortality	Timberland removals	Land-clearing removals	Net change [§]
-----Million board feet [¶] -----										
North Delta	Softwood	50.8	11.3	11.8	0.9	-3.2	1.8	55.7	0.0	20.4
	Hardwood	113.9	70.7	21.7	2.5	-25.0	21.1	159.2	6.3	47.3
	Total	164.7	82.0	33.5	3.4	-28.2	22.9	214.9	6.3	67.6
South Delta	Softwood	84.7	12.0	7.0	1.6	-26.5	12.9	39.6	14.2	65.0
	Hardwood	208.5	93.6	13.4	10.4	-39.9	70.9	133.5	40.6	120.9
	Total	293.2	105.6	20.4	12.0	-66.4	83.7	173.1	54.8	185.9
Southwest	Softwood	576.1	256.5	236.6	32.6	-9.2	127.8	1,063.2	68.9	-148.9
	Hardwood	160.0	64.6	24.9	3.7	-24.3	35.2	167.5	2.4	72.3
	Total	736.1	321.1	261.4	36.3	-33.4	163.1	1,230.7	71.3	-76.6
Southeast	Softwood	184.3	103.1	111.5	7.1	-3.5	30.8	435.1	18.8	-75.2
	Hardwood	109.0	32.5	6.5	3.3	-27.7	23.9	40.8	5.5	108.6
	Total	293.3	135.6	118.0	10.4	-31.2	54.7	475.9	24.3	33.6
Northwest	Softwood	610.9	233.5	254.0	21.7	-12.0	124.3	1,227.8	6.1	-226.0
	Hardwood	177.4	92.0	57.2	8.3	+5.0	68.4	303.4	3.3	-45.1
	Total	788.4	325.5	311.3	30.0	-7.0	192.8	1,531.3	9.3	-271.2
All units	Softwood	1,506.8	616.4	620.9	63.9	-54.4	297.7	2,821.5	108.0	-364.7
	Hardwood	768.8	353.4	123.7	28.1	-111.9	219.5	804.5	58.0	304.0
	Total	2,275.6	969.8	744.7	92.0	-166.3	517.1	3,626.0	166.0	-60.7

*Numbers in columns may not sum to totals due to rounding.

[†]Includes nongrowth trees.

[‡]Includes ongrowth trees.

[§]Net change = (survivor growth + ingrowth + growth on removals + growth on mortality) - (cull increment + mortality + timberland removals + land-clearing removals).

[¶]International 1/4-inch Rule.

Table XXII.—Components of annual change in the volume of sawtimber by ownership and species group, Louisiana, 1984 to 1991*

Ownership	Species group	Growth component								
		Survivor growth [†]	Ingrowth [‡]	Growth on removals	Growth on mortality	Cull increment	Mortality	Timberland removals	Land-clearing removals	Net change [§]
----- Million board feet [¶] -----										
Public	Softwood	135.6	37.6	26.8	7.1	-3.5	26.8	171.8	0.0	12.0
	Hardwood	82.6	31.4	4.5	3.6	-19.1	25.7	31.1	0.0	84.5
	Total	218.2	69.0	31.3	10.7	-22.6	52.4	202.9	0.0	96.5
Forest industry	Softwood	419.8	241.5	226.6	15.3	-8.4	95.1	1,043.9	34.1	-261.4
	Hardwood	140.3	79.5	38.0	4.7	-28.5	46.7	268.2	2.1	-25.9
	Total	560.1	321.0	264.6	20.0	-36.9	141.8	1,312.0	36.2	-287.4
Nonindustrial private	Softwood	951.4	337.2	367.5	41.6	-42.5	175.7	1,605.8	74.0	-115.3
	Hardwood	545.8	242.5	81.2	19.8	-64.3	147.1	505.2	55.9	245.5
	Total	1,497.3	579.8	448.7	61.4	-106.8	322.9	2,111.0	129.9	130.1
All owners	Softwood	1,506.8	616.4	620.9	63.9	-54.4	297.7	2,821.5	108.0	-364.7
	Hardwood	768.8	353.4	123.7	28.1	-111.9	219.5	804.5	58.0	304.0
	Total	2,275.6	969.8	744.7	92.0	-166.3	517.1	3,626.0	166.0	-60.7

*Numbers in columns may not sum to totals due to rounding.

[†]Includes nongrowth trees.

[‡]Includes ongrowth trees.

[§]Net change = (survivor growth + ingrowth + growth on removals + growth on mortality) - (cull increment + mortality + timberland removals + land-clearing removals).

[¶]International 1/4-inch Rule.

Table XXIII.—Components of annual change in the volume of sawtimber in plantations by ownership and species group, Louisiana, 1984 to 1991*

Ownership	Species group	Growth component								
		Survivor growth [†]	Ingrowth [‡]	Growth on removals	Growth on mortality	Cull increment	Mortality	Timberland removals	Land-clearing removals	Net change [§]
----- Million board feet [¶] -----										
Public	Softwood	25.7	5.7	8.9	0.7	0.0	1.4	73.5	0.0	-33.9
	Hardwood	2.4	0.0	0.6	0.5	-0.5	0.8	3.1	0.0	0.1
	Total	28.1	5.7	9.6	1.2	-0.5	2.2	76.6	0.0	-33.8
Forest industry	Softwood	143.8	148.5	123.5	5.7	-1.8	21.3	506.4	0.0	-104.3
	Hardwood	8.5	12.6	9.0	0.	+0.6	0.6	58.8	0.0	-30.0
	Total	152.3	161.1	132.6	5.7	-1.1	21.9	565.2	0.0	-134.4
Nonindustrial private	Softwood	141.4	94.0	111.7	4.1	-1.8	16.3	421.0	0.0	-84.2
	Hardwood	11.6	3.0	10.2	0.5	-0.5	1.5	41.9	0.0	-17.7
	Total	153.0	97.0	121.9	4.6	-2.3	17.8	462.9	0.0	-101.9
All owners	Softwood	311.0	248.2	244.2	10.5	-3.6	39.0	1,000.9	0.0	-222.5
	Hardwood	22.4	15.5	19.9	1.0	-0.4	2.9	103.9	0.0	-47.6
	Total	333.4	263.7	264.1	11.5	-3.9	41.9	1,104.7	0.0	-270.1

*Numbers in columns may not sum to totals due to rounding.

[†]Includes nongrowth trees.

[‡]Includes ongrowth trees.

[§]Net change = (survivor growth + ingrowth + growth on removals + growth on mortality) - (cull increment + mortality + timberland removals + land-clearing removals).

[¶]International 1/4-inch Rule.

clearcut since 1984 underwent site preparation by the time of the 1991 survey. This estimate is conservative because an unknown acreage that was harvested before SO-FIA field crews arrived was prepared for regeneration after the crews had completed the sample.

Hurricane Andrew

Approximately 8 months after field work was completed, Hurricane Andrew struck south Louisiana on August 26, 1992. An aerial video survey conducted by SO-FIA revealed only 127,000 acres of timberland with moderate or severe damage. There were, however, 1,100,000 acres with some damage (Kelly 1993). Most of the damage was in the Atchafalaya River Basin, and hardwoods received the most damage. Overall, approximately 10 percent of live-tree volume was downed and expected to die. The inventory decline in this 1,100,000-acre area was estimated to be 378.7 million ft³ (Kelly 1993).

TREATMENT OPPORTUNITIES

Possible treatment opportunities for Louisiana's timberland are given in table XXXIII. These estimates are derived solely from the 1991 survey data by use of a computer algorithm. Plot-level parameters important in making these estimates are: stocking level of growing stock, amount of cull, species groups, stand size class, amount of volume, and amount of damage. The threshold levels for the various treatment classes are subjective but do help to give an indication of the stand conditions of Louisiana's timberland resource.

In terms of affected area, the largest need is for stand regeneration of 2,316,700 acres. The majority of this area is on NIPF land in oak-hickory and bottomland forest types. This area includes all stands less than 50 percent stocked with growing-stock trees, or all stands >50 but <60 percent stocked with growing-stock trees and in which the stocking of rough and rotten trees is more than 30 percent. The stocking condition is based on all growing-stock trees.

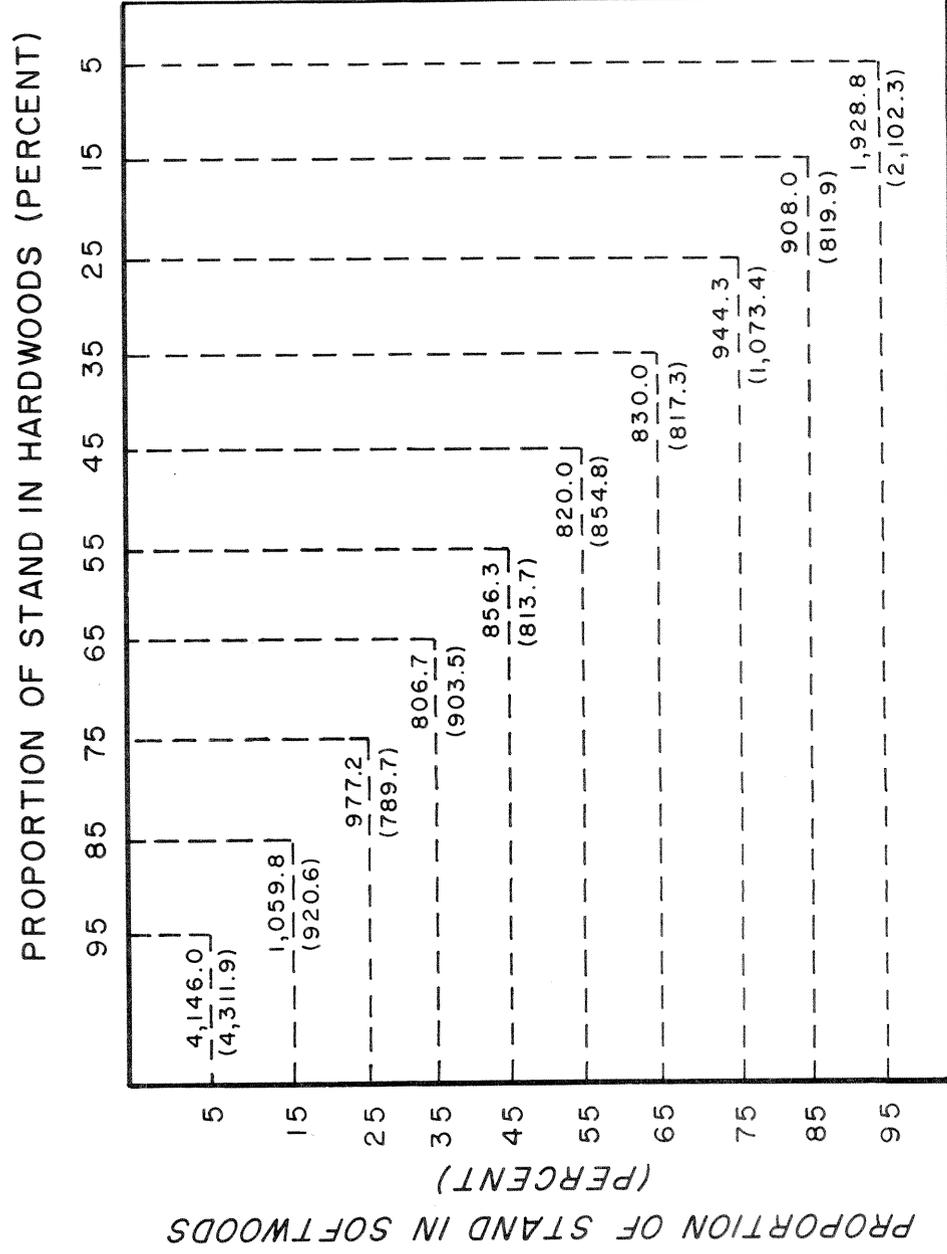


Figure 24. — Area of timberland by proportion of stand in softwoods and hardwoods, Louisiana, 1991. The percentage values are the midpoints of the deciles. Thus, 85 percent includes values ≥ 80 but <90 percent. Area is in thousand acres; the acreage enclosed in parentheses is from the 1984 survey. Proportions are based on basal area, and only stands with trees ≥ 1.0 inch in diameter at breast height are included.

