# Forest Resources of East Texas, 1992

**James F. Rosson, Jr.**

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## Foreword

This resource bulletin describes the principal findings of the sixth inventory of east Texas' forest resources. Data on the extent, condition, and classification of forest land and associated timber volumes, growth, removals, and mortality are described and interpreted. Although data on nontimber commodities associated with forests were also collected, evaluations of these data are not included in this report.

At the time of the east Texas survey, periodic surveys were mandated by 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. These surveys are part of a continuing, nationwide undertaking by the regional experiment stations of the U.S. Department of Agriculture, Forest Service. Inventories of the 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia) and the Commonwealth of Puerto Rico are conducted by the Southern Research Station, Forest Inventory and Analysis Research Work Unit (FIA) operating from its headquarters in Asheville, NC, and from an office in Starkville, MS. The primary objective of these periodic appraisals is to develop and maintain the resource information needed to formulate sound forest policies and programs. More information is available about Forest Service resource inventories in Forest Service Resource Inventories: An Overview (U.S. Department of Agriculture, Forest Service 1992).

Tabular data included in FIA reports are designed to provide a comprehensive array of forest resource statistics, but additional data can be obtained for those who require more specialized information. The forest resource data for Southern States can be accessed directly via the Internet at: www.srsfia.usfs.msstate.edu. Data in a format common to the three FIA units in the Eastern United States (Eastwide Data Base) are also available (Hansen and others 1992). These data may be obtained at the Internet site referenced above.

## Acknowledgments

# Contents

## Highlights from the Sixth Inventory of East Texas

Important findings of the sixth forest survey of east Texas are presented here. Comparisons, unless otherwise noted, are based on estimates dated January 1, 1986, and January 1, 1992.

- Timberland area increased by 202,700 acres to 11.8 million acres. A total of 485,100 nonforest acres reverted to timberland and 282,500 acres of timberland were diverted to nonforest land uses.

- The loblolly-shortleaf pine forest-type group remained the predominant type in east Texas. In 1992, 4.1 million acres were in this type. Oak-hickory was the second most dominant forest-type group, even after losing 242,900 acres since the 1986 inventory.

- The predominant stand-size class was sawtimber with 5.3 million acres (45 percent). The sapling-seedling size class was second, occupying 3.9 million acres (33 percent) of timberland area.

- Softwood live-tree volume did not change appreciably (a decline of less than 1 percent). The volume for 1992 was 8,008.6 million cubic feet.

- Hardwood live-tree volume increased slightly (by 2 percent). The volume for 1992 was 6,220.4 million cubic feet.

- Softwood live-tree net growth increased by 36 percent to 566.5 million cubic feet per year. Removals increased by 19 percent, leaving a negative net change between growth and removals of 6.9 million cubic feet per year (only slightly more than 1 percent of net growth).

- Hardwood live-tree net growth increased only slightly, from 188.3 to 192.8 million cubic feet per year. Removals increased by 10 percent to 173.3 million cubic feet per year. Net change in the inventory was a positive 19.6 million cubic feet per year.

- Plantation area increased to 2.5 million acres—a 597,500-acre increase since 1986.

- Nineteen percent of east Texas softwood volume was in plantations—1,506.9 million cubic feet. This was a 504.9-million-cubic-feet increase.

- Approximately 3.3 million acres, or 28 percent of all timberland, underwent some form of commercial harvest.

- Approximately 1.1 million acres of east Texas timberland underwent some form of intermediate stand treatment (thinning or stand improvement).

# Introduction

This bulletin presents the findings of the sixth forest survey of 43 counties in east Texas. At the time field work was conducted, the FIA survey was administered by the USDA Forest Service, Southern Forest Experiment Station, headquartered in New Orleans, LA. In 1995, the Southern Forest Experiment Station merged with the Southeastern Forest Experiment Station in Asheville, NC, to become the Southern Research Station, which is headquartered in Asheville, NC. The following States are now under the administration of the Southern Research Station: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and the Commonwealth of Puerto Rico.

East Texas is divided into the Southeast and Northeast survey units (fig. 1). Another 26-county region, called the east Texas Post Oak Region, was surveyed in 1939 (Davis 1940), 1965 (Sternitzke 1967), and 1986 (McWilliams and Lord 1988). The 1939 survey was cursory, but the 1965 survey was more detailed. Only the Northeast and Southeast survey units are covered in this bulletin. Limited rainfall west of these survey units results in growth rates and a species mix considered noncommercial or of limited commercial value, especially in relation to sustainable forestry values. However, increasing interest in a more holistic view of forest ecosystems will necessitate detailed surveys of central and western Texas.

Earlier surveys of the eastern counties were conducted by the Southern Forest Experiment Station in 1935 (Cruikshank 1938, Cruikshank and Eldredge 1939), in 1953 to 1955 (U.S. Department of Agriculture, Forest Service 1956), in 1965 (Sternitzke 1967), in 1975 (Murphy 1976), and in 1986 (McWilliams and Lord 1988).



Figure 1—Forest survey units of east Texas.

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This survey is dated January 1, 1992. The first plot was measured in November 1991, and the last plot in August 1992. A total of 2,086 forested plots were measured. Measurements were taken of 43,698 trees 5.0 inches in diameter at breast height (d.b.h.) and larger and 24,809 trees 1.0 inch and larger but less than 5.0 inches in d.b.h. More details about survey methodology are provided in the appendix.

Tables and figures present data for January 1, 1992, as well as estimates of trends. Comparisons are made between estimates for January 1, 1986, and January 1, 1992. The appendix describes survey methods and data reliability, defines terms, lists the tree species occurring in the sample, and provides 22 detailed tables. These standard tables have been used to document the status of forest resources in surveys of east Texas for the last three surveys.

Several publications about the sixth east Texas survey are already available: two forest survey unit reports (Kelly and others 1992a, 1992b), a county statistical report (Miller and Hartsell 1992), and a biomass report (Rosson 1993). Additionally, data are available on the FIA Web site http://www.srsfia.usfs.msstate.edu. Data, in the form of tables or plot and tree records, can be downloaded from this site.

## Forest Area

The 43 counties of Texas' eastern forest survey region contained 21.6 million acres. There were 11.9 million acres of forest and 9.7 million acres of nonforest land. Most forest acreage was classified as timberland (11.8 million acres), while a small portion was classified as productive reserved (125,100 acres) or woodland (44,300 acres) (see the appendix for definitions of these types of forest land). Including more counties west of the 43-county survey region probably would have increased the amount of forest land classified as woodland, and decreased the relative proportion of forest-to-nonforest acreage. The net overall timberland acreage for all east Texas counties was the highest ever recorded.

The Southeast unit had the most timberland (6.7 million acres), even though it had declined from what was reported in 1954 and 1975 (table I). The decline from 1954 was especially noteworthy, because four fewer counties were included in the earlier survey. The Northeast unit, however, had its highest ever timberland acreage. Even though the earlier surveys of this unit did not include Henderson and Van Zandt Counties, timberland acreage has steadily increased in the Northeast beyond that contributed by these two counties.

Table I.—*Timberland area by survey unit, east Texas, 1935 to 1992\**

| Forest survey unit | Survey year | | | | | |
|---|---|---|---|---|---|---|
| | 1935 | 1954 | 1965 | 1975 | 1986 | 1992 |
| | *- - - - - - - - - - - - - - - - - - - - - - - - Thousand acres - - - - - - - - - - - - - - - - - - - - - - - - - - -* | | | | | |
| Northeast | 4,008.4 | 4,569.5 | 4,865.0 | 4,855.5† | 4,905.9† | 5,070.5† |
| Southeast | 6,672.8 | 7,006.5 | 6,590.8 | 6,806.4‡ | 6,665.3‡ | 6,703.3‡ |
| All units | 10,681.2 | 11,576.0 | 11,455.8 | 11,661.9 | 11,571.1 | 11,773.8 |

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

†Denotes the addition of Henderson and Van Zandt Counties to the Northeast forest survey unit for the 1975, 1986, and 1992 survey years.