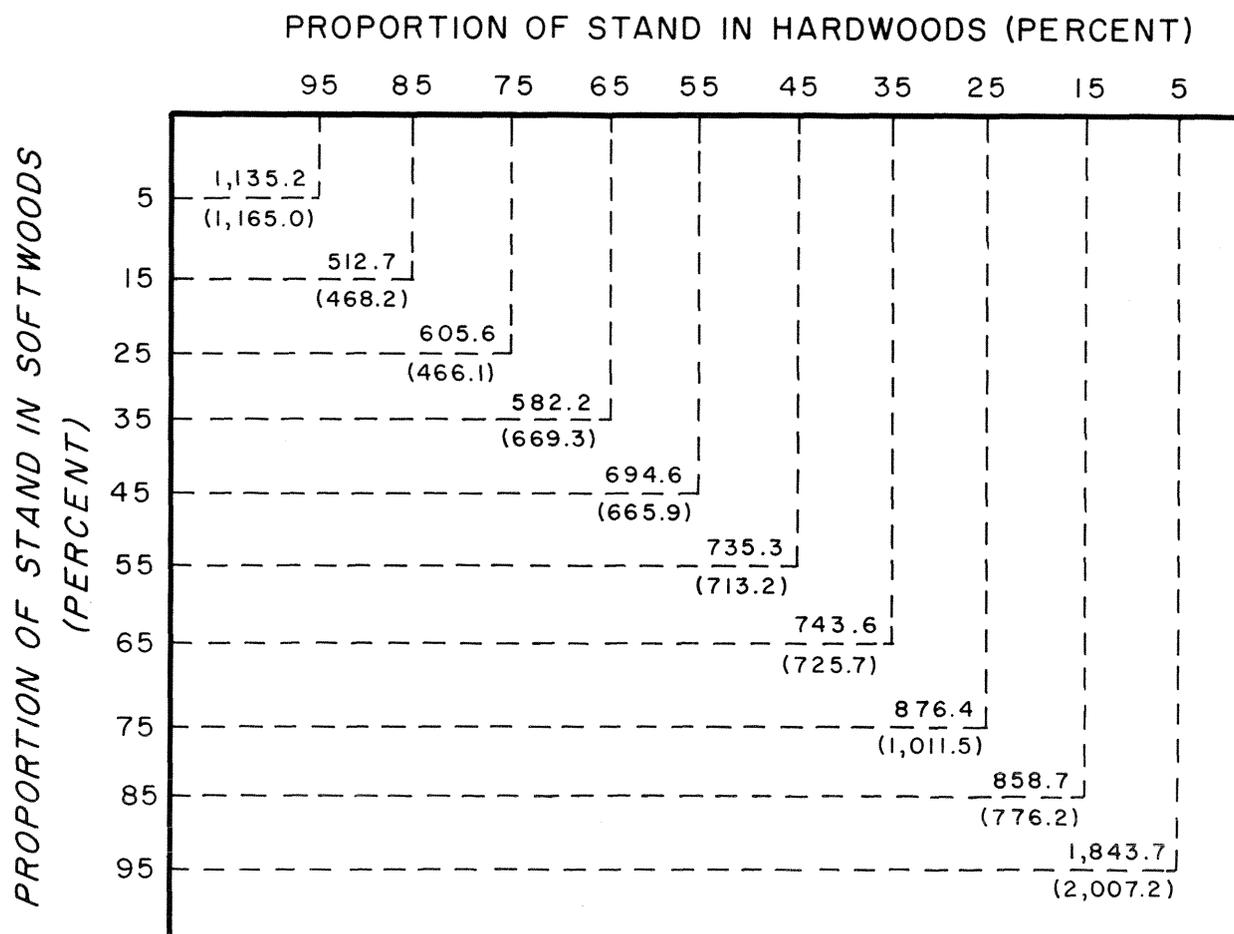


Figure 25. — Area of upland timberland by proportion of stand in softwoods and hardwoods, Louisiana, 1991. The percentage values are the midpoints of the deciles. Thus, 85 percent includes values ≥ 80 but < 90 percent. Area is in thousand acres; the acreage enclosed in parentheses is from the 1984 survey. Proportions are based on basal area, and only upland stands with trees ≥ 1.0 inch in diameter at breast height are included.

Three categories of intermediate treatment were considered: sapling-seedling or precommercial thinnings, poletimber thinnings, and other stocking controls. Sapling-seedling stands more than 150 percent stocked with growing-stock trees were judged to need thinning. Louisiana has 50,400 acres in this condition. Poletimber stands with more than 110-percent stocking were classed as poletimber thinning opportunities; 418,700 acres are in this class. The other stocking control category includes all sapling-seedling and poletimber stands with more than 110-percent stocking and more than 30 percent of stocking in rough and rotten trees. Louisiana has 713,000 acres in this class.

Final harvest treatments include both regeneration cuts and salvage cuts. Timberland on which the trees are sawlog sized, with more than 110-percent stocking in growing-stock trees, and with more than 5,000 fbm/acre qualifies for a regeneration cut. Currently, Louisiana has 1,276,100 acres in this category. Sixty-nine percent of the opportunities for regeneration cuts

are on NIPF land; most are in the loblolly-shortleaf pine and bottomland hardwood FTG's. Salvage cuts are in poletimber and sawtimber stands where more than 80 percent of the stocking is made up of trees with a cull deduction due to disease, insect, or other naturally occurring injury. Only 140,000 acres of Louisiana timberland fell into this category, but the totals were compiled before Hurricane Andrew struck.

TIMBER PRODUCTS OUTPUT

A total of 122 primary wood-using plants was reported in operation in Louisiana in 1991 (fig. 26). Sixty of these are sawmills; 17 are panel plants; 23 are plants for treating ties, poles, and lumber; 11 are chipping mills; and 11 are pulp and paper mills. The largest concentration of plants is in the northwest portion of the state.

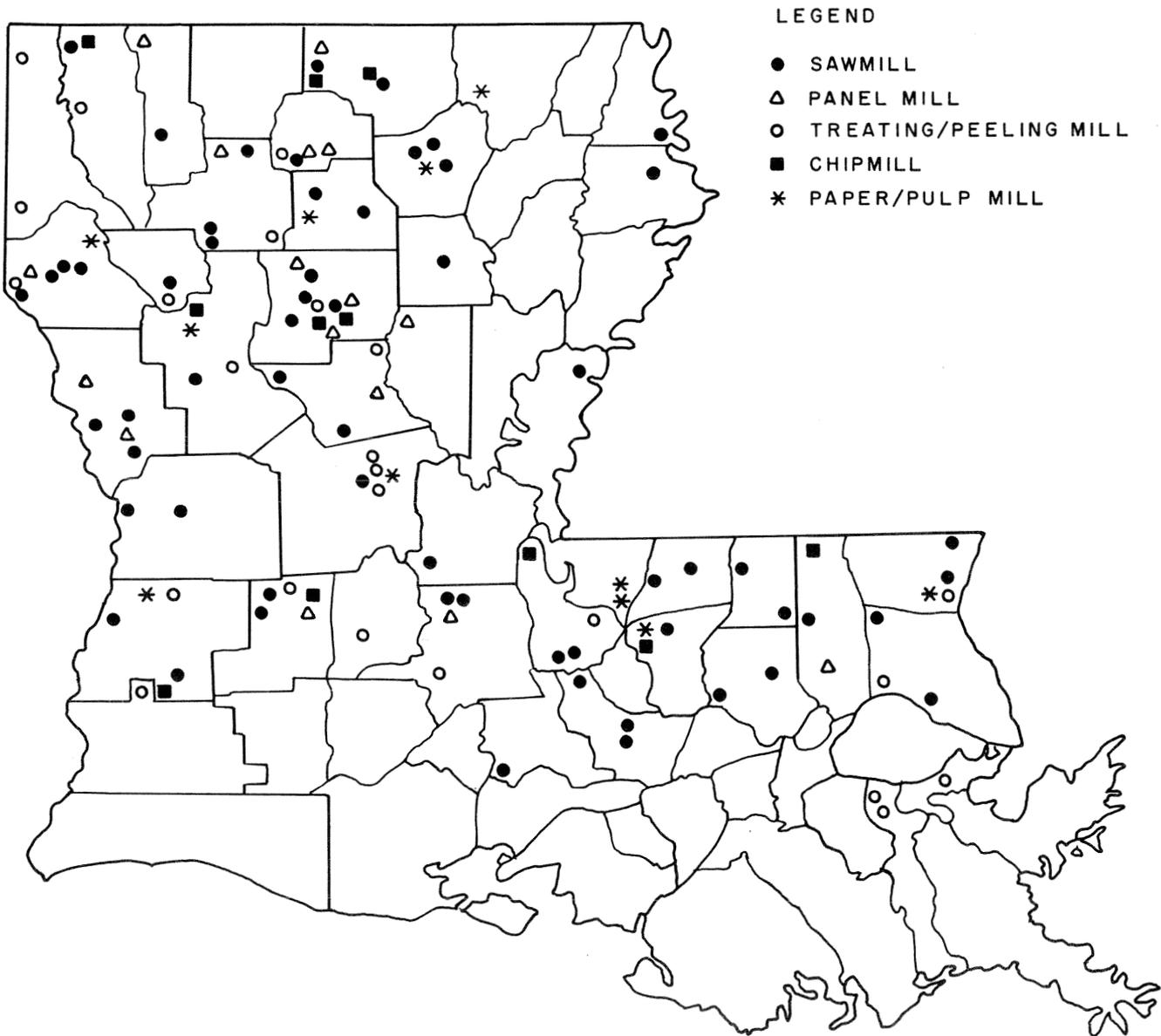


Figure 26. — Primary wood-using plants in Louisiana, 1991. Information supplied by the Louisiana Department of Agriculture and Forestry, Office of Forestry.

Table XXIV.—Area of timberland on plantations by ownership and forest type group, Louisiana, 1991*

Ownership	Forest type group					
	All types	Longleaf-slash	Loblolly-shortleaf	Oak-pine	Oak-hickory	Bottomland hardwoods [†]
	-----Thousand acres-----					
Public	179.0	39.6	109.2	11.5	15.0	3.8
Forest industry	1,534.3	308.6	980.2	166.6	73.4	5.4
Nonindustrial private	1,022.4	252.5	555.1	146.5	40.3	28.0
All owners	2,735.7	600.6	1,644.5	324.6	128.7	37.3

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Includes oak-gum-cypress and elm-ash-cottonwood types.

Table XXV.—Area of timberland on plantations by ownership and age class, Louisiana, 1991*

Ownership	All classes	Age class (Years) [†]						Mixed age [‡]
		5	15	25	35	45	46-92	
	-----Thousand acres-----							
Public	179.0	65.2	29.0	4.7	8.3	17.0	20.1	34.7
Forest industry	1,534.3	567.4	384.2	181.6	180.2	10.9	0.0	210.0
Nonindustrial private	1,022.4	363.9	189.2	112.6	123.3	21.5	5.6	206.2
All owners	2,735.7	996.6	602.5	298.8	311.8	49.4	25.7	451.0

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Values are midpoints of 10-year ranges, i.e., 5 = 0-10 years, 15 = 11-20 years, etc.

[‡]Stand structure disturbed to the point where no single age class could be defined, i.e., two or more strata >10 years difference in age.

Table XXVI.—Softwood stocking on plantations by ownership, Louisiana, 1991*

Ownership	All classes	Stocking class (Percent)				
		<30	30-59	60-89	90-119	≥120
	-----Thousand acres-----					
Public	179.0	7.7	26.8	56.3	61.8	26.5
Forest industry	1,534.3	77.2	231.4	489.4	528.8	207.5
Nonindustrial private	1,022.4	57.1	184.6	356.9	341.0	82.8
All owners	2,735.7	142.0	442.8	902.6	931.6	316.7

*Numbers in rows and columns may not sum to totals due to rounding.

Table XXVII.—Softwood live-tree volume on plantations by ownership and diameter class, Louisiana, 1991*

Ownership	All classes	Diameter class (Inches at breast height)			
		5.0-9.9	10.0-14.9	15.0-19.9	≥20
	-----Million cubic feet-----				
Public	191.4	26.9	79.4	70.4	14.6
Forest industry	1,207.3	577.3	488.7	126.7	14.7
Nonindustrial private	915.5	304.0	422.3	147.5	41.7
All owners	2,314.2	908.1	990.4	344.6	71.0

*Numbers in rows and columns may not sum to totals due to rounding.

Table XXVIII.—Area of timberland on plantations by ownership and treatment class, Louisiana, 1991*

Ownership	Treatment		
	All treatments	Commercial harvest [†]	Thinning/stand improvement [‡]
-----Thousand acres-----			
Public	50.9	8.0	43.0
Forest industry	691.7	347.7	344.0
Nonindustrial private	598.2	356.1	242.1
All owners	1,340.7	711.7	629.1

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Includes all types of commercial harvests.

[‡]Includes all types of stand treatment except stand conversions and natural disturbance.

Pulpwood

Louisiana reported 1,815.9 million ft³ of pine pulpwood subject to severance tax from 1985 through 1991 (table XXXIV). After increasing from 1985 to 1986,

output remained fairly steady for the remainder of the period.

A total of 796.9 million ft³ of hardwood pulpwood was reported for the survey period. After peaking in 1989, production decreased slightly by 1991.

In 1991, pulping capacity of Louisiana mills was 15,085 tons per day (Howell 1993), an increase of 1,085 tons from 1985 (Hutchins 1987). Totals are for all pulping processes combined. The majority (84 percent) of Louisiana's capacity is in the sulfate process.

Sawlog Products

From 1985 through 1991, Louisiana produced 2,557.8 million ft³ of pine sawlogs (table XXXIV). Eight-six percent of all logs produced during the period were pine. Production of pine sawlogs increased from 311.2 million ft³ in 1985 to a high of 391.7 million ft³ in 1990.

Table XXIX.—Area of timberland by forest type group prior to harvesting, ownership, and harvesting activity, Louisiana, 1991*

Forest type group and ownership	Commercial harvesting activity				
	All classes	None	Partial [†]	Clearcut	
				Merchantable	Complete [‡]
-----Thousand acres-----					
Longleaf-slash pine					
Public	183.6	139.1	34.1	0.0	10.4
Forest industry	409.6	233.6	135.1	0.0	40.9
Nonindustrial private	945.3	719.6	141.3	50.3	34.0
All owners	1,538.5	1,092.4	310.5	50.3	85.3
Loblolly-shortleaf pine					
Public	370.4	239.1	106.8	15.9	8.5
Forest industry	1,461.5	795.6	384.7	99.2	182.1
Nonindustrial private	2,106.0	1,085.8	711.4	167.0	141.8
All owners	3,937.9	2,120.4	1,202.9	282.2	332.3
Oak-pine					
Public	139.4	82.7	49.2	3.7	3.7
Forest industry	674.5	292.6	225.9	73.1	82.9
Nonindustrial private	1,026.1	611.3	242.5	92.6	79.9
All owners	1,840.0	986.6	517.6	169.4	166.5
Oak-hickory					
Public	105.9	83.8	11.4	4.7	6.1
Forest industry	657.1	455.7	74.9	63.7	62.9
Nonindustrial private	1,308.1	889.6	287.6	104.5	26.4
All owners	2,071.2	1,429.1	373.9	172.9	95.4
Bottomland hardwoods [§]					
Public	506.9	466.8	35.7	4.5	0.0
Forest industry	695.6	505.9	140.8	27.9	21.0
Nonindustrial private	3,192.9	2,808.4	263.4	82.1	39.0
All owners	4,395.4	3,781.0	439.9	114.5	60.0
All forest types					
Public	1,306.3	1,011.6	237.2	28.8	28.7
Forest industry	3,898.3	2,283.3	961.3	264.0	389.8
Nonindustrial private	8,578.4	6,114.7	1,646.2	496.5	321.0
All owners	13,783.0	9,409.5	2,844.7	789.3	739.5

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Includes 50.9 thousand acres of salvage cuts.

[‡]Includes 88.0 thousand acres of seed tree and shelterwood cuts.

[§]Includes oak-gum-cypress and elm-ash-cottonwood forest type groups.

Hardwood log production also peaked in 1990 at 71.1 million ft³. The total volume reported for severance taxes from 1985 through 1991 was 426.6 million ft³. Production dropped to 47.7 million ft³ in 1991, but it is expected to increase along with the overall demand for hardwoods throughout the 1990's.

The pine severance tax data tracks fairly closely with the SO-FIA pine removal estimate. However, there is a fairly wide margin between the severance tax data and forest survey estimates for hardwood removals. On average, the hardwood severance tax estimate is 34 percent less than the survey estimate. Three factors may be affecting this difference: (1) the board-foot to cubic-foot ratio for the Doyle scale is not reflective of average log size, (2) the time periods for the two sets of data are not exactly the same, and (3) mill utilization of hardwoods may be somewhat less than the forest survey measurements define as merchantable material.

CONCLUSION AND OUTLOOK

The most notable trend since the 1984 survey is the increase in the softwood harvest. Whether or not this level of harvesting will continue is uncertain. There is certainly the potential for many varied interests to be competing for Louisiana's forest resources. With this in mind, it is important to emphasize the impact that continued high levels of harvest will have on Louisiana's forests for the long term.

Of all the Midsouth States, Louisiana has the highest ratio of softwood removals-to-growth, 1.27 to 1. The Midsouth average is 1.09 to 1 (as of 1991). High levels of removals make it imperative that Louisiana's harvested timberland is regenerated in a timely manner and at adequate stocking levels.

Table XXX.*—Area of timberland commercially harvested by year of harvest and ownership, Louisiana, 1984 to 1991[†]

Year of harvest	All classes	Ownership		
		Public	Forest industry	Nonindustrial private
-----Thousand acres-----				
1985	145.6	10.1	76.7	58.8
1986	329.8	17.7	159.3	152.7
1987	755.0	84.2	253.9	417.0
1988	950.3	64.8	350.0	535.5
1989	1,068.8	49.9	351.4	667.5
1990	737.8	51.5	271.1	415.1
1991	299.1	10.9	136.5	151.8
All years	4,286.4	289.1	1,598.8	2,398.4

*Modified from Rosson (1994a). Timberland totaling 87,100 acres was not included in this table because of ground use changes between the 1984 and 1991 surveys.

[†]Numbers in rows and columns may not sum to totals due to rounding.

Two recent papers (Rosson 1994a, 1994b) have addressed these concerns by examining harvesting trends and the status of precommercial-sized softwoods. Highlights of these studies reveal several important areas in need of attention. There are 952,500 acres and 765,800 acres in seedling-sized and sapling-sized stands, respectively, less than 60 percent stocked with softwoods (equivalent to fewer than 360 trees per acre). Most of this timberland is on NIPF lands and is naturally regenerating. There were 1,996,400 acres of pine forest types clearcut between 1975 and 1991. Of these, 513,300 acres have converted to the oak-hickory forest type, indicating lack of softwood regeneration or stands being left in a cutover condition. Additionally, the lag time between harvest and regeneration further delays the onset of the next stand rotation. It is taking approximately 6 to 7 years after harvest for substantial amounts of softwoods to reach the 4-inch diameter class. Even then, many stands are below the survey stocking standard and below

Table XXXI*—Area of clearcut upland timberland by year of harvest and forest type group, Louisiana, 1984 to 1991[†]

Year of harvest	All types	Forest type group [†]			
		Longleaf-slash pine	Loblolly-shortleaf pine	Oak-pine	Oak-hickory
-----Thousand acres-----					
1985	91.6	5.5	25.2	15.6	45.3
1986	147.2	6.2	83.4	39.6	17.9
1987	213.5	17.4	99.2	46.4	50.7
1988	247.6	32.6	119.7	51.0	44.4
1989	234.4	45.0	89.7	71.7	28.0
1990	295.8	22.6	148.2	72.7	52.2
1991	112.5	0.0	49.2	33.6	29.7
All years	1,342.5	129.3	614.5	330.4	268.2

*Modified from Rosson (1994a). Timberland totaling 11,800 acres was not included in this table because of ground use changes between the 1984 and 1991 surveys.

[†]Numbers in rows and columns may not sum to totals due to rounding.

[†]Forest type group prior to harvest.

Table XXXII.—Area of timberland by forest type group prior to activity, ownership, and management activity, Louisiana, 1991*

Forest type group and ownership	Management activity				
	All classes	None	Thinning operation	Stand improvement	Site preparation
-----Thousand acres-----					
Longleaf-slash pine					
Public	183.6	51.0	13.1	109.1	10.4
Forest industry	409.6	158.2	125.2	102.6	23.6
Nonindustrial private	945.3	613.7	77.3	208.1	46.2
All owners	1,538.5	823.0	215.6	419.8	80.2
Loblolly-shortleaf pine					
Public	370.4	208.4	23.8	117.4	20.8
Forest industry	1,461.5	720.9	174.5	391.1	175.0
Nonindustrial private	2,106.0	1,580.2	118.5	299.0	108.2
All owners	3,937.9	2,509.6	316.9	807.6	303.9
Oak-pine					
Public	139.4	73.1	10.6	44.5	11.2
Forest industry	674.5	433.6	21.9	134.6	84.3
Nonindustrial private	1,026.1	841.1	34.1	115.5	35.4
All owners	1,840.0	1,347.9	66.6	294.6	131.0
Oak-hickory					
Public	105.9	65.6	3.8	25.7	10.7
Forest industry	657.1	461.0	23.5	82.0	90.6
Nonindustrial private	1,308.1	1,179.4	25.8	69.4	33.6
All owners	2,071.2	1,706.0	53.1	177.1	135.0
Bottomland hardwoods [†]					
Public	506.9	502.0	0.0	4.9	0.0
Forest industry	695.6	649.7	5.4	29.5	11.0
Nonindustrial private	3,192.9	3,152.2	5.6	6.1	29.1
All owners	4,395.4	4,303.9	11.0	40.4	40.0
All forest types					
Public	1,306.3	900.1	51.4	301.6	53.1
Forest industry	3,898.3	2,423.5	350.5	739.8	384.5
Nonindustrial private	8,578.4	7,366.7	261.2	698.1	252.5
All owners	13,783.0	10,690.3	663.1	1,739.4	690.2

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Includes oak-gum-cypress and elm-ash-cottonwood forest type groups.

normal yields. Softwood volumes are averaging approximately 1,000 ft³/acre 13 to 17 years after harvest, whereas stands on average sites should have yields averaging 2,000 ft³/acre at 20 years of age (Rosson 1994a).

In spite of the heavy drain on softwoods in this survey period, Louisiana still ranks first in softwood sawtimber volume and second in total softwood volume among Midsouth States. It ranks fifth in both hardwood sawtimber volume and total hardwood volume.

Ranking so high in softwood volume after this heavy cut since 1984 is particularly impressive, given that Louisiana ranks fourth in total timberland area.

The long-term supply of forest resources can be enhanced by timely stand establishment after harvest and by maintaining adequate stocking levels through all stages of stand development. Although there are shortcomings in all ownership classes, NIPF needs are particularly acute. Prompt regeneration after harvest to adequate stocking levels is a most pressing need.

Table XXXIII.—Area of timberland by forest type group, ownership, and treatment opportunity, Louisiana, 1991*

Forest type group and ownership	Type of treatment								
	All classes	No treatment	Stand establishment		Intermediate treatment			Final harvest	
			Regenerate	Stand conversion	Thin seedling and saplings	Thin poletimber	Other stocking control	Regeneration cut	Salvage cut
-----Thousand acres-----									
Longleaf-slash pine									
Public	127.1	96.3	20.2	0.0	0.0	0.0	0.0	10.7	0.0
Forest industry	338.8	264.6	34.0	0.0	0.0	12.4	0.0	27.8	0.0
Nonindustrial private	418.6	315.9	73.7	0.0	0.0	6.2	0.0	22.7	0.0
All owners	884.5	676.8	127.9	0.0	0.0	18.6	0.0	61.2	0.0
Loblolly-shortleaf pine									
Public	374.5	289.2	21.9	0.0	4.7	4.7	9.4	44.7	0.0
Forest industry	1,726.0	1,200.2	49.2	6.1	23.4	218.4	50.7	178.0	0.0
Nonindustrial private	2,053.1	1,364.4	126.9	5.4	10.8	117.3	33.7	394.6	0.0
All owners	4,153.6	2,853.8	198.0	11.4	38.9	340.3	93.7	617.4	0.0
Oak-pine									
Public	156.4	97.4	17.0	0.0	0.0	11.8	30.2	0.0	
Forest industry	532.0	440.8	21.9	0.0	0.0	5.7	46.4	17.3	0.0
Nonindustrial private	1,198.2	856.1	133.1	0.0	0.0	16.3	117.3	75.4	0.0
All owners	1,886.6	1,394.3	172.0	0.0	0.0	21.9	175.5	122.8	0.0
Oak-hickory									
Public	136.8	102.0	12.2	0.0	0.0	0.0	18.1	4.5	0.0
Forest industry	584.1	370.9	125.6	0.0	11.5	0.0	70.0	6.3	0.0
Nonindustrial private	1,386.2	743.0	439.6	0.0	0.0	5.4	150.2	25.0	22.9
All owners	2,107.2	1,215.9	577.4	0.0	11.5	5.4	238.2	35.8	22.9
Bottomland hardwoods [†]									
Public	511.4	304.2	139.5	0.0	0.0	0.0	18.2	24.8	24.8
Forest industry	717.3	409.4	187.0	0.0	0.0	0.0	48.4	45.1	27.4
Nonindustrial private	3,522.4	2,002.3	914.8	0.0	0.0	32.4	139.0	369.0	64.9
All owners	4,751.2	2,715.8	1,241.3	0.0	0.0	32.4	205.5	439.0	117.1
All forest types									
Public	1,306.3	889.1	210.8	0.0	4.7	4.7	57.4	114.9	24.8
Forest industry	3,898.3	2,685.9	417.8	6.1	34.9	236.5	215.4	274.5	27.4
Nonindustrial private	8,578.4	5,281.7	1,688.1	5.4	10.8	177.5	440.2	886.8	87.8
All owners	13,783.0	8,856.7	2,316.7	11.4	50.4	418.7	713.0	1,276.1	140.0

*Numbers in rows and columns may not sum to totals due to rounding.

[†]Includes oak-gum-cypress and elm-ash-cottonwood forest type groups.

Table XXXIV.—Output of primary timber products subject to severance tax by year and species group, Louisiana, 1985 through 1991*

Year	Total		Pulpwood		Logs	
	Pine	Hardwood	Pine [†]	Hardwood [‡]	Pine [§]	Hardwood [§]
	-----Million cubic feet-----					
1985	521.3	153.6	210.1	95.8	311.2	57.8
1986	634.2	157.8	254.8	102.4	379.4	55.4
1987	633.1	172.5	262.6	110.7	370.5	61.8
1988	660.1	181.1	277.6	111.9	382.5	69.2
1989	622.5	203.0	270.7	139.4	351.8	63.6
1990	659.6	191.6	267.9	120.5	391.7	71.1
1991	642.9	163.9	272.2	116.2	370.7	47.7
All years	4,373.7	1,223.5	1,815.9	796.9	2,557.8	426.6

*Based on severance tax data released by the Louisiana Department of Agriculture and Forestry, Office of Forestry.

[†]Conversion of standard cords to cubic feet based on 72 cubic feet per cord (Avery and Burkhardt 1983).

[‡]Conversion of standard cords to cubic feet based on 79 cubic feet per cord (Avery and Burkhardt 1983).

[§]Conversion of Doyle scale to cubic feet based on board foot to cubic foot ratio of 3.3 to 1 (the ratio is based on 16-foot logs with a 10-inch diameter inside the bark at small end) (Husch and others 1982).