‡Denotes the addition of Grimes, Leon, Madison, and Waller Counties to the Southeast forest survey unit for the 1975, 1986, and 1992 survey years.

There are usually many more acres reverted to or diverted from the timberland base than the net change indicates. Between the last two surveys, 485,100 acres of land reverted to timberland use and 282,500 acres of timberland diverted to a nontimberland use (table II). Most reversions were in the Northeast unit, but both survey units had almost equal amounts of diversions (the Northeast unit had 15,500 acres more).

A total of 379,700 acres of agricultural land reverted to timberland, mostly in the Northeast survey unit (67 percent). In addition, 105,400 acres of nonagricultural lands reverted to timberland, nearly equally divided between the Northeast and Southeast units.

Of the 282,500 acres of timberland lost to a nonforest land use, 160,500 acres were converted to agricultural uses and 122,000 acres to nonagricultural purposes. Neither the Northeast nor Southeast unit had a substantially higher or lower contribution of diverted acres.

The most noteworthy changes in timberland area occurred in only a portion of the 43 eastern counties. Four counties lost more than 20,000 acres of timberland, but 7 counties gained more than 20,000 acres (fig. 2); 32 counties had timberland changes of less than 20,000 acres.

Table II.—*Changes in timberland by forest survey unit, east Texas, 1986 to 1992\**

| Forest survey unit | Total land | Timberland | Change | Additions | | | Diversions | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | Agriculture | Other[†] | Total | Agriculture | Other[†] |
| | *- - - - - - - - - - - - - - - - - - - - - - - - - - - Thousand acres - - - - - - - - - - - - - - - - - - - - - - - - - - -* | | | | | | | | |
| Northeast | 9,706.6 | 5,070.5 | 164.6 | 313.6 | 255.8 | 57.8 | -149.0 | -71.5 | -77.5 |
| Southeast | 11,887.4 | 6,703.3 | 38.1 | 171.6 | 123.9 | 47.7 | -133.5 | -89.0 | -44.5 |
| All units | 21,594.0 | 11,773.8 | 202.7 | 485.1 | 379.7 | 105.4 | -282.5 | -160.5 | -122.0 |

*Numbers in rows and columns may not sum to totals due to rounding.
[†]Includes urban, industrial, highway, water, rights-of-way, etc.
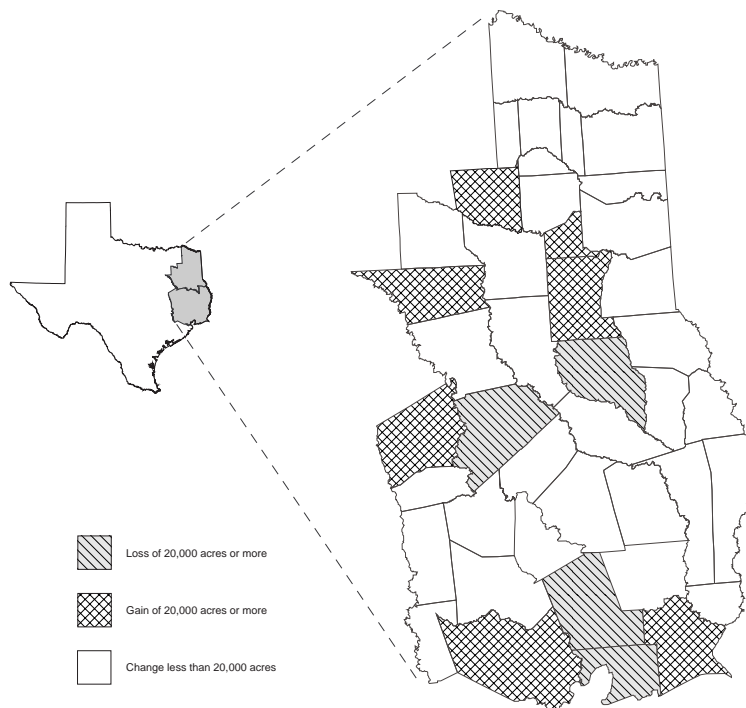


Figure 2—East Texas counties with gains and losses in timberland, 1986 to 1992.

The proportion of timberland in the 43 eastern counties was not evenly distributed. Three counties had less than 20 percent of their land area in timberland, whereas six counties had more than 80 percent in timberland. The majority of counties had moderate timberland coverage; 13 were in the range of 41 to 60 percent, and 13 had 61 to 80 percent of their land base in timberland (fig. 3).

Most timberland in the east Texas counties was nonindustrial private forest (NIPF) land, 7.3 million acres. This was 62 percent of the total timberland area. Forest industry followed with 3.7 million acres (32 percent), then national forest and other public timberlands, with 576,700 acres (5 percent) and 206,700 acres (2 percent), respectively. Timberland in the
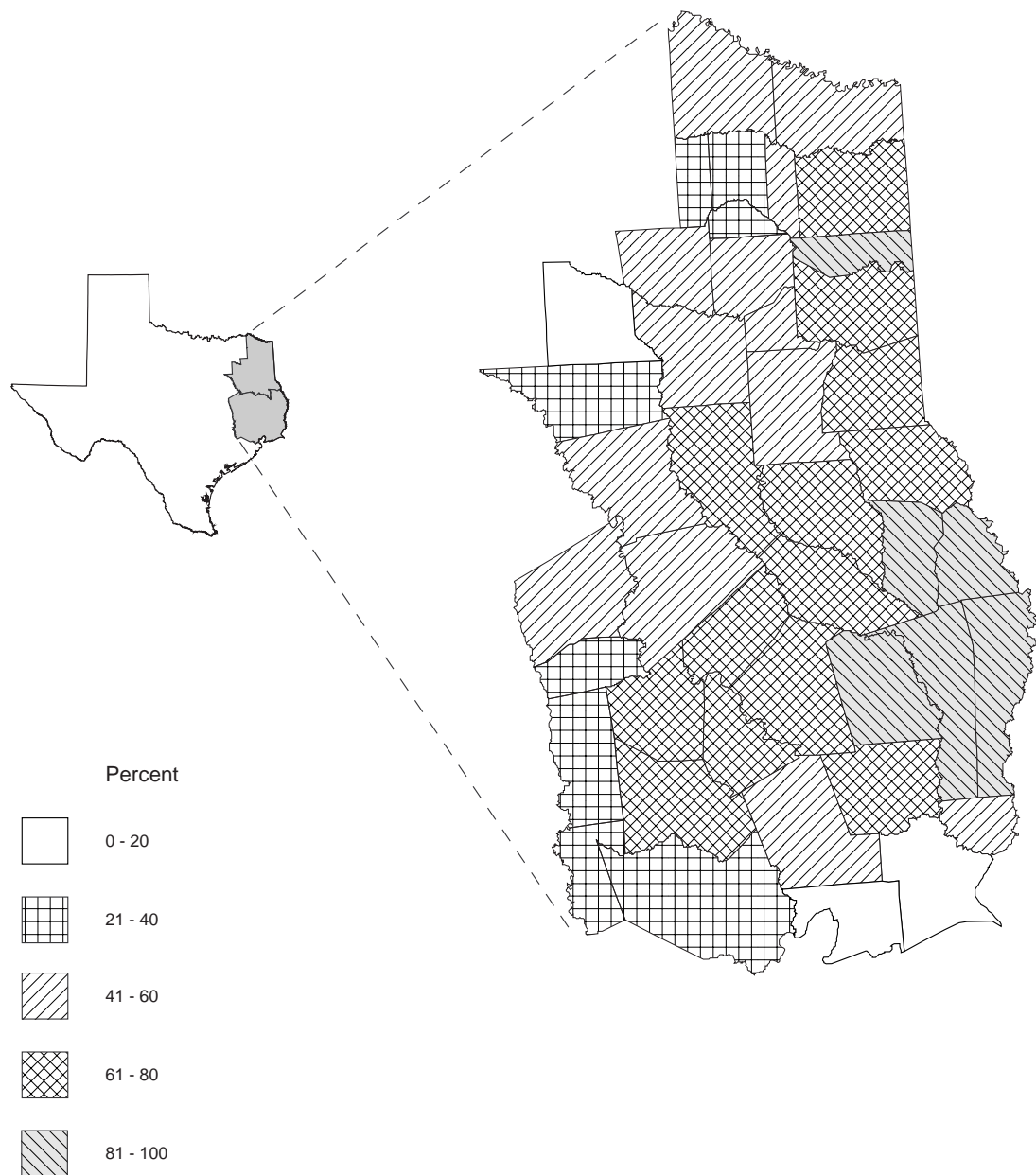


Figure 3—Percentage of county area in timberland, east Texas, 1992.