LITERATURE CITED

- Avery, Thomas Eugene; Burkhardt, Harold W. 1983. Forest measurements. New York: McGraw-Hill. 331 p.
- Beers, T.W.; Miller, C.I. 1964. Point sampling: research results, theory and applications. Resour. Bull. 786. West Lafayette, IN: Purdue University Agriculture Experiment Station. 55 p. + insert.
- Eyre, F. H. 1980. Forest cover types of the United States and Canada. Washington, DC: Society of American Foresters. 148 p.
- Howell, Michael. 1993. Southern pulpwood production, 1991. Resour. Bull. SE-137. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 25 p.
- Husch, Bertram; Miller, Charles I.; Beers, Thomas W. 1982. Forest mensuration. New York: John Wiley and Sons. 402 p.
- Hutchins, Cecil C., Jr. 1987. Southern pulpwood production, 1985. Resour. Bull. SE-94. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 28 p.
- Kelly, John F. 1993. Hurricane Andrew forest damage assessment. World Resource Review. 5(4): 401-408.
- 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. 11 p.
- Murphy, Paul A. 1975. Louisiana forests: status and outlook. Resour. Bull. SO-53. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 31 p.
- Rosson, James F., Jr. 1993. The woody biomass resource of Louisiana, 1991. Resour. Bull. SO-181. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 114 p.
- Rosson, James F., Jr. 1994a. Current stand characteristics of Louisiana timberland harvested between 1975 and 1991. Res. Pap. SO-279. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 22 p.
- Rosson, James F., Jr. 1994b. The status of precommercial-sized softwoods in Louisiana, 1991. Res. Pap. SO-278. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 24 p.
- Rosson, James F., Jr.; McWilliams, William H.; Frey, Paul D. 1988. Forest resources of Louisiana. Resour. Bull. SO-130. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 81 p.
- Rosson, James F., Jr.; Miller, Patrick E.; Vissage, John S. 1991a. Forest statistics for north delta Louisiana parishes—1991. Resour. Bull. SO-165. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 30 p.
- Rosson, James F., Jr.; Miller, Patrick E.; Vissage, John S. 1991b. Forest statistics for south delta Louisiana parishes—1991. Resour. Bull. SO-163. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 35 p.
- Rosson, James F., Jr.; Miller, Patrick E.; Vissage, John S. 1991c. Forest statistics for southeast Louisiana parishes—1991. Resour. Bull. SO-162. New Or-

- leans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 33 p.
- Rosson, James F., Jr.; Miller, Patrick E.; Vissage, John S. 1991d. Forest statistics for southwest Louisiana parishes—1991. Resour. Bull. SO-161. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 34 p.
- Rosson, James F., Jr.; Miller, Patrick E.; Vissage, John S. 1992. Forest statistics for northwest Louisiana parishes—1991. Resour. Bull. SO-167. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 34 p.
- Sternitzke, Herbert S. 1965. Louisiana forests. Resour. Bull. SO-7. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 31 p.
- U.S. Department of Agriculture, Forest Service. 1955. Forests of Louisiana, 1953-1954. Forest Survey Release-75. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 64 p.
- Van Deusen, Paul C.; Dell, Tom R.; Thomas, Charles E. 1986. Volume growth estimation from permanent horizontal points. *Forest Science*. 32(2): 415-422.
- Vissage, John S.; Miller, Patrick E.; Hartsell, Andrew J. 1992. Forest statistics for Louisiana parishes—1991. Resour. Bull. SO-168. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 65 p.
- Winters, Robert K.; Ward, George B., Jr.; Eldredge, Inman F. 1943. Louisiana forest resources and industries. Misc. Publ. 519. Washington, DC: U.S. Department of Agriculture. 44 p.

Appendix

INVENTORY METHODS

Forest resource statistics are obtained by a two-phase sampling method employing a forest-nonforest classification system using aerial photographs (to determine forest area) and on-the-ground measurements of trees at permanent sample locations (to determine tree and stand parameters). Inventory volume and area statistics are required to give precise estimates at the State level to 1 standard error of the total, equal to 1 percent per million acres of forest land and to 5 percent per billion cubic feet.

The estimate of timberland area is based on interpreting dot grid counts, overlaid on recent aerial photographs, as forest or nonforest. Each dot represents approximately 230 acres. This forest-nonforest estimate is then adjusted by ground truth checks at all permanent sample locations. Permanent sample locations consist of intensification plots (used only as ground truths for forest-nonforest classifications) and 3- by 3-mile plots (plots on a 3- by 3-mile square grid). The proportion of dots classified as forest is applied to U.S. Census land area data to develop an estimate of forest area in individual parishes. Appropriate expansion factors for each forested 3- by 3-mile plot are assigned. The expansion factor is dependent on the number of forested plots in a parish but averages 5,760 acres per plot for the State.

Each forested 3- by 3-mile sample plot consists of 10 satellite points spread over an area of approximately 1 acre (fig. 27). This design improves portrayal of stand conditions by eliminating the effect that vegetation clumping and open gaps would induce if only one point or a fixed plot were used at each location.

At each forested sample plot, trees ≥ 5.0 inches in d.b.h. are selected with a 37.5-factor prism at each of the 10 satellite points; each tree selected with the prism represents 3.75 ft²/acre of basal area. Trees ≤ 5.0 inches in d.b.h. are tallied on a 1/275-acre circular plot fixed around the first three satellite points (fig. 28).

Volumes in Louisiana are derived from deterministic measurements of trees on forested sample locations. These deterministic measurements include d.b.h., bark thickness, total height, bole length, log length, and four upper stem diameters. Smalian's formula is used to compute volume. In addition, volume equations are developed to estimate the volume for trees not surviving the measurement period or for past volumes of new sample trees.

Data collection at each forested location also includes estimates of site productivity, stand origin, slope, aspect, disturbance, management, and non-timber resources. Ownership information is obtained for each plot from parish tax assessors' records and contact with owners in the field. Additionally, personnel from public agencies and other contacts are con-

sulted when classifying absentee owners such as farmers, individuals, corporations, or lessors.

Components of inventory volume change (growth, removals, and mortality) are estimated from tally tree data on remeasured sample plots. The remeasurement of sample plots allows the history and volume change of each tally tree to be tracked over time. This information can then be used to assign tally tree volumes and changes in volume to one of nine components of change: survivor growth, nongrowth, ingrowth, on-growth, growth on removals, growth on mortality, mortality, timberland removals, and land clearing removals. These components can then be combined to estimate gross growth, net growth, and net change using a Beers and Miller (1964) approach, as modified by Van Deusen and others (1986) and demonstrated by May (1988).

The estimates of timberland area, volume, growth, removals, and mortality for Louisiana are based on the latest and most up-to-date inventory techniques available. There are important differences between the methods used in the 1984 and 1991 inventories. In many cases, improvements in methodology for deriving current estimates can raise concerns about trends between survey periods. Because these differences might appear to cloud the comparisons between 1984 and 1991 results, the major differences in procedures are documented below.

First, the 1984 inventory used 5 satellite points per plot; the 1991 inventory used 10 points. This change should affect comparisons of Louisiana totals very little, but caution should be used when analyzing smaller aggregations of data.

Second, the 1984 survey used regression equations to estimate volume. The coefficients were based on deterministic tree measurements from a small number of sample plots. Volumes for the 1991 survey were derived from deterministic measurements made on all trees ≥ 5.0 inches in d.b.h. on all plots.

Third, the classification of trees into growing-stock, rough, or rotten classes has been modified in two ways to ensure compatibility among the eastern Forest Inventory and Analysis units. (1) Currently, any tree that contains or is capable of producing one 12-ft or two 8-ft logs anywhere in the sawlog portion of the tree is classified as growing stock. The 1984 survey classified growing-stock trees as those that had or were capable of producing a 12-ft log only in the butt 16-ft section. (2) The 1984 survey required that over one-half of the sawlog volume (or prospective volume) had to be utilizable for the tree to be classified as growing stock. The current standard is that one-third of the sawlog volume in the sawlog portion of the tree has to be utilizable.

Using 5 or 10 satellite points per plot has little effect on volume totals because of the large sample size. Likewise, test runs comparing the results of volume

3-BY 3-MILE SAMPLE PLOT LAYOUT

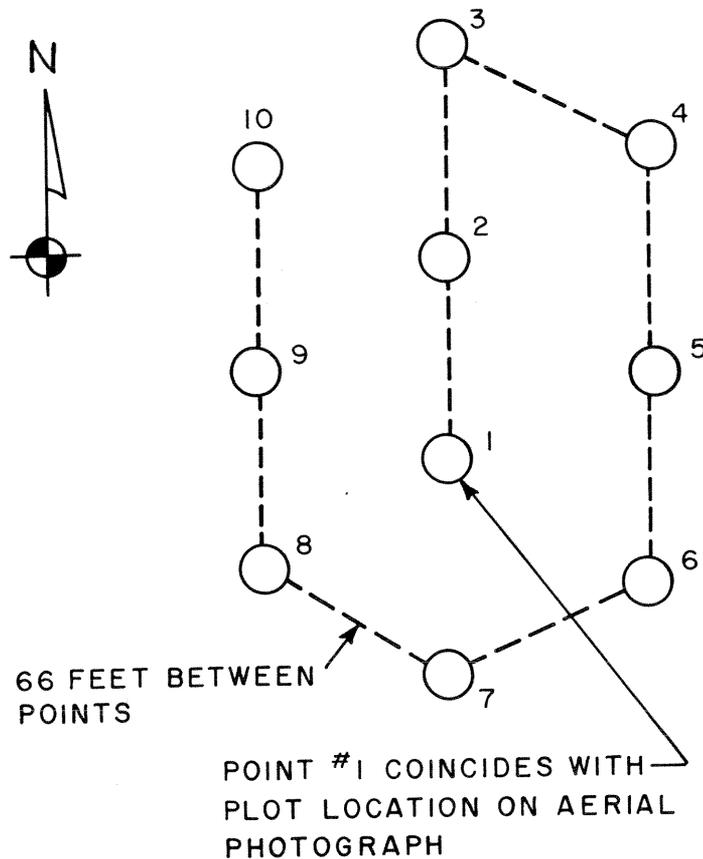


Figure 27. — Configuration of the 10 satellite points at a sample location, Louisiana, 1991.

equations and tree measurements have demonstrated very little difference between methods. Here again, the larger sample size enhances precision.

The first change in the growing-stock definition (that of the log position) did affect direct comparisons between 1984 and 1991 estimates. To compensate for this definition change, the 1984 inventory data were reprocessed to be compatible with the 1991 growing-stock standard. The total number of trees affected by the definition change is small, and most of these trees are hardwoods because of growth habit. It was not possible to consistently reclassify all trees selected in the 1984 survey by the new growing-stock definition. Some trees died or were cut between measurement periods. Since these trees are gone, the survey staff had no way of determining what the classification of these trees would be under the new standard. Therefore, trend information for growing-stock trees in these situations is uncertain.

Expanding the definition of growing stock to include trees with sawlog portions that are one-third sound had virtually no impact. Only a small number of saw-

timber sample trees had between 33 and 50 percent of their sawlog portions sound. Of these, most were reprocessed to resolve log position differences stated earlier. This step left only a very few trees that were affected by this definition change. Thus, the subsequent effect on estimation of growing-stock trends was small.

Users interested in trend analysis of growing-stock volume, growth, removals, and mortality between the 1984 and 1991 surveys should be aware of the impact of the growing-stock definition change. The incompatibility arises from trees that were cut or died, effecting growth, removals, and mortality estimates. The magnitude is, most likely, small but not possible to define with certainty.

Growing-stock comparisons between the 1984 reprocessed data and the 1991 data are valid for most general applications. In a more rigorous analysis, however, it is important to make sure the changes are real and not due to definition changes. In such instances, the comparisons between surveys should be done using all live trees. This procedure eliminates any uncer-

SATELLITE POINT LAYOUT

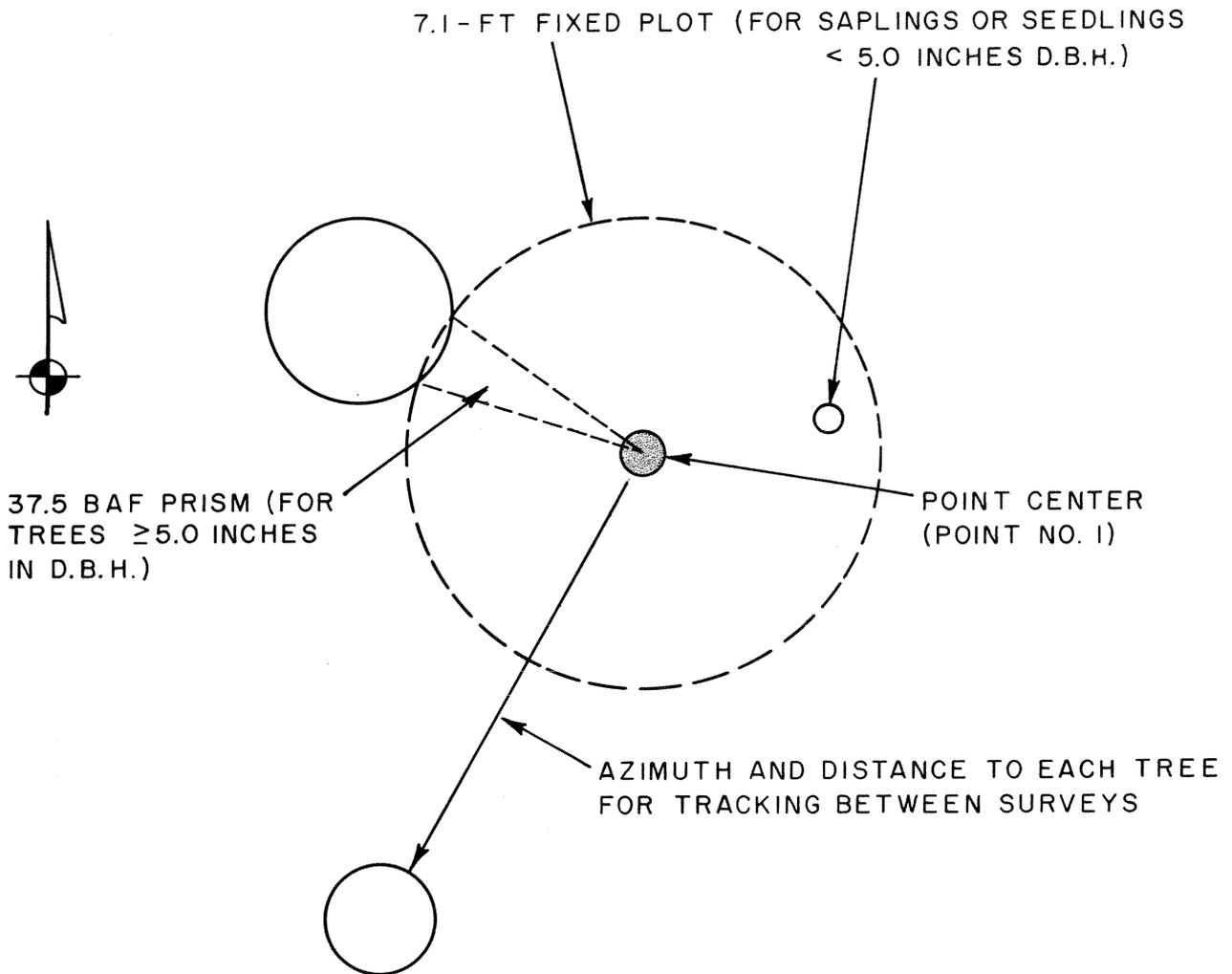


Figure 28. — Configuration of a satellite point, Louisiana, 1991.

tainties caused by the growing-stock definition changes. Finally, to further enhance trend analysis, a slight improvement in precision was made in the 1984 volume estimates by using all the deterministic tree measurements from the 1991 survey to develop new volume coefficients. Because of the change in the growing-stock standard and the improved volume coefficients, estimates for the reprocessed 1984 data may differ slightly from those previously published.

STATISTICAL RELIABILITY

A relative standard of accuracy has been incorporated into the forest survey. This standard satisfies

user demands, minimizes human and instrumental sources of error, and keeps costs within prescribed limits. The two primary types of error are measurement error and sampling error.

There are three elements of measurement error: (1) biased error, caused by instruments not properly calibrated; (2) compensating error, caused by instruments of moderate precision; and (3) accidental error, caused by human error in measuring and compiling. All of these are held to a minimum by a system that incorporates training, check plots, and editing and checking for consistency. Each new field person is trained for 3 to 4 months under the guidance of an experienced field person. Field work is checked by supervisors. Editing checks in the office screen out logical and

key punching errors for all plots. It is not possible to measure measurement error statistically, but SO-FIA holds it to a minimum through training, experienced supervision, and emphasis on careful work.

Sampling error is associated with the natural and expected deviation of the sample from the true population mean. This deviation is susceptible to a mathematical evaluation of the probability of error. Sampling errors for State totals in table XXXV are based on 1 standard error. 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 proportionally 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 XXXVI, which shows the sampling error to which the estimates are liable, two chances out of three.

Table XXXV.—Sampling errors for estimates of total timberland area ^{*}(1991), volume [†](1991), average net annual growth [‡](1984 to 1991), and average annual removals [‡](1984 to 1991), Louisiana

Item	Total	Units	Percent sampling error
Timberland area	13,783.0	Thousand acres	0.3
Live trees			
Volume	20,738.3	Million cubic feet	1.6
Average net annual growth	850.1	Million cubic feet	2.3
Average annual removals	954.7	Million cubic feet	3.9
Sawtimber			
Volume	75,525.2	Million board feet [‡]	2.0
Average net annual growth	3,731.3	Million board feet [‡]	2.5
Average annual removals	3,792.0	Million board feet [‡]	3.9

^{*}By binomial formula.

[†]By random sampling formula.

[‡]International 1/4-inch Rule.

Table XXXVI.—Sampling error to which estimates are liable, two chances out of three, Louisiana, 1991^{*}

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	1,240.5						
2.0	310.1	13,272.5			75,525.2		
3.0	137.8	5,898.9	499.7		33,566.8	2,591.2	
4.0	77.5	3,318.1	281.1	907.6	18,881.3	1,457.5	3,604.8
5.0	49.6	2,123.6	179.9	580.8	12,084.0	932.8	2,307.1
10.0	12.4	530.9	45.0	145.2	3,021.0	233.2	576.8
15.0	5.5	235.9	20.0	64.5	1,342.7	103.7	256.3
20.0	3.1	132.7	11.2	36.3	755.3	58.3	144.2
25.0	2.0	85.0	7.2	23.2	483.4	37.3	92.3

^{*}By binomial formula for timberland area and by random sampling formula for live-tree and sawtimber parameters.

[†]International 1/4-inch Rule.

Definition of Terms

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.

Dimension Classes of Trees

Poletimber trees—Trees 5.0 inches to 8.9 inches in diameter at breast height (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.

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

Seedlings—Trees < 1.0 inch in d.b.h. and > 1 foot tall for hardwoods, > 6 inches tall for softwoods, and > 0.5 inch in diameter at ground level for longleaf pine.

Forest Land Classes

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 uses. Minimum area considered for classification is 1 acre. Forest land is divided into timberland, reserved timberland, and woodland.

Reserved timberland—Public timberland withdrawn from timber utilization through statutes or administrative regulations.

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

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

Forest Type Groups

Elm-ash-cottonwood—Forests in which elms, ashes, or cottonwoods, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, American beech, and maples.

Loblolly-shortleaf pine—Forests in which pines (except longleaf and slash pines) and eastern redcedar, singly or in combination, comprise a plurality of the stocking. Common associates include oaks, hickories, and gums.

Longleaf-slash pine—Forests in which longleaf or slash pines, singly or in combination, comprise a plurality of the stocking. Common associates include other southern pines, oaks, and gums.

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

Oak-gum-cypress—Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, comprise a plurality of the stocking, except where pines comprise 25 to 49 percent, in which case the stand would be classified oak-pine. Common associates include cottonwoods, willow, ashes, elms, hackberries, and maples.

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

Oak-pine—Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking, but in which softwoods, except southern cypress, comprise 25 to 49 percent of the stocking. Common associates include gums, hickories, and yellow-poplar.

Growth Classes

Gross growth—Total increase in stand volume computed on growing-stock trees or live trees at least 5.0 inches in d.b.h. Gross growth equals survivor growth, plus ingrowth, plus growth on removals, plus growth on mortality, plus cull increment (for growing-stock computations). Gross growth includes mortality.

Net change—Increase or decrease in stand volume computed on growing-stock trees or live trees at least 5.0 inches in d.b.h. Net change is equal to net growth minus removals.

Net growth—Increase in stand volume computed on growing-stock trees or live trees at least 5.0 inches in d.b.h. Net growth is equal to gross growth minus mortality.

Miscellaneous Definitions

Average annual mortality—Average annual sound-wood volume of growing-stock or live trees that died from natural causes for the intersurvey period.

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 for the intersurvey period.

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

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 surveys.

D.b.h. (diameter at breast height)—Tree diameter in inches, outside bark, usually measured at 4.5 feet above ground.

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

D.o.b. (diameter outside bark)—Stem diameter including bark.

Log grades—A classification of logs based on external characteristics as indicators of quality or value.

Mortality—Number or sound-wood volume of growing-stock trees or live trees that died from natural causes during a specified period.

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

Plantations—Planted or artificially seeded stands.

Removals—The net 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.

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

Sawlog top—The point on 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 in d.o.b. for hardwoods.

Select red oaks—A group of several red oak species composed of cherrybark, Shumard, and northern red oaks. Other red oak species are included in the "other red oaks" group.

Select white oaks—A group of several white oak species composed of white, swamp chestnut, swamp white, chinkapin, Durand, and bur oaks. 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.

Tree grade—A classification of the sawlog portion of sawtimber trees based on: (1) the grade of the butt log or (2) the ability to produce at least one 12-foot or two 8-foot logs in the upper section of the sawlog portion.

Upper-stem portion—That part of the main stem of a sawtimber tree above the sawlog top to a d.o.b. of 4.0 inches or to the point where the main stem breaks into limbs.

Ownership Classes

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

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

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

Nonindustrial private forest land (corporate)—Land privately owned by corporations other than forest industries and incorporated farms.

Nonindustrial private forest land (individual)—Land privately owned by individuals other than forest industries or farmers.

Other Federal land—Federal land other than national forests.

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

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, with 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, with more than half of this stocking in saplings or seedlings.

Sawtimber stands—Stands at least 10 percent stocked with live trees, with 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 measurement of the extent to which the growth potential of the site is utilized by trees or

preempted by vegetative cover. Stocking is determined by comparing the stand density in terms of number of trees or basal area with a specified standard. Therefore, full stocking is 100 percent of the stocking standard.

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

D.b.h.	Trees per acre	D.b.h.	Trees per acre
<i>Inches</i>		<i>Inches</i>	
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

Stocking categories are arbitrarily defined as follows:

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

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

Understocked—Stands 0 to 60 percent stocked with growing-stock trees. 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 on the bole.

Tree Classes

Commercial species—Tree species currently or potentially suitable for industrial wood products.

Cull trees—Rough or rotten trees.

Growing-stock trees—Living trees of commercial species classified as sawtimber, poletimber, saplings, and seedlings. Trees must contain at least one 12-foot or two 8-foot logs in the sawlog portion, currently or potentially (if too small to qualify), to be classed as growing stock. The log(s) must meet dimension and merchantability standards to qualify. Trees must also have, currently or potentially, one-third of the gross board-foot volume in sound wood.

Hardwoods—Dicotyledonous trees, usually broad leaved and deciduous.

Live trees—All living trees. Included are all size classes, all tree classes, and both commercial and non-commercial species.

Noncommercial species—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Rotten trees—Live trees of commercial species that are unmerchantable for sawlogs, currently or potentially, because of rot deduction in the sawlog section. See growing-stock trees.

Rough trees—Live trees of commercial species that are unmerchantable for sawlogs, currently or potentially, because of roughness or poor form in the sawlog section. Also included are all live trees of noncommercial species. See growing-stock trees.

Salvable dead trees—Standing or downed dead trees that were formerly growing stock and are considered merchantable. Trees must be at least 5.0 inches in d.b.h. to qualify.

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

Volume

Volume of cull—The cubic-foot volume of sound wood in rough and rotten 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 the point where the central stem breaks into limbs.

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 the point where the central stem breaks into limbs.

Volume of live trees—The cubic-foot volume of sound wood in growing-stock, rough, and rotten 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 the point where the central stem breaks into limbs.

Volume of sawlog portion of sawtimber trees—The cubic-foot volume of sound wood in the sawlog portion of sawtimber trees. Volume is the net result after deductions for rot, sweep, and other defects that affect use for lumber.

Volume of sawtimber—The board-foot volume (International 1/4-inch Rule) of sound wood in the sawlog portion of sawtimber trees. Volume is the net result after deductions for rot, sweep, and other defects that affect use for lumber.

Volume of timber—The cubic-foot volume of sound wood in growing-stock, rough, rotten, and salvable dead 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 the point where the central stem breaks into limbs.

Species List

Scientific* and common names of tree species ≥ 1.0 inch in d.b.h. occurring in the SO-FIA sample, Louisiana, 1991:

Commercial Species

Scientific Name

Common Name

Softwoods

<i>Juniperus silicicola</i>	Southern redcedar
<i>J. virginiana</i>	Eastern redcedar
<i>Pinus echinata</i>	Shortleaf pine
<i>P. elliotii</i>	Slash pine
<i>P. glabra</i>	Spruce pine
<i>P. palustris</i>	Longleaf pine
<i>P. taeda</i>	Loblolly pine
<i>Taxodium distichum</i>	Baldcypress (may include some pondcypress)

Hardwoods

<i>Acer barbatum</i>	Florida maple
<i>A. negundo</i>	Boxelder
<i>A. rubrum</i>	Red maple
<i>A. saccharum</i>	Sugar maple
<i>Betula nigra</i>	River birch
<i>Carya</i> spp.	Hickories
<i>C. aquatica</i>	Water hickory
<i>C. illinoensis</i>	Pecan
<i>Catalpa</i> spp.	Catalpas
<i>Celtis laevigata</i>	Sugarberry
<i>C. occidentalis</i>	Hackberry
<i>Cornus florida</i>	Flowering dogwood
<i>Diospyros virginiana</i>	Common persimmon
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus americana</i>	White ash
<i>F. pennsylvanica</i>	Green ash
<i>Gleditsia aquatica</i>	Waterlocust
<i>G. triacanthos</i>	Honeylocust
<i>Ilex opaca</i>	American holly
<i>Juglans cinerea</i>	Butternut
<i>J. nigra</i>	Black walnut
<i>Liquidambar styraciflua</i>	Sweetgum
<i>Liriodendron tulipifera</i>	Yellow-poplar
<i>Maclura pomifera</i>	Osage-orange
<i>Magnolia acuminata</i>	Cucumbertree
<i>M. grandiflora</i>	Southern magnolia
<i>M. virginiana</i>	Sweetbay
<i>Morus rubra</i>	Red mulberry
<i>Nyssa aquatica</i>	Water tupelo

<i>N. sylvatica</i>	Blackgum
<i>N. sylvatica</i> var. <i>biflora</i>	Swamp tupelo
<i>Persea borbonia</i>	Redbay
<i>Platanus occidentalis</i>	American sycamore
<i>Populus deltoides</i>	Eastern cottonwood
<i>Prunus serotina</i>	Black cherry
<i>Quercus alba</i>	White oak
<i>Q. bicolor</i>	Swamp white oak
<i>Q. coccinea</i>	Scarlet oak
<i>Q. durandii</i>	Durand oak
<i>Q. falcata</i>	Southern red oak
<i>Q. falcata</i> var. <i>pagodifolia</i>	Cherrybark oak
<i>Q. laurifolia</i>	Laurel oak
<i>Q. lyrata</i>	Overcup oak
<i>Q. michauxii</i>	Swamp chestnut oak
<i>Q. muehlenbergii</i>	Chinkapin oak
<i>Q. nigra</i>	Water oak
<i>Q. nuttallii</i>	Nuttall oak
<i>Q. palustris</i>	Pin oak
<i>Q. phellos</i>	Willow oak
<i>Q. prinus</i>	Chestnut oak
<i>Q. rubra</i>	Northern red oak
<i>Q. shumardii</i>	Shumard oak
<i>Q. stellata</i>	Post oak
<i>Q. stellata</i> var. <i>paludosa</i>	Delta post oak
<i>Q. velutina</i>	Black oak
<i>Robinia pseudoacacia</i>	Black locust
<i>Salix nigra</i>	Black willow
<i>Sassafras albidum</i>	Sassafras
<i>Tilia americana</i>	American basswood
<i>T. heterophylla</i>	White basswood
<i>Ulmus alata</i>	Winged elm
<i>U. americana</i>	American elm
<i>U. crassifolia</i>	Cedar elm
<i>U. rubra</i>	Slippery elm
<i>U. serotina</i>	September elm

Noncommercial Species

<i>Aleurites fordii</i>	Tung-oil-tree
<i>Amelanchier</i> spp.	Serviceberry

Bumelia spp.
Carpinus caroliniana
Castanea spp.
Cercis canadensis
Crataegus spp.
Magnolia macrophylla
Malus spp.
Melia azedarach
Morus alba
Ostrya virginiana

Oxydendrum arboreum
Paulownia tomentosa
Planera aquatica

Bumelias
American hornbeam
Chinkapins
Eastern redbud
Hawthorns
Bigleaf magnolia
Apples
Chinaberry
White mulberry
Eastern
hophornbeam
Sourwood
Royal paulownia
Water-elm

Prunus spp.