NIPF ownership class increased by 258,200 acres (table III). Most of this increase was in the Northeast unit (71 percent) and from reversion of agricultural land to timberland (table II). The public and forest industry acreage changed very little (table III).

The distribution of timberland ownership was different for each survey unit. The Northeast unit had most of its ownership in NIPF land, 4.2 million acres (82 percent). A relatively small amount of timberland was in forest industry, 742,000 acres (15 percent); national forest, 67,400 acres (1 percent); and other public, 106,100 acres (2 percent) ownerships (fig. 4).

Table III.—*Area of timberland by forest survey unit, ownership, and change, east Texas, 1986 to 1992\**

| Forest survey unit | All owners | Public | Change | Forest industry | Change | Nonindustrial private | Change |
|---|---|---|---|---|---|---|---|
| | | | - - - - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | |
| Northeast | 5,070.5 | 173.5 | -13.9 | 742.0 | -5.0 | 4,155.0 | 183.6 |
| Southeast | 6,703.3 | 609.9 | 34.5 | 2,977.7 | -71.0 | 3,115.7 | 74.6 |
| All units | 11,773.8 | 783.5 | 20.5 | 3,719.7 | -76.1 | 7,270.7 | 258.2 |

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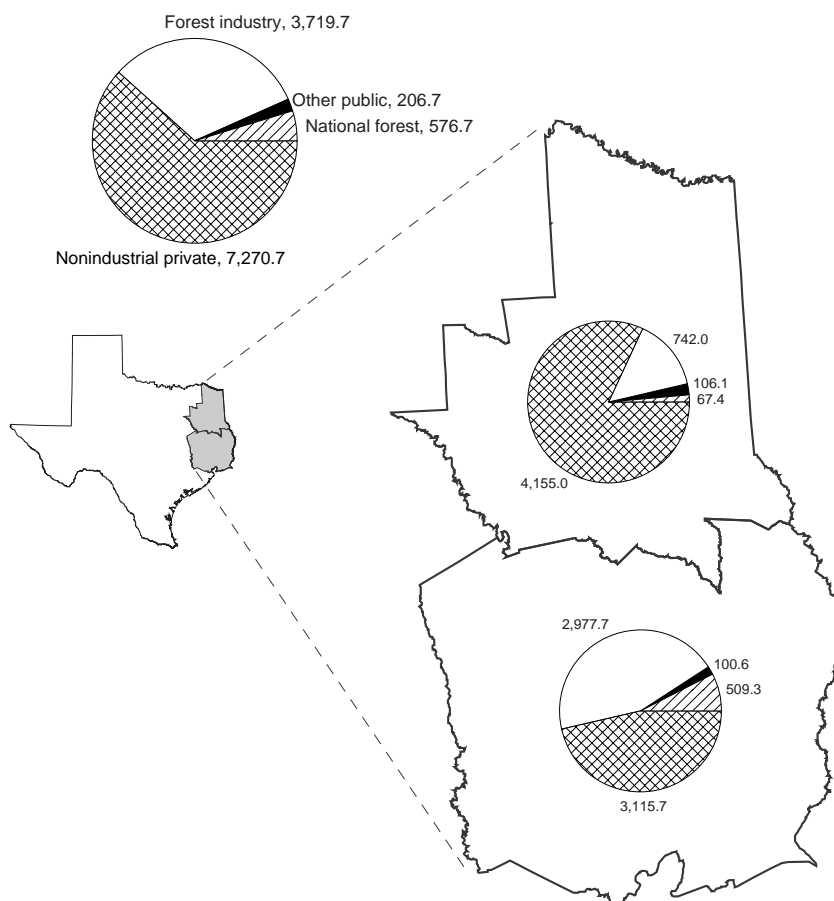


Figure 4—Proportion of timberland, in thousand acres, by ownership, east Texas, 1992.

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In the Southeast unit, forest industry owned a much larger proportion of timberland, 3.0 million acres (44 percent). The proportion of timberland held by the NIPF sector was much smaller, 3.1 million acres (46 percent) but still constituted a plurality of the four major ownerships. Most national forest-held timberland was in the Southeast unit, 509,300 acres (88 percent). The other-public ownership was evenly divided between the two survey units, approximately 100,000 acres in each.

The heaviest concentration of NIPF ownership was in the western counties of the survey region. Additionally, a heavy concentration of NIPF ownership was evident in the Northeast unit (fig. 5). There, 15 counties had more than 81 percent of timberland in NIPF ownership.



**Percent**

| | |
|---|---|
| ☐ | 0 - 20 |
| ▦ | 21 - 40 |
| ▨ | 41 - 60 |
| ▩ | 61 - 80 |
| ▨ | 81 - 100 |
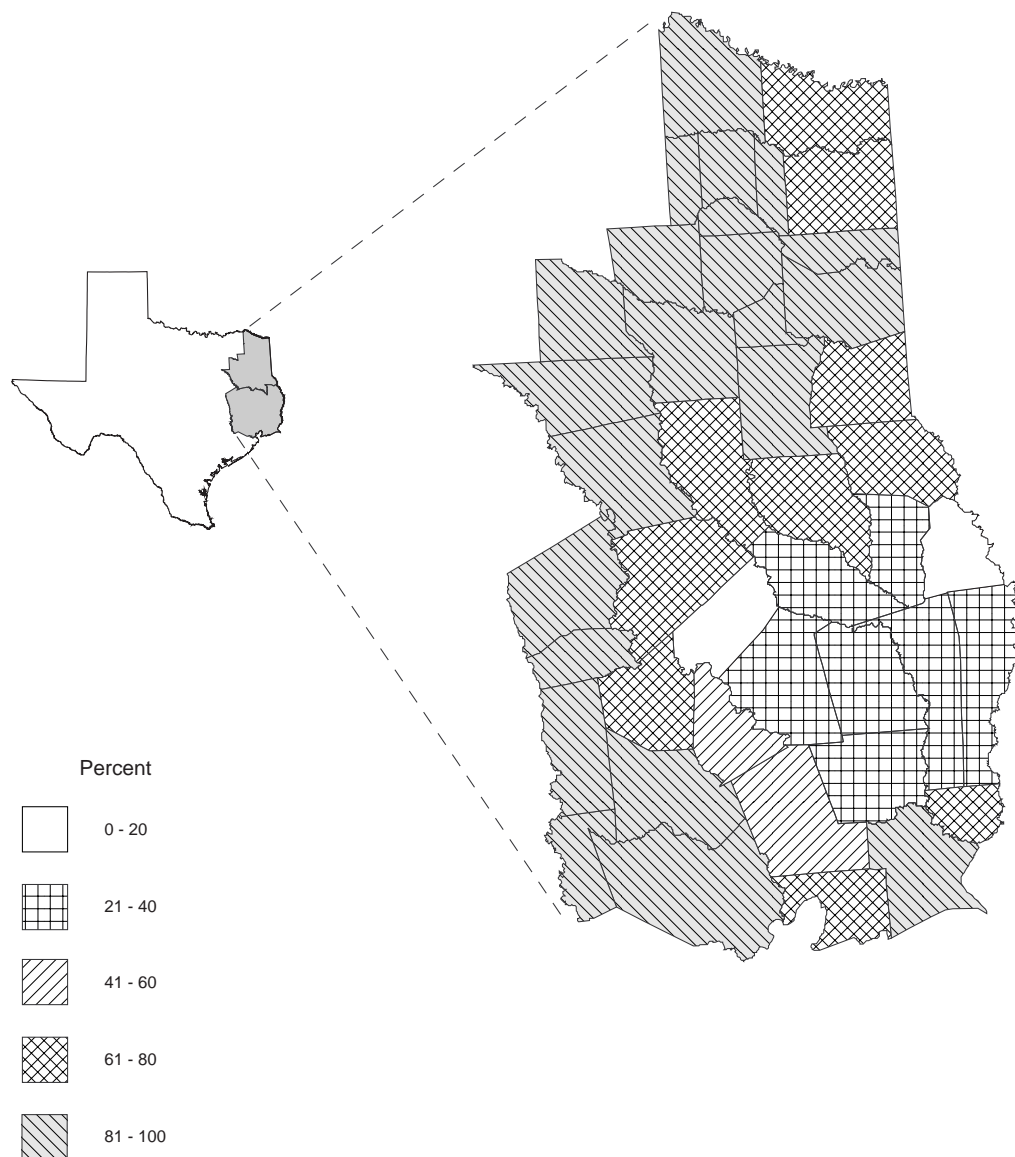
Figure 5—Percentage of county timberland held by nonindustrial private forest landowners, east Texas, 1992.