Quercus incana
Q. laevis
Q. marilandica
Q. virginiana
Sapium sebiferum
Vaccinium arboreum

Plums, cherries
(other than black
cherry)
Bluejack oak
Turkey oak
Blackjack oak
Live oak
Chinese tallowtree
Sparkleberry

*Nomenclature after: Little, Elbert L., Jr. 1979.
Checklist of United States trees (native and natural-
ized). Agric. Handb. 541. Washington, DC: U.S. De-
partment of Agriculture. 375 p.

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Table 1. — Area by land class, Louisiana, 1991

Land class	Area
	<i>Thousand acres</i>
Forest	
Commercial	
Timberland	13,783.0
Deferred timberland	0.0
Noncommercial	
Productive-reserved	8.7
Unproductive	0.00
Total forest	<u>13,791.7</u>
Nonforest	
Cropland*	5,488.7
Other	6,985.0
Total nonforest	<u>12,473.7</u>
All land†	<u>26,265.4</u>

*U.S. Department of Commerce, Bureau of the Census, 1987 Census of agriculture: State and county data, issued 1989. Vol. 1.

†United States Department of Commerce, Bureau of the Census, 1980 (issued October 1981). The following parishes, totaling 3,047.1 thousand acres of total land, were not included in the sixth Louisiana forest survey because of the infrequent occurrence of timberland: Cameron, Jefferson, Orleans, Plaquemines, and St. Bernard. Forest and nonforest estimates do not include these parishes.

Table 2. — Area of timberland by ownership class, Louisiana, 1991*

Ownership class	Area
	<i>Thousand acres</i>
Public	
National forest	568.5
Other Federal	230.2
State	300.2
Parish	207.4
Total public	<u>1,306.3</u>
Private	
Forest industry	3,898.3
Farmer	739.6
Miscellaneous private	
Individual	5,789.2
Corporate	2,049.7
Total private	<u>12,476.7</u>
All ownership	<u>13,783.0</u>

*Numbers in column may not sum to totals due to rounding.

Table 3.—Area of timberland by stand size and ownership class, Louisiana, 1991*

Stand size class	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
	<i>Thousand acres</i>					
Sawtimber	8,148.1	400.1	597.9	1,799.8	449.2	4,901.2
Poletimber stands	2,161.5	36.7	58.3	845.8	154.2	1,066.5
Sapling and seedling	3,403.4	131.7	81.6	1,242.5	136.2	1,811.4
Nonstocked areas	70.0	0.0	0.0	10.2	0.0	59.8
All classes	13,783.0	568.5	737.8	3,898.3	739.6	7,838.9

*Numbers in rows and columns may not sum to totals due to rounding.

Table 4.—Area of timberland by stand volume and ownership class, Louisiana, 1991*

Stand volume per acre	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
<i>Board feet</i> [†]	----- <i>Thousand acres</i> -----					
Less than 1,500	4,116.3	111.2	128.1	1,532.9	201.0	2,143.1
1,500 to 5,000	3,623.8	90.1	219.1	986.7	257.8	2,070.0
More than 5,000	6,043.0	367.2	390.7	1,378.7	280.7	3,625.8
All classes	13,783.0	568.5	737.8	3,898.3	739.6	7,838.9

*Numbers in rows and columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.

Table 5. — Area of timberland by percent growing-stock trees and cull trees, Louisiana, 1991*

Growing stock trees	Cull trees (Percent stocking)							
	Total	0-10	10-20	20-30	30-40	40-50	50-60	60+
<i>Percent stocking</i>	----- <i>Thousand acres</i> -----							
0-10	156.9	58.8	28.8	6.7	16.5	5.4	6.9	33.8
10-20	152.1	33.0	32.6	17.2	23.2	24.0	0.0	22.0
20-30	220.4	46.0	46.1	17.3	34.6	27.4	22.3	26.8
30-40	373.5	40.9	62.0	72.5	52.4	53.7	32.9	59.0
40-50	741.7	132.4	110.8	129.5	88.1	154.5	73.5	52.8
50-60	1,033.2	142.1	112.5	158.3	313.2	212.5	54.2	40.4
60-70	1,212.6	232.7	252.6	233.7	218.4	137.9	116.4	20.9
70-80	1,714.4	347.1	453.9	450.0	331.1	114.8	12.1	5.2
80-90	1,869.4	444.9	546.1	433.8	284.0	120.7	39.8	0.0
90-100	1,995.0	656.1	650.7	469.3	176.4	36.9	5.5	0.0
100-110	1,562.2	642.5	523.1	252.8	108.7	23.6	11.6	0.0
110-120	1,192.3	726.1	302.6	129.3	15.7	18.7	0.0	0.0
120-130	816.3	623.0	145.5	47.7	0.0	0.0	0.0	0.0
130-140	501.4	376.2	90.5	34.7	0.0	0.0	0.0	0.0
140-150	165.8	142.4	23.5	0.0	0.0	0.0	0.0	0.0
150-160	45.9	45.9	0.0	0.0	0.0	0.0	0.0	0.0
160+	29.8	29.8	0.0	0.0	0.0	0.0	0.0	0.0
Total	13,783.0	4,719.9	3,381.4	2,452.8	1,662.5	930.2	375.2	261.1

*Numbers in 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, Louisiana, 1991*

Ownership and tree class	Softwood				Hardwood		
	All species	Sapling and seedling	Poletimber	Sawtimber	Sapling and seedling	Poletimber	Sawtimber
----- Square feet per acre -----							
National Forest							
Growing stock	75.0	6.5	6.1	36.4	3.6	7.6	15.0
Rough and rotten	12.0	0.6	0.2	0.3	4.3	3.3	3.4
Total	87.1	7.0	6.3	36.6	7.8	10.9	18.4
Other public							
Growing stock	66.6	1.8	3.7	14.6	2.8	11.0	32.8
Rough and rotten	21.2	0.4	0.2	0.9	5.3	5.3	9.0
Total	87.7	2.2	3.9	15.4	8.1	16.3	41.8
Forest industry							
Growing stock	64.4	7.2	12.5	19.9	3.9	8.0	13.1
Rough and rotten	13.2	0.9	0.4	0.4	5.1	2.8	3.6
Total	77.6	8.1	12.9	20.2	8.9	10.8	16.7
Farmer							
Growing stock	62.6	1.0	3.8	14.2	3.1	15.2	25.4
Rough and rotten	20.0	0.5	0.3	1.2	5.7	4.7	7.6
Total	82.6	1.5	4.0	15.3	8.7	19.9	33.0
Miscellaneous private							
Growing stock	70.0	2.7	6.1	22.3	4.8	12.6	21.5
Rough and rotten	19.2	0.5	0.4	0.8	6.0	4.3	7.2
Total	89.1	3.2	6.4	23.1	10.8	16.9	28.7
All owners							
Growing stock	68.0	4.0	7.6	21.4	4.3	11.1	19.7
Rough and rotten	17.3	0.6	0.4	0.7	5.6	3.9	6.1
Total	85.4	4.6	8.0	22.0	9.9	15.1	25.8

*Numbers in rows and columns may not sum to totals due to rounding.

Table 7.—Area of timberland by site and ownership class, Louisiana, 1991*

Site class	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
----- Thousand acres -----						
≥165 ft ³	2,073.0	101.0	109.1	559.6	126.4	1,176.9
120 to 165 ft ³	4,328.6	186.6	138.2	1,319.7	254.7	2,429.3
85 to 120 ft ³	4,522.8	203.0	265.7	1,427.8	224.8	2,401.4
50 to 85 ft ³	2,559.3	73.9	199.4	543.1	122.3	1,620.6
<50 ft ³	299.4	3.9	25.3	48.1	11.3	210.7
All classes	13,783.0	568.5	737.8	3,898.3	739.6	7,838.9

*Numbers in rows and columns may not sum to totals due to rounding.

Table 8.—Area of timberland by forest type group and ownership class, Louisiana, 1991*

Forest type group	All ownerships	National forest	Other public	Forest industry	Farmer	Miscellaneous private
	----- <i>Thousand acres</i> -----					
Longleaf-slash pine	869.7	108.7	18.4	338.8	11.1	392.6
Loblolly-shortleaf pine	4,153.6	219.2	155.4	1,726.0	127.1	1,925.9
Oak-pine	1,886.6	115.6	40.8	532.0	83.3	1,114.9
Oak-hickory	2,107.2	78.5	58.3	584.1	147.6	1,238.7
Oak-gum-cypress	4,349.9	46.5	411.4	671.1	345.5	2,875.4
Elm-ash-cottonwood	401.3	0.0	53.6	46.2	25.0	276.5
Nontyped	14.9	0.0	0.0	0.0	0.0	14.9
All types	13,783.0	568.5	737.8	3,898.3	739.6	7,838.9

*Numbers in rows and columns may not sum to totals due to rounding.

Table 9. — Area of noncommercial forest land by forest type group, Louisiana, 1991

Forest type group	All areas	Productive reserved areas	Unproductive areas
	----- <i>Thousand acres</i> -----		
Longleaf-slash pine	0.0	0.0	0.0
Loblolly-shortleaf pine	8.7	8.7	0.0
Softwood total	8.7	8.7	0.0
Oak-pine	0.0	0.0	0.0
Oak-hickory	0.0	0.0	0.0
Oak-gum-cypress	0.0	0.0	0.0
Elm-ash-cottonwood	0.0	0.0	0.0
Hardwood total	0.0	0.0	0.0
All types	8.7	8.7	0.0

Table 10. — Number of growing-stock trees on timberland by species and diameter class, Louisiana, 1991*

Species	Diameter class (Inches at breast height)										
	All classes	5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	≥29.0
	----- Thousand trees -----										
Longleaf pine	25,111	4,311	5,196	5,609	4,262	2,406	1,821	818	460	228	0
Slash pine	68,115	21,233	16,724	14,410	9,707	3,895	1,479	529	104	35	0
Shortleaf pine	51,160	12,257	12,157	10,009	8,188	4,615	2,353	1,030	308	242	0
Loblolly pine	492,280	193,813	119,405	63,445	43,141	29,539	19,128	11,513	6,061	5,907	327
Spruce pine	2,898	429	377	576	383	328	282	207	141	166	9
Redcedar	946	590	89	165	66	25	0	11	0	0	0
Cypress	73,453	14,730	15,276	8,796	9,161	8,043	6,837	4,812	2,494	3,000	305
Total softwoods	713,963	247,363	169,225	103,010	74,908	48,850	31,900	18,920	9,567	9,578	642
Select white oaks [†]	28,398	9,772	5,291	4,576	2,957	1,850	1,391	1,029	540	882	110
Select red oaks [‡]	16,314	3,552	3,187	2,788	1,618	1,174	1,252	786	733	1,036	190
Other white oaks	33,932	10,305	7,565	5,204	3,248	2,470	1,608	1,246	768	1,311	205
Other red oaks	111,633	28,775	23,389	17,368	11,592	9,755	6,486	4,817	3,163	5,270	1,018
Sweet pecan	3,599	643	922	552	337	260	273	193	145	204	70
Water hickory	17,048	4,640	3,204	3,152	1,723	1,319	1,190	701	472	555	92
Other hickories	15,749	4,621	3,556	3,076	1,176	1,408	776	513	294	315	15
Persimmon	3,085	1,806	785	419	54	21	0	0	0	0	0
Hard maples	957	526	304	0	61	19	34	0	0	14	0
Soft maples	37,262	19,710	9,461	4,119	1,639	1,043	614	240	237	187	12
Boxelder	7,458	2,597	2,406	1,285	674	202	196	88	10	0	0
Beech	5,084	744	258	913	494	487	634	468	277	735	73
Sweetgum	148,070	61,811	32,032	22,449	11,347	8,473	5,001	3,126	1,780	1,914	137
Blackgum	36,898	15,880	9,950	4,675	2,315	1,928	1,135	602	226	182	5
Other gums/tupelos	64,308	13,987	14,444	15,128	6,990	6,365	3,821	1,939	720	843	71
White ash	2,366	839	732	115	236	154	138	82	30	31	9
Other ashes	32,597	11,026	7,754	4,796	2,451	1,924	1,619	1,111	816	1,005	93
Sycamore	6,337	2,132	1,385	824	758	618	174	154	135	155	2
Cottonwood	5,014	1,121	627	672	690	508	338	396	263	326	73
Basswood	559	265	110	0	121	32	0	13	10	0	8
Yellow-poplar	2,785	618	444	434	261	275	316	117	131	166	22
Magnolia	1,355	262	193	90	167	259	174	58	39	102	12
Sweetbay	6,873	2,971	1,364	1,178	481	485	200	82	40	72	0
Willow	18,940	4,600	3,594	2,339	2,585	1,486	1,593	803	679	1,139	120
Black walnut	227	114	72	0	0	23	18	0	0	0	0
Black cherry	2,409	1,051	694	289	145	80	108	41	0	0	0
American elm	13,967	4,977	3,499	1,530	1,474	809	616	442	278	306	37
Other elms	17,052	7,369	4,005	2,875	1,227	667	333	281	101	189	4
River birch	988	427	281	87	120	38	18	0	0	17	0
Hackberry	25,709	6,502	7,075	4,204	2,509	1,806	1,325	1,091	595	551	51
Black locust	271	178	83	0	0	0	0	0	0	10	0
Other locusts	4,337	1,397	872	837	429	339	278	55	66	55	10
Sassafras	1,194	643	339	85	84	0	67	11	9	7	0
Dogwood	2,247	2,093	122	32	0	0	0	0	0	0	0
Holly	3,705	2,671	698	255	28	21	19	15	0	0	0
Other commercial	1,718	1,160	289	128	84	48	0	0	9	0	0
Total hardwoods	680,445	231,784	150,984	106,475	60,076	46,346	31,698	20,502	12,568	17,577	2,436
All species	1,394,408	479,147	320,209	209,485	134,984	95,195	63,598	39,442	22,136	27,155	3,078

*Numbers in 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 softwoods and hardwoods, Louisiana, 1991**

Class of timber	All species	Softwood	Hardwood
----- Million cubic feet -----			
Sawtimber trees:			
Sawlog portion	12,622.2	7,393.2	5,229.0
Upper-stem portion	2,036.8	916.7	1,120.1
Total	14,659.0	8,309.9	6,349.1
Poletimber trees	4,185.5	1,618.2	2,567.3
All growing stock	18,844.4	9,928.1	8,916.3
Rough trees	1,600.5	159.2	1,441.4
Rotten trees	293.5	35.1	258.4
Salvable dead trees	33.2	14.8	18.4
All timber	20,771.7	10,137.1	10,634.6

*Numbers in 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 softwoods and hardwoods, Louisiana, 1991**

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
----- Million cubic feet -----				----- Million board feet [†] -----		
National forest	1,024.2	731.6	292.6	5,191.0	4,030.6	1,160.4
Other public	1,025.8	351.4	674.4	4,408.3	1,732.3	2,676.0
Forest industry	4,633.1	2,855.1	1,778.0	17,561.5	11,423.8	6,137.8
Farmer	976.1	344.6	631.4	3,725.2	1,638.2	2,086.9
Miscellaneous private	11,185.2	5,645.3	5,539.9	44,639.7	26,119.3	18,520.4
All ownerships	18,844.4	9,928.1	8,916.3	75,525.6	44,944.2	30,581.4

*Numbers in rows and columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.