In contrast to the NIPF ownership, forest industry ownership was predominant in the Southeast unit (fig. 6), where six counties had 61 to 80 percent of this type of timberland. Only three counties in the southern portion of the Northeast unit had more than 20 percent of timberland held by forest industry.

Percent

| | |
|---|---|
| | 0 - 20 |
| | 21 - 40 |
| | 41 - 60 |
| | 61 - 80 |
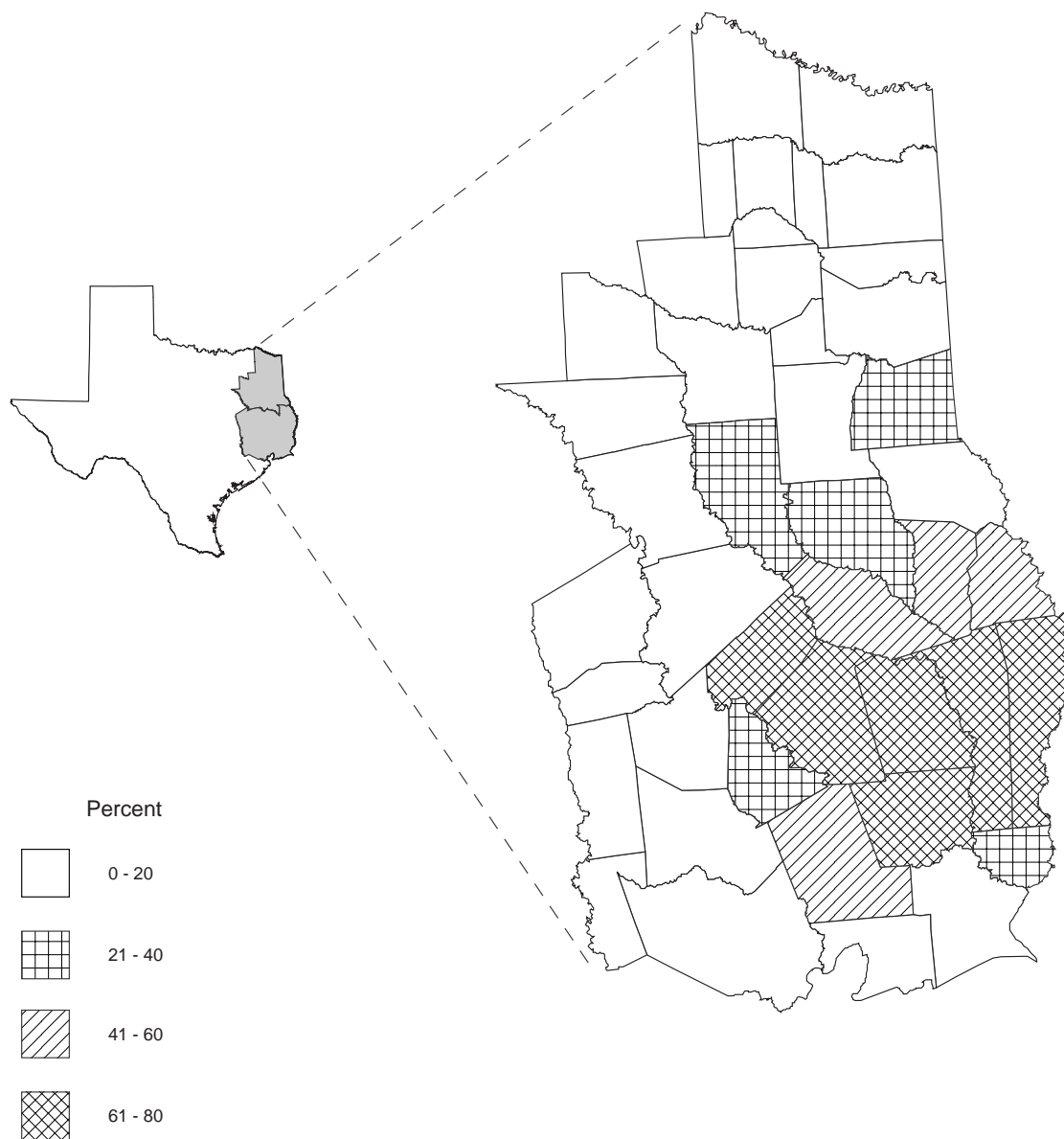
Figure 6—Percentage of county timberland held by forest industries, east Texas, 1992. There were no counties with more than 76 percent of timberland in forest industry ownership.

The predominant forest-type group in east Texas was the loblolly-shortleaf pine type, 4.1 million acres (35 percent of all timberland) (fig. 7). Next in rank were the oak-hickory, 3.1 million acres; oak-pine, 2.5 million acres; bottomland hardwoods, 1.8 million acres; and longleaf-slash pine forest-type groups, 232,000 acres making up 27, 21, 15, and 2 percent, respectively.
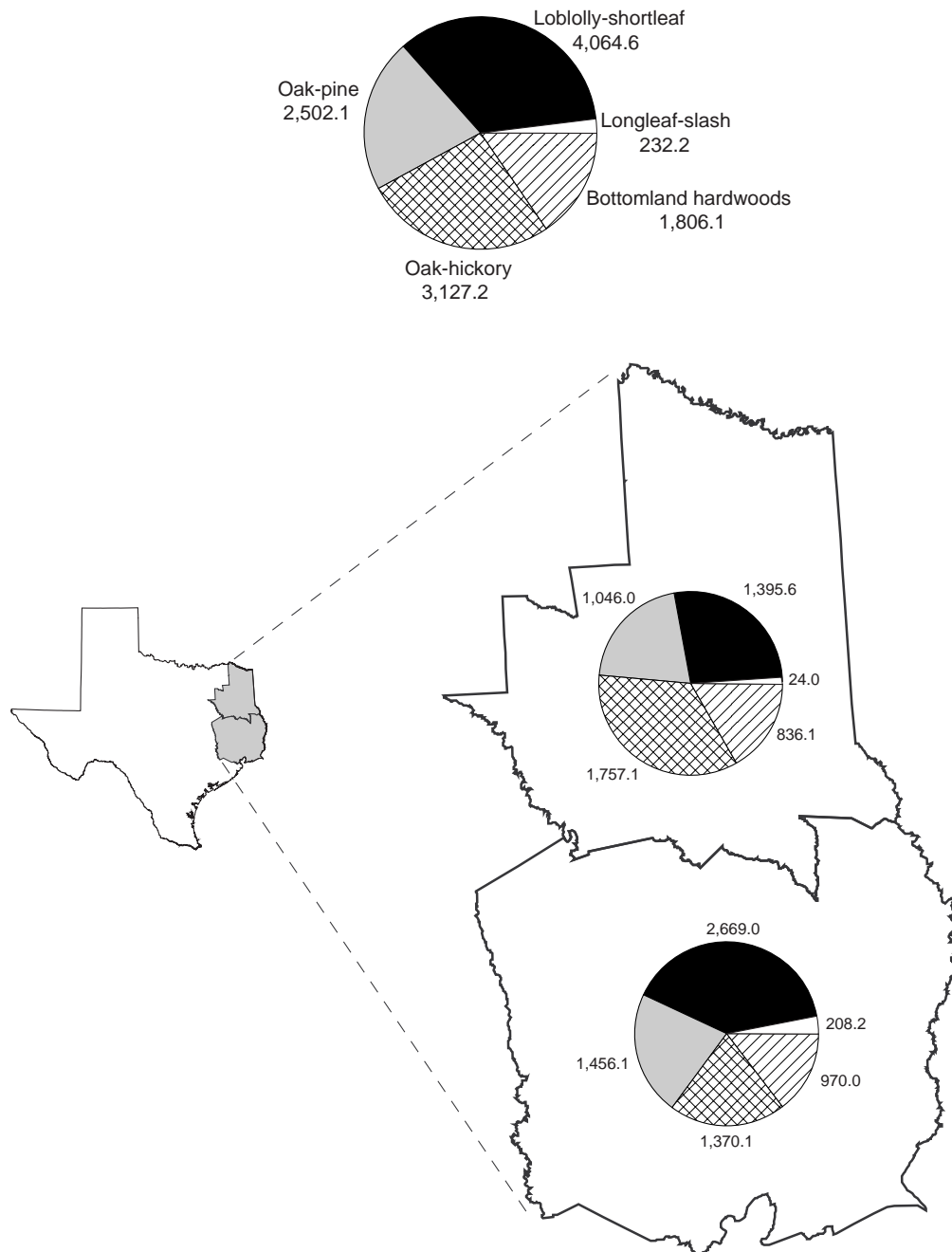


Figure 7—Proportion of timberland, in thousand acres, by forest-type group, east Texas, 1992. Bottomland hardwoods include the oak-gum-cypress and elm-ash-cottonwood forest type groups.  There were 41,500 acres of nontyped timberland not included in this figure.

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There were regional differences in the distribution of the forest-type groups. Most of the loblolly-shortleaf pine forest-type group was in the Southeast unit—2.7 million acres or 66 percent of the type. Another obvious uneven distribution of forest-type groups in the two survey units was in the longleaf-slash type. About 90 percent of that type group was located in the Southeast unit—208,200 acres. Edaphic and precipitation differences between the two units explained much of the species distribution differences. Pines dropped out in favor of more drought-resistant hardwoods (primarily post oak) on a south-to-north gradient and southeast-to-northwest gradient.

There were significant trend dynamics in the areal amounts of specific forest-type groups. Most notable was the loss of 242,900 acres of the oak-hickory forest-type group and the increase of 247,500 acres of the oak-gum-cypress type group. The largest increase of a forest-type group in a specific survey unit was a 190,600-acre increase in the loblolly-shortleaf pine group in the Northeast unit. The largest decrease (124,200 acres) was in oak-hickory, also in the Northeast unit (table IV).

The longleaf-slash forest-type group continued to decline. An additional 56,100 acres dropped from the type group during the survey period; about 232,200 acres remained. A total of 43 sample plots were within this forest-type group; 21 were dominated by longleaf pine, 22 by slash pine. One slash pine-dominated plot was removed from the survey sample population by land clearing. Two longleaf pine-dominated plots changed type—one to the oak-hickory forest-type group, the other to the oak-pine forest-type group.

Table IV.—*Area of timberland by forest survey unit, forest type group, and change, east Texas, 1986 to 1992**

| Forest survey unit | All types | Longleaf-slash | Change | Loblolly-shortleaf | Change | Oak-pine | Change | Oak-hickory† | Change | Oak-gum-cypress | Change | Elm-ash-cottonwood | Change | Nontyped‡ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | - - - - *Thousand acres* - - - - | | | | | | | |
| Northeast | 5,070.5 | 24.0 | -0.6 | 1,395.6 | 190.6 | 1,046.0 | -12.2 | 1,757.1 | -124.2 | 793.2 | 109.0 | 42.9 | -9.5 | 11.6 |
| Southeast | 6,703.3 | 208.2 | -55.4 | 2,669.0 | -94.3 | 1,456.1 | 138.4 | 1,370.1 | -118.7 | 947.6 | 138.5 | 22.4 | 16.6 | 29.9 |
| All units | 11,773.8 | 232.2 | -56.1 | 4,064.6 | 96.3 | 2,502.1 | 126.2 | 3,127.2 | -242.9 | 1,740.8 | 247.5 | 65.3 | 7.0 | 41.5 |

*Numbers in rows and columns may not sum to totals due to rounding.
†There were 10,800 acres of the maple-beech-birch type in the 1986 survey that were included with the oak-hickory forest-type group.
‡Timberland <16.7 percent stocked.

## Stand Volume

Live-tree timber volume for east Texas totaled 14,229.0 million cubic feet, a 96.4 million-cubic-feet increase from 1986. Softwood still predominated, making up 56 percent of the total live-tree timber volume. The total standing live-tree volume was evenly divided between the Northeast and Southeast survey units, with 57 percent in the Southeast and 43 percent in the Northeast.

Ninety-one percent of the total live-tree volume was in growing-stock trees (12,938.7 million cubic feet). Of this, 9,430.5 million cubic feet were in sawtimber-size trees and 3,508.2 million cubic feet were in poletimber-size trees. There was a slightly higher proportion of growing-stock volume in softwoods than in hardwoods—98 percent versus 81 percent, respectively. This was mostly due to the fact that grading and tree classification standards are more stringent for hardwoods than softwoods. This, coupled with the tendency for hardwoods to be more susceptible to deformity and grade reduction caused by weather, insects, and disease, resulted in slightly more softwood volume in growing-stock trees.

Sawtimber volume totaled 50,711.6 million board feet, measured in the International 1/4-inch rule. Sixty-nine percent of this volume was in softwoods, 31 percent in hardwoods. In terms of sawtimber volume, east Texas was definitely dominated by softwoods.

The volume of sound wood in cull trees (trees classed as rough or rotten) totaled 1,290.2 million cubic feet. Of that total, 10 percent was in softwoods and 90 percent in hardwoods. Most of the cull (87 percent) was in rough trees. A small portion of volume was in salvable dead trees, 62.5 million cubic feet, most of which (77 percent) was in softwoods. The estimate for salvable dead trees was very conservative, because many trees are salvable at the time of their death. However, because of the time lapse that may occur between tree death and the next survey measurement, a tree may pass from a salvable to a nonsalvable state.