Table 13. — Volume of growing stock on timberland by species and diameter class, Louisiana, 1991*

Species	Diameter class (Inches at breast height)										
	All classes	5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	≥29.0
	----- Million cubic feet -----										
Longleaf pine	436.8	11.6	35.8	74.7	86.6	68.3	71.6	39.6	31.2	17.5	0.0
Slash pine	790.3	48.6	111.3	191.5	206.3	124.7	66.0	30.2	7.9	3.8	0.0
Shortleaf pine	838.3	37.7	89.4	148.0	191.3	155.9	107.4	62.6	21.7	24.5	0.0
Loblolly pine	6,268.7	459.2	700.0	784.9	886.3	903.4	801.2	639.5	427.8	607.1	59.3
Spruce pine	92.0	1.0	2.6	8.1	9.2	11.6	13.7	13.6	12.0	18.4	1.8
Redcedar	4.5	1.3	0.3	1.3	0.9	0.4	0.0	0.2	0.0	0.0	0.0
Cypress	1,497.5	33.4	86.0	103.2	162.3	213.5	251.6	227.8	142.4	235.6	41.7
Total softwoods	9,928.1	592.7	1,025.5	1,311.9	1,542.9	1,477.8	1,311.2	1,013.6	642.8	906.8	102.8
Select white oaks [†]	411.5	25.0	32.5	49.5	54.8	48.6	47.0	46.2	30.0	63.0	14.9
Select red oaks [‡]	364.6	8.6	20.1	32.0	30.3	33.2	46.5	37.9	41.5	86.7	27.8
Other white oaks	449.7	24.7	40.0	49.3	48.7	52.7	44.7	43.8	36.7	84.3	24.9
Other red oaks	1,989.7	78.4	141.5	192.5	204.0	248.5	213.5	207.7	169.2	396.5	137.9
Sweet pecan	83.2	1.3	5.5	6.5	5.8	6.4	9.6	8.9	8.6	18.4	12.1
Water hickory	266.4	12.3	17.1	32.0	27.7	30.8	36.8	29.1	25.2	39.4	16.1
Other hickories	213.1	9.7	19.9	31.9	22.3	35.7	25.8	23.1	16.6	25.3	2.9
Persimmon	13.2	4.2	4.1	3.6	0.9	0.4	0.0	0.0	0.0	0.0	0.0
Hard maples	6.9	2.0	1.4	0.0	1.0	0.4	1.2	0.0	0.0	0.8	0.0
Soft maples	243.6	52.1	55.0	40.2	25.7	22.1	16.7	8.3	11.4	10.9	1.3
Boxelder	59.9	7.4	14.0	13.9	11.4	4.3	5.4	3.0	0.4	0.0	0.0
Beech	148.8	1.9	1.5	9.2	8.1	10.9	20.5	19.2	15.4	53.4	8.7
Sweetgum	1,664.2	141.0	188.0	252.4	220.1	237.3	191.3	151.9	105.6	160.4	16.3
Blackgum	304.7	35.9	51.5	46.7	40.2	45.5	36.5	25.9	11.1	11.1	0.4
Other gums/tupelos	785.0	33.0	78.1	153.2	112.1	142.3	108.3	73.7	31.2	46.1	7.0
White ash	29.2	2.6	5.2	1.3	4.2	3.4	4.8	3.8	1.7	1.8	0.6
Other ashes	396.7	28.2	46.8	49.7	39.3	43.7	47.7	39.7	36.6	57.5	7.4
Sycamore	99.1	6.4	10.7	11.5	16.0	18.0	7.1	7.8	8.6	12.2	0.8
Cottonwood	131.6	2.5	2.5	7.8	13.7	14.3	12.6	19.5	16.7	30.4	11.5
Basswood	5.9	0.8	0.6	0.0	2.0	0.9	0.0	0.6	0.3	0.0	0.7
Yellow-poplar	61.9	1.7	2.3	5.1	5.0	6.5	10.2	5.9	8.1	13.9	3.3
Magnolia	28.6	0.5	1.2	0.9	2.9	5.4	5.6	2.2	2.3	6.6	1.1
Sweetbay	63.4	8.7	7.8	13.0	8.5	11.0	5.8	3.0	1.6	4.0	0.0
Willow	347.5	12.5	19.6	22.9	42.6	36.2	50.4	32.7	32.8	84.7	13.1
Black walnut	1.9	0.3	0.3	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0
Black cherry	19.5	2.7	3.8	3.1	2.6	2.0	4.1	1.4	0.0	0.0	0.0
American elm	157.2	11.8	19.0	14.4	24.1	17.1	17.3	17.5	13.2	18.9	3.9
Other elms	152.2	17.0	24.0	29.7	20.8	16.2	11.3	12.3	5.0	15.0	0.9
River birch	7.5	1.2	1.5	0.8	1.6	0.9	0.7	0.0	0.0	0.9	0.0
Hackberry	326.4	17.1	40.0	44.1	40.1	41.0	37.7	41.0	26.6	34.1	4.6
Black locust	1.7	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Other locusts	48.8	3.8	5.0	7.4	7.0	6.4	8.7	1.6	3.7	4.4	0.8
Sassafras	6.8	1.2	2.3	0.5	1.0	0.0	0.6	0.5	0.4	0.4	0.0
Dogwood	4.9	4.1	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holly	12.9	6.4	3.2	1.8	0.4	0.4	0.6	0.2	0.0	0.0	0.0
Other commercial	8.1	3.0	1.3	1.0	1.6	1.0	0.0	0.0	0.3	0.0	0.0
Total hardwoods	8,916.3	570.8	868.3	1,128.2	1,046.3	1,143.7	1,029.6	868.6	660.8	1,281.4	318.6
All species	18,844.4	1,163.5	1,893.7	2,440.1	2,589.2	2,621.6	2,340.8	1,882.2	1,303.7	2,188.2	421.4

*Numbers in 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, Louisiana, 1991*

Species	Diameter class (Inches at breast height)								
	All classes	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	≥29.0
	----- Million board feet [†] -----								
Longleaf pine	2,071.8	338.1	446.7	373.8	401.0	221.0	187.1	104.1	0.0
Slash pine	3,365.3	850.9	1,107.4	730.4	411.7	189.4	51.0	24.6	0.0
Shortleaf pine	4,060.8	715.1	1,082.4	935.7	656.2	385.2	136.6	149.6	0.0
Loblolly pine	28,292.3	3,355.4	4,637.3	5,110.3	4,672.7	3,804.1	2,592.1	3,751.9	368.4
Spruce pine	522.1	34.5	52.0	69.3	81.7	87.3	74.3	110.9	12.2
Redcedar	12.2	4.6	4.0	2.0	0.0	1.6	0.0	0.0	0.0
Cypress	6,619.7	330.0	675.2	1,006.9	1,270.3	1,171.1	733.3	1,223.9	209.1
Total softwoods	44,944.2	5,628.6	8,005.0	8,228.4	7,493.6	5,859.6	3,774.3	5,365.0	589.8
Select white oaks [‡]	1,517.7	0.0	233.6	244.9	233.6	242.6	159.3	338.5	85.3
Select red oaks [§]	1,568.4	0.0	118.6	159.8	228.6	201.7	220.4	485.7	153.5
Other white oaks	1,666.9	0.0	203.4	244.6	216.2	221.9	193.1	446.1	141.6
Other red oaks	7,893.5	0.0	818.6	1,185.9	1,067.3	1,071.3	891.4	2,127.7	731.3
Sweet pecan	355.4	0.0	25.5	30.2	45.5	44.5	42.9	99.3	67.5
Water hickory	1,001.5	0.0	112.7	138.1	183.2	142.6	131.3	205.4	88.2
Other hickories	764.4	0.0	96.7	171.1	127.9	122.6	89.5	138.5	18.1
Persimmon	5.3	0.0	3.8	1.5	0.0	0.0	0.0	0.0	0.0
Hard maples	18.9	0.0	4.9	1.4	7.7	0.0	0.0	4.9	0.0
Soft maples	414.2	0.0	97.6	94.3	69.0	42.0	54.2	51.0	6.1
Boxelder	100.6	0.0	43.9	16.6	25.5	13.3	1.5	0.0	0.0
Beech	723.6	0.0	35.2	54.0	106.8	104.9	83.6	289.7	49.6
Sweetgum	5,300.7	0.0	863.7	1,137.6	955.7	813.6	567.0	881.2	81.9
Blackgum	775.6	0.0	150.6	200.9	178.0	129.9	57.7	57.5	0.9
Other gums/tupelos	2,116.6	0.0	357.8	551.5	465.0	353.4	146.8	210.6	31.3
White ash	99.3	0.0	16.5	15.2	26.1	21.2	8.2	10.0	2.1
Other ashes	1,196.2	0.0	141.9	181.9	212.0	188.1	172.8	267.3	32.2
Sycamore	335.8	0.0	66.4	83.2	38.5	38.9	43.7	60.9	4.3
Cottonwood	601.9	0.0	53.6	66.6	63.0	97.4	91.9	168.5	61.0
Basswood	18.4	0.0	6.9	3.5	0.0	3.2	0.9	0.0	3.8
Yellow-poplar	263.5	0.0	20.4	27.0	48.8	32.5	43.4	74.7	16.7
Magnolia	125.9	0.0	11.8	22.9	29.3	11.7	12.5	35.0	2.8
Sweetbay	151.2	0.0	36.5	46.2	27.9	15.2	6.6	18.7	0.0
Willow	1,370.4	0.0	152.8	161.0	237.6	161.0	161.5	437.1	59.4
Black walnut	6.6	0.0	0.0	2.7	4.0	0.0	0.0	0.0	0.0
Black cherry	47.7	0.0	10.9	8.2	22.3	6.4	0.0	0.0	0.0
American elm	519.7	0.0	97.6	77.9	79.5	85.2	64.5	95.5	19.4
Other elms	397.3	0.0	90.1	79.5	57.6	62.8	24.8	77.9	4.6
River birch	20.6	0.0	7.3	4.6	4.2	0.0	0.0	4.5	0.0
Hackberry	1,016.4	0.0	153.7	176.7	171.5	196.4	126.4	172.1	19.5
Black locust	2.9	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0
Other locusts	152.2	0.0	28.7	28.2	41.9	8.5	20.2	22.3	2.5
Sassafras	13.9	0.0	4.0	0.0	3.0	2.6	2.3	2.0	0.0
Holly	7.1	0.0	1.6	1.9	3.0	0.7	0.0	0.0	0.0
Other commercial	11.0	0.0	6.0	3.3	0.0	0.0	1.7	0.0	0.0
Total hardwoods	30,581.4	0.0	4,073.1	5,202.9	4,980.1	4,436.1	3,420.1	6,785.6	1,683.5
All species	75,525.6	5,628.6	12,078.1	13,431.3	12,473.7	10,295.6	7,194.4	12,150.6	2,273.3

*Numbers in rows and columns may not sum to totals due to rounding.

[†]International 1/4-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, Louisiana, 1991*

Species	All grades	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
	----- Million board feet [†] -----					
Yellow pines	38,312.3	6,893.0	6,789.9	24,001.1	0.0	628.3
Cypress	6,619.7	1,892.3	1,793.0	2,646.7	0.0	287.7
Redcedar	12.2	6.6	0.0	2.0	0.0	3.6
Total softwoods	44,944.2	8,791.9	8,582.9	26,649.8	0.0	919.6
Select white and red oaks [‡]	3,086.1	583.8	734.3	1,189.6	392.4	186.0
Other white and red oaks	9,560.4	1,125.8	1,668.0	4,021.7	2,071.9	673.0
Hickories	2,121.3	273.3	428.6	914.9	358.0	146.5
Hard maples	18.9	0.0	7.7	4.4	5.7	1.1
Sweetgum	5,300.7	731.8	1,314.5	2,324.9	514.0	415.5
Tupelo and blackgum	2,892.2	305.3	708.3	1,426.2	206.3	246.0
Ash, walnut, and black cherry	1,349.9	272.1	343.9	560.6	47.0	126.4
Yellow-poplar	263.5	45.8	43.9	129.6	29.2	15.1
Other hardwoods	5,988.6	612.9	792.4	2,861.4	981.6	740.4
Total hardwoods	30,581.4	3,950.8	6,041.5	13,433.2	4,605.9	2,549.9
All species	75,525.6	12,742.7	14,624.4	40,083.0	4,605.9	3,469.5

*Numbers in rows and columns may not sum to totals due to rounding.