There were 454.6 million tons of dry, woody biomass in live trees of east Texas forests. A total of 189.8 million dry tons was in softwoods and 264.8 million in hardwoods. Most
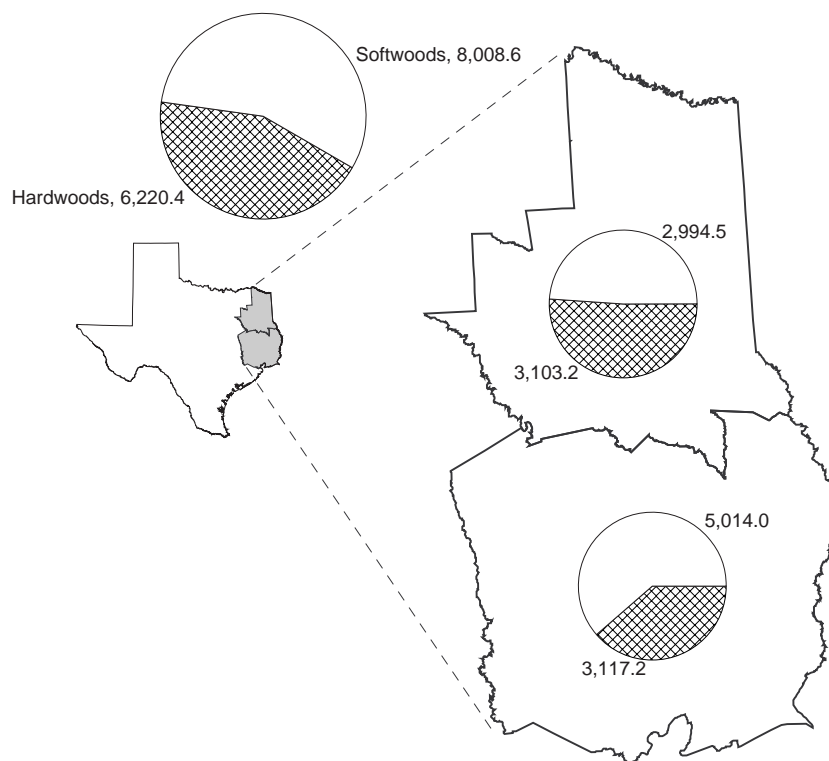


Figure 8—Proportion of live-tree volume, in million cubic feet, by species group, east Texas, 1992.

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biomass was in the stem component (359.3 million dry tons or 79 percent). [See Rosson (1993) for a more detailed analysis of the woody biomass on east Texas timberland.]

**Softwood Volume**

Softwood live-tree volume was 8,008.6 million cubic feet. Most east Texas live-tree volume was in softwoods—56 percent. Most softwood volume was in the Southeast survey unit—5,014.0 million cubic feet (63 percent) (fig. 8).

Total live-tree softwood volume declined only slightly during the survey (by 11.5 million cubic feet). However, Northeast unit volume increased by 248.6 million cubic feet (9 percent)

while Southeast unit volume declined by 260.1 million cubic feet (5 percent). A substantial volume increase was offset by a substantial volume decrease in the respective survey units (table V).

Most of the east Texas forest live-tree softwood volume was held by NIPF owners, 4,574.5 million cubic feet in this survey (table VI), or 57 percent of the softwood inventory. Forest industry was the other major owner of softwood volume, with 2,153.7 million cubic feet (27 percent). The NIPF softwood volume increased by 142.5 million cubic feet; but that gain was offset by a 168.1-million-cubic-feet decrease in the forest industry inventory.

Table V.—*Change in live-tree volume by forest survey unit, east Texas, 1986 to 1992**

| Forest survey unit | Softwood | | Hardwood | |
|---|---|---|---|---|
| | Volume | Change | Volume | Change |
| | - - - - - - - - - - - - - - - - - - - - -*Million cubic feet* - - - - - - - - - - - - - - - - - - - - - - | | | |
| Northeast | 2,994.6 | 248.6 | 3,103.2 | 186.1 |
| Southeast | 5,014.0 | -260.1 | 3,117.2 | -78.2 |
| All units | 8,008.6 | -11.5 | 6,220.4 | 107.9 |

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

Table VI.—*Change in live-tree volume by ownership, east Texas, 1986 to 1992**

| Ownership | Softwood | | Hardwood | |
|---|---|---|---|---|
| | Volume | Change | Volume | Change |
| | - - - - - - - - - - - - - - - - - - - - - - -*Million cubic feet* - - - - - - - - - - - - - - - - - - - - - - - | | | |
| National forest | 1,156.3 | 12.0 | 270.1 | 35.6 |
| Other public | 124.1 | 2.0 | 138.3 | 27.1 |
| Forest industry | 2,153.7 | -168.1 | 1,378.5 | -168.9 |
| Nonindustrial private | 4,574.5 | 142.5 | 4,433.4 | 214.1 |
| All owners | 8,008.6 | -11.5 | 6,220.4 | 107.9 |

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

The distribution of softwood live-tree volume by 2-inch diameter classes is illustrated in figure 9. Most volume was in trees less than 20.0 inches in d.b.h. (84 percent). The highest concentration of volume was in the 8- to 16-inch diameter classes (66 percent). The most pronounced trend evidence of volume change between surveys occurred in the 10- to 16-inch diameter classes, where volume dropped by 361.8 million cubic feet (8 percent). Other trend information indicated a slight volume increase in the 6- to 8-inch diameter classes. Beyond the 16-inch diameter class, there was very little volume change, although the volume of trees in the larger diameter classes did increase.

Loblolly pine volume increased (fig. 10), but shortleaf, longleaf, and slash pine volume decreased. The longleaf pine decrease was noteworthy. Even though the drop in longleaf volume was very small, the decrease has continued to occur in every recent survey. Volumes increased on national forest lands but declined substantially on forest industry and NIPF lands.
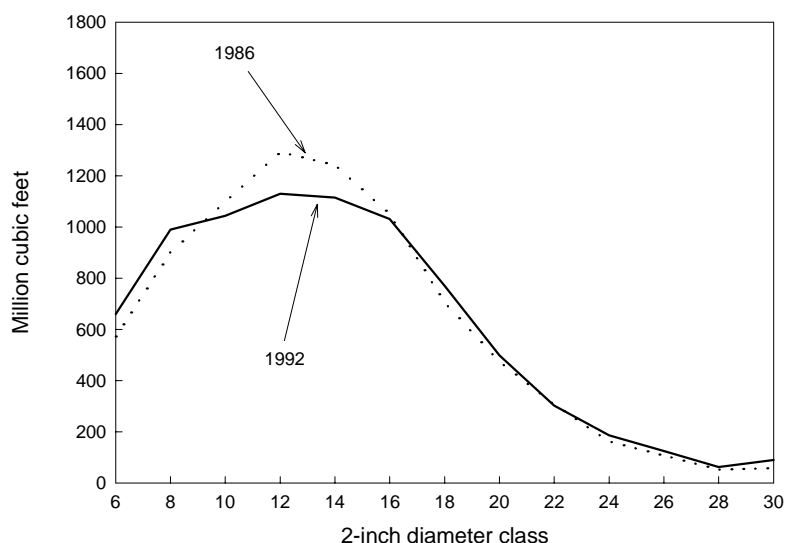


Figure 9—Softwood live-tree volume by 2-inch diameter class, east Texas, 1986 and 1992.
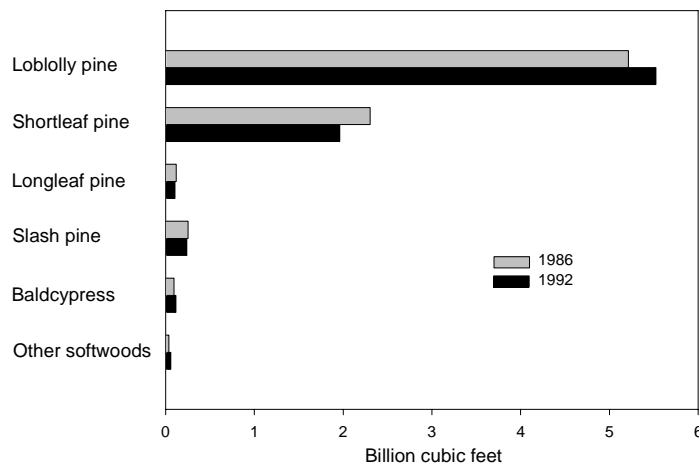


Figure 10—Softwood live-tree volume by species, east Texas, 1986 and 1992.

To portray the distribution of volume across the landscape, effective density graphs were constructed (fig. 11). The graphs are categorized by stand-volume classes on the y-axis and the respective percentage of total area and volume in each respective volume class on the x-axis. The graphs portray an uneven distribution of softwood volume across forest lands in east Texas. For example, approximately 42 percent of softwood live-tree volume occurred on only 10 percent of east Texas timberland; this volume was in stands containing more than 2,000 cubic feet per acre. In contrast, 60 percent of east Texas timberlands were in stands containing less than 500 cubic feet per acre. The distribution of volume across east Texas was similar in the Northeast and Southeast units (fig. 11).
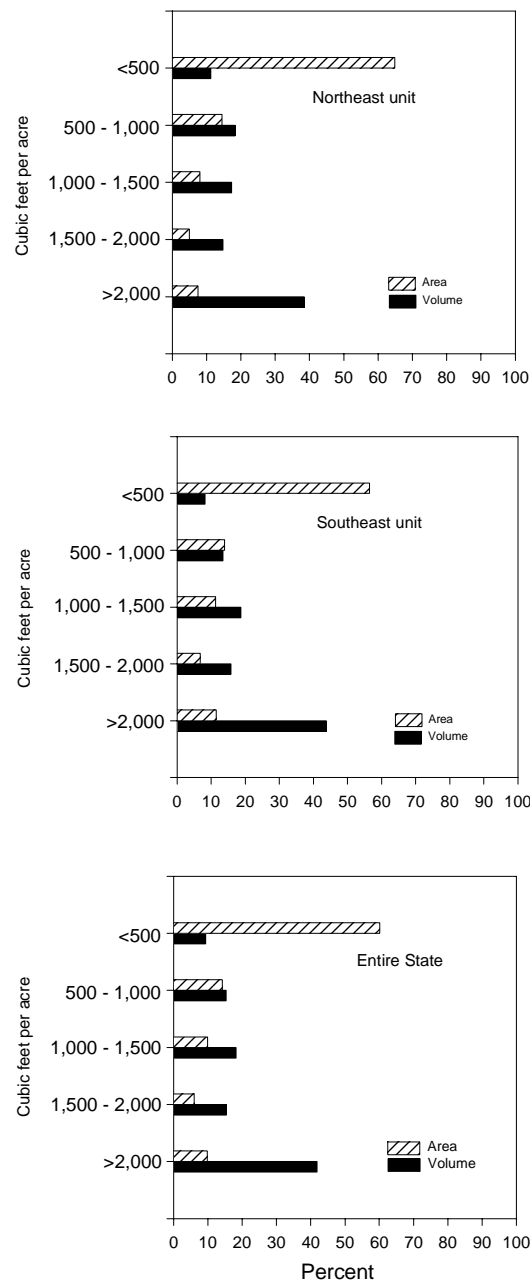


Figure 11—Timberland area and live-tree volume of softwoods by stand-volume class, east Texas, 1992.

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## Softwood Sawtimber Volume

A total of 69 percent of east Texas sawtimber was in softwoods, or 35,133.1 million board feet. This represents a 1,348.3-million-board-feet decrease from the previous survey (a 4-percent decline) (table VII). Over 63 percent of the softwood sawtimber was in the Southeast unit (fig. 12), and the proportion of softwoods to hardwoods was much higher there than in the Northeast unit. There was a total softwood loss of 2,129.2 million board feet in the Southeast unit, but that was partially offset by a 781.0-million-board-feet gain in the Northeast unit.

Table VII.—*Change in sawtimber volume by forest survey unit, east Texas, 1986 to 1992*\*

| Forest survey unit | Softwood | | Hardwood | |
|---|---|---|---|---|
| | Volume | Change | Volume | Change |
| | - - - - - - - - - - - - - - - - - *Million board feet*† - - - - - - - - - - - - - - - - - - - | | | |
| Northeast | 12,887.3 | 781.0 | 7,375.4 | 425.6 |
| Southeast | 22,245.8 | -2,129.2 | 8,203.1 | -45.7 |
| All units | 35,133.1 | -1,348.3 | 15,578.5 | 379.9 |

\*Numbers in rows and columns may not sum to totals due to rounding.
†International 1/4-inch rule.
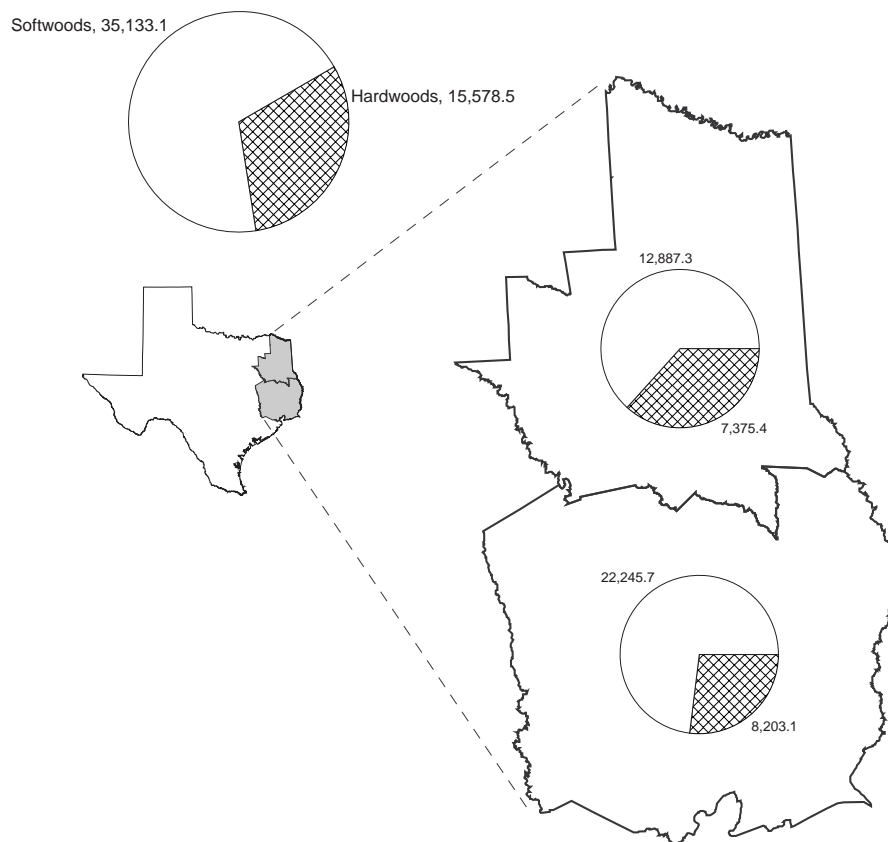


Figure 12—Proportion of sawtimber volume, in million board feet, by species group, east Texas, 1992.

Most of the softwood sawtimber was held by NIPF owner-ship, 20,480.9 million board feet, or 58 percent (table VIII). Almost equal amounts of volume were held by national forests and forest industry—6,429.8 and 7,584.0 million board feet, respectively. The largest losses were on forest industry land—2,361.6 million board feet. This was a 24-percent decrease in softwood sawtimber volume. Both NIPF and national forests sawtimber volumes increased (table VIII).

The effective density graphs in figure 13 illustrate the spatial distribution of softwood sawtimber volume by stand-volume classes. Approximately 55 percent of the east Texas softwood sawtimber volume was in stands containing more than 9,000 board feet (measured in International 1/4-inch rule) per acre. However, only slightly more than 10 percent of timberland was in stands of this volume density. In contrast, approximately 55 percent of timberland was in

Table VIII.—*Change in sawtimber volume by ownership, east Texas, 1986 to 1992\**

| Ownership | Softwood | | Hardwood | |
|---|---|---|---|---|
| | Volume | Change | Volume | Change |
| | - - - - - - - - - - - - - - - - - - - - *Million board feet†* - - - - - - - - - - - - - - - - - - - - | | | |
| National forest | 6,429.8 | 109.6 | 820.6 | 125.5 |
| Other public | 638.4 | -10.2 | 333.7 | 62.5 |
| Forest industry | 7,584.0 | -2,361.6 | 4,024.9 | -213.6 |
| Nonindustrial private | 20,480.9 | 913.9 | 10,399.3 | 405.5 |
| All owners | 35,133.1 | -1,348.3 | 15,578.5 | 379.9 |