[†]International 1/4-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, Louisiana, 1984 to 1991*

Species	Average net annual growth	Average annual removals
	----- Million cubic feet -----	
Yellow pines	502.7	655.3
Other softwoods	23.8	6.7
Total softwoods	526.6	662.0
Select white and red oaks [†]	35.2	25.2
Other white and red oaks	98.9	87.2
Hickories	13.6	14.8
Hard maples	0.4	0.1
Sweetgum	59.0	64.1
Tupelo and blackgum	14.4	13.4
Ash, walnut and black cherry	14.3	9.4
Yellow-poplar	3.7	1.6
Other hardwoods	68.5	47.4
Total hardwoods	308.1	263.7
All species	834.7	925.8

*Numbers in 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 softwoods and hardwoods, Louisiana, 1984 to 1991**

Ownership class	Average net annual growth			Average annual removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
----- Million cubic feet -----						
National forest	27.3	21.0	6.3	28.6	25.1	3.4
Other public	32.4	11.8	20.6	14.5	9.1	5.7
Forest industry	280.0	210.2	69.7	347.6	263.6	83.8
Farmer	42.4	12.6	29.8	44.7	24.3	20.6
Miscellaneous private	452.6	270.9	181.7	490.3	339.8	150.3
All ownerships	834.7	526.6	308.1	925.8	662.0	263.7

*Numbers in 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, Louisiana, 1984 to 1991**

Species	Average net annual growth	Average annual removals
----- Million board feet [†] -----		
Yellow pines	2,437.2	2,899.6
Cypress	126.4	29.9
Redcedar	0.9	0.0
Total softwoods	2,564.4	2,929.5
Select white and red oaks [‡]	151.5	89.2
Other white and red oaks	408.0	304.7
Hickories	46.5	47.7
Hard maples	-0.2	0.5
Sweetgum	203.1	160.5
Tupelo and blackgum	58.0	47.9
Ash, walnut, and black cherry	49.7	32.6
Yellow-poplar	18.1	6.7
Other hardwoods	231.8	172.6
Total hardwoods	1,166.5	862.4
All species	3,731.0	3,792.0

*Numbers in columns may not sum to totals due to rounding.

[†]International 1/4-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 softwoods and hardwoods, Louisiana, 1984 to 1991*

Ownership class	Average net annual growth			Average annual removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
----- Million board feet [†] -----						
National forest	153.9	121.0	32.9	137.7	130.0	7.7
Other public	145.5	62.8	82.7	65.2	41.8	23.4
Forest industry	1,060.8	816.5	244.4	1,348.2	1,078.0	270.3
Farmer	197.1	80.0	117.1	201.5	119.2	82.3
Miscellaneous private	2,173.7	1,484.1	689.5	2,039.4	1,560.6	478.8
All ownerships	3,731.0	2,564.4	1,166.5	3,792.0	2,929.5	862.5

*Numbers in rows and columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.

Table 20. — Average annual mortality of growing stock and sawtimber on timberland by species, Louisiana, 1984 to 1991*

Species	Growing stock	Sawtimber
	Million cubic feet	Million board feet [†]
Yellow pines	74.9	285.9
Cypress	2.7	11.7
Redcedar	0.1	0.0
Total softwoods	77.7	297.7
Select white and red oaks [‡]	2.4	8.9
Other white and red oaks	19.4	70.0
Hickories	5.4	15.6
Sweetgum	12.3	26.8
Tupelo and blackgum	9.9	28.5
Ash, walnut, and black cherry	5.0	5.7
Yellow-poplar	0.4	0.7
Other hardwoods	25.2	63.4
Total hardwoods	80.0	219.5
All species	157.6	517.2

*Numbers in columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.

[‡]Includes white, swamp chestnut, swamp white, 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 softwoods and hardwoods, Louisiana, 1984 to 1991*

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	----- Million cubic feet -----			----- Million board feet [†] -----		
National forest	5.8	4.2	1.6	19.8	17.3	2.5
Other public	10.2	2.2	8.1	32.6	9.5	23.1
Forest industry	38.6	23.5	15.1	141.8	95.1	46.7
Farmer	13.9	6.5	7.4	49.2	26.7	22.6
Miscellaneous private	89.2	41.3	47.9	273.6	149.1	124.5
All ownerships	157.6	77.7	80.0	517.2	297.7	219.5

*Numbers in rows and columns may not sum to totals due to rounding.

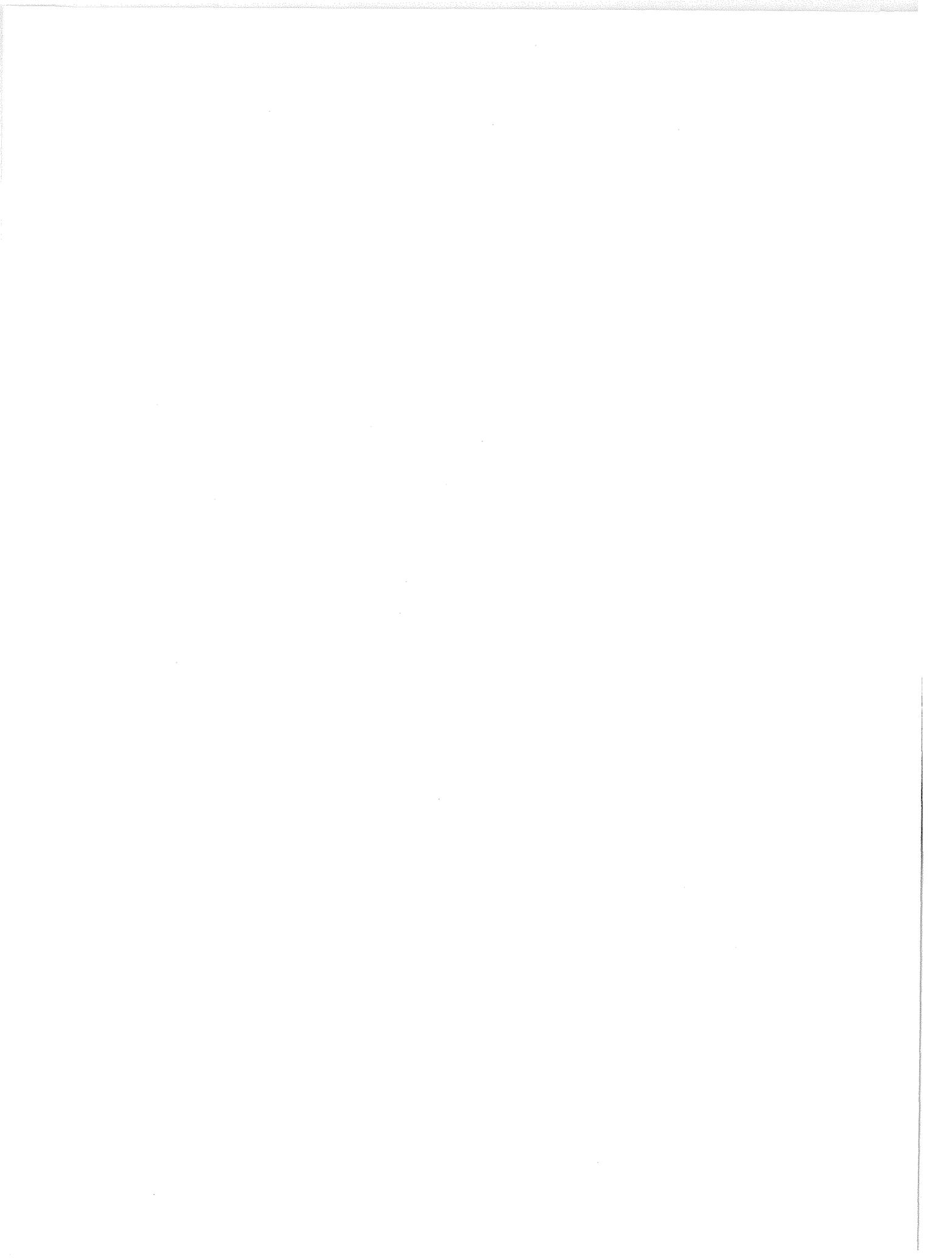
[†]International 1/4-inch Rule.

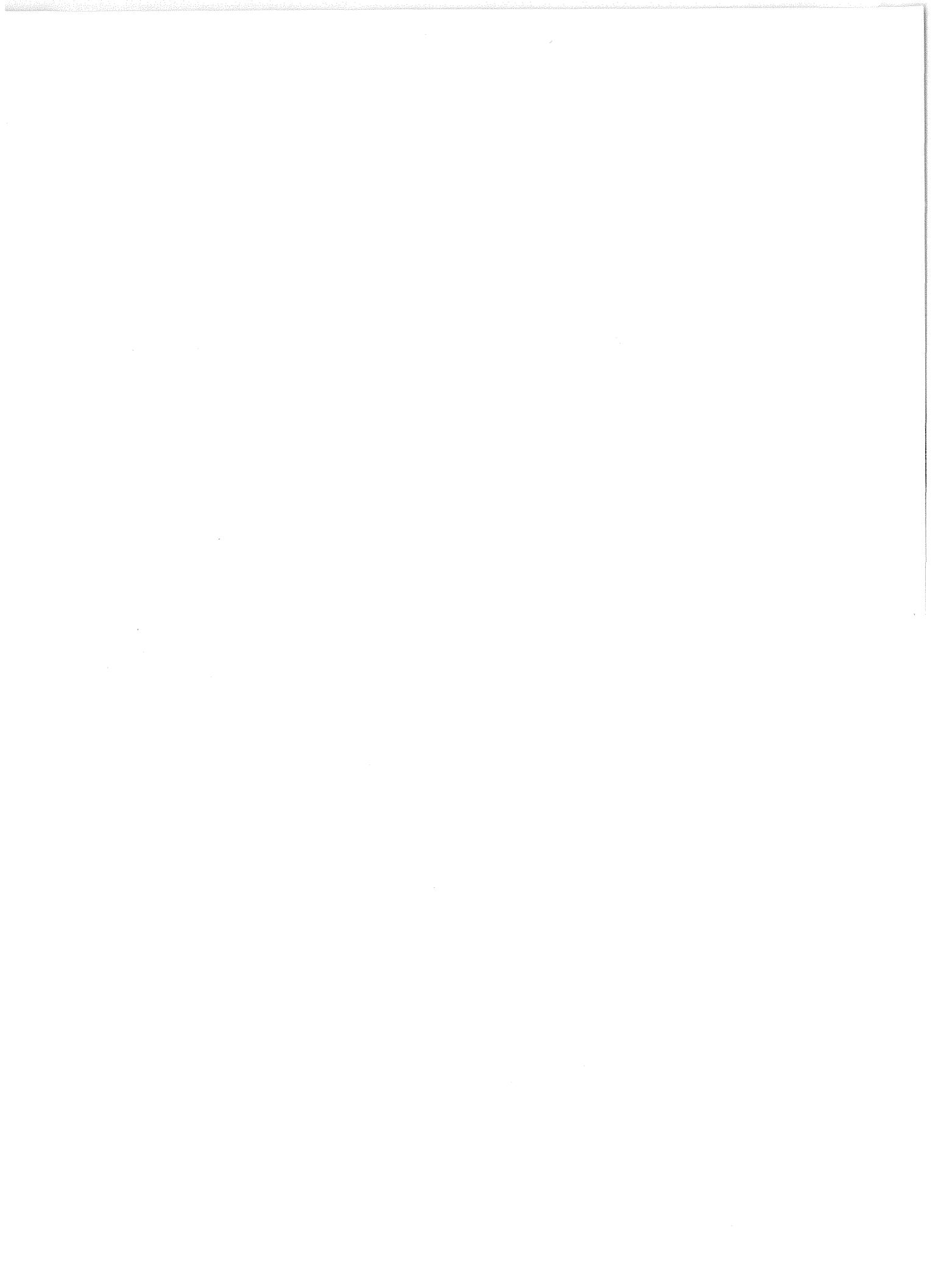
Table 22. — Average annual mortality of growing stock and sawtimber on timberland by cause of death and by softwoods and hardwoods, Louisiana, 1984 to 1991*

Cause of death	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	----- Million cubic feet -----			----- Million board feet [†] -----		
Bark beetles	17.4	17.4	0.0	79.2	79.2	0.0
Other insects	0.9	0.9	0.0	2.5	2.5	0.0
Disease	117.7	52.7	65.1	369.0	195.7	173.3
Fire	0.4	0.2	0.2	0.0	0.0	0.0
Beaver	1.6	0.0	1.6	3.4	0.0	3.4
Weather	14.6	4.5	10.1	49.9	17.3	32.6
Suppression	2.0	1.1	0.9	0.7	0.0	0.7
Other	3.0	0.9	2.2	12.5	3.0	9.5
All causes	157.6	77.7	80.0	517.2	297.7	219.5

*Numbers in rows and columns may not sum to totals due to rounding.

[†]International 1/4-inch Rule.





Rosson, James F., Jr. 1995 Forest resources of Louisiana, 1991. Resour. Bull. SO-192. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 71 p.

The principal findings of the sixth forest survey of Louisiana (1991) and changes that have occurred since the previous survey are presented. Topics examined include forest area, ownership, forest type group, stand structure, basal area, timber volume, growth, removals, mortality, harvesting, management activity, and timber products output.

Keywords: Forest inventory, forest productivity, forest survey, large-scale sample, plantation, species distribution.

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