\*Numbers in rows and columns may not sum to totals due to rounding.
†International 1/4-inch rule.
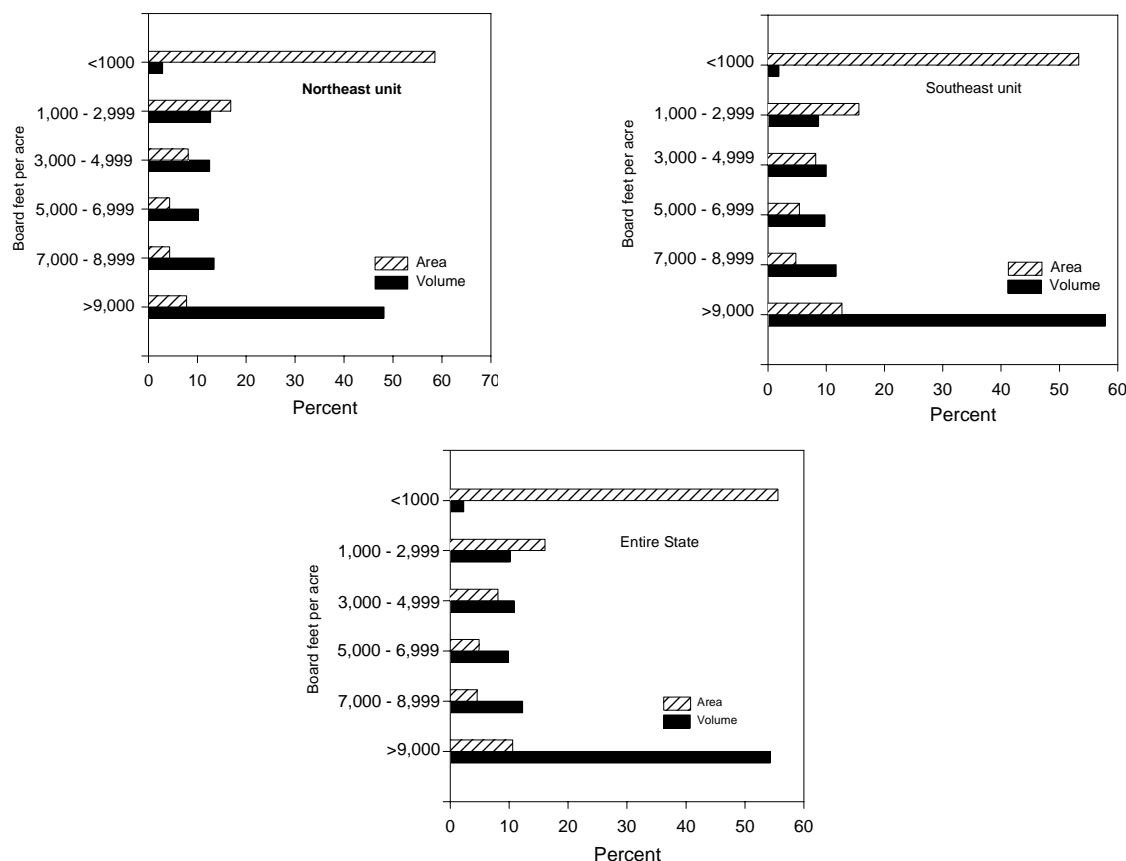


Figure 13—Timberland area and sawtimber volume of softwoods by stand and volume class, east Texas, 1992.

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stands of less than 1,000 board feet per acre. The patterns were similar for the Northeast and Southeast units. In the Southeast unit, approximately 58 percent of the 22,245.8 million board feet was on approximately 13 percent of the timberland.

**Hardwood Volume**

Hardwood live-tree volume for east Texas was 6,220.4 million cubic feet. Volume increased by only 107.9 million cubic feet, or less than 2 percent. Hardwood represented 44 percent of the total live-tree volume resource in east Texas.

The hardwood live-tree volume was equally divided between the Northeast and Southeast units. One of the differences between the units was that the Northeast unit volume increased by almost 6 percent while the Southeast unit volume decreased by slightly less than 3 percent.

Most of the hardwood volume was in NIPF ownership, 4,433.4 million cubic feet (71 percent), while forest industry held 1,378.5 million cubic feet (22 percent). This was in contrast to the softwood volume, of which NIPF owned 4,574.5 million cubic feet (57 percent) (table VI). Forest industry held almost an equal share of softwoods and hardwoods, 2,153.7 and 1,378.5 million cubic feet (27 and 22 percent), respectively. Another difference between holdings was that a smaller proportion of the hardwood resource (7 percent) was in the public domain.

There was little change in the hardwood inventory in the 6- to 10-inch diameter classes (fig. 14). Noteworthy was the decline in the 10- to 14-inch diameter classes, which will affect the future inventory of the important larger diameter classes. The 1992 inventory showed an increase in the larger classes of hardwoods—those greater than the 16-inch diameter class. This indicated a potential increase in hardwood quality as many trees may reach tree grade 1 status. There were noteworthy volume shifts by specific species or
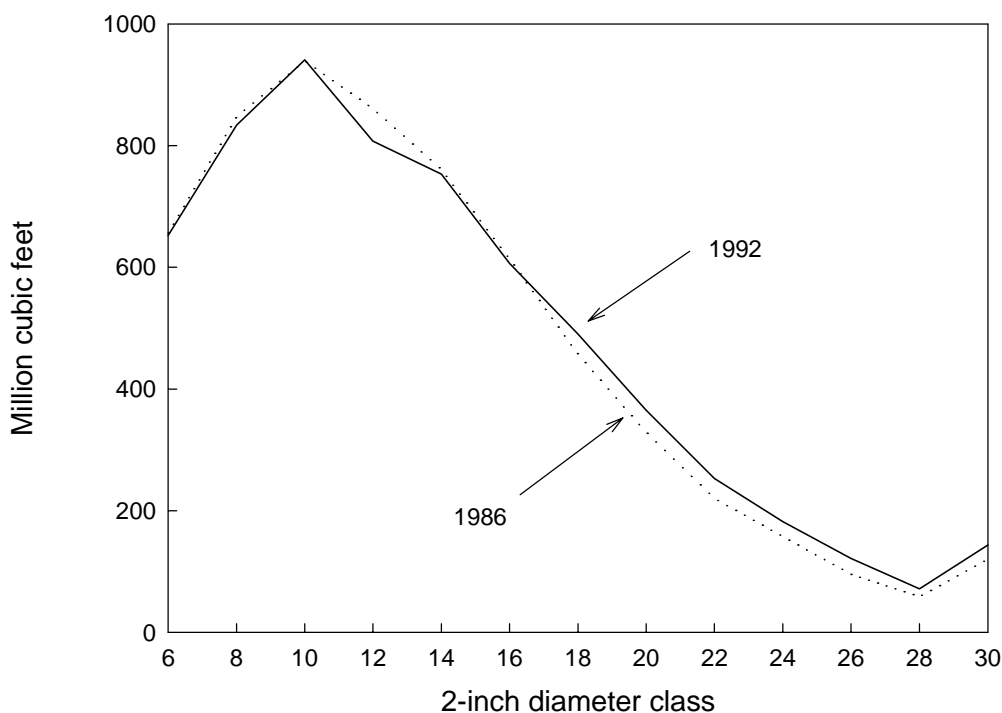


Figure 14—Hardwood live-tree volume by 2-inch diameter class, east Texas, 1986 and 1992.

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species groups (fig. 15). Species with volume increases were select red oaks, nonselect white oaks, sweetgum, hickories, ash, willow, and miscellaneous other hardwoods. Decreases were noted in select white oaks, other red oaks, blackgum, and hackberries.

Hardwood volume tended to be more evenly distributed among the stand-volume classes than softwood volume (fig.

16). Also, most hardwood volume was in stands containing 500 to 1,500 cubic feet per acre, while very little was in stands of more than 2,000 cubic feet per acre. More than 60 percent of the east Texas timberland area was in stands composed of less than 500 cubic feet per acre in hardwoods. Both survey units had a similar pattern in the distribution of hardwood volume.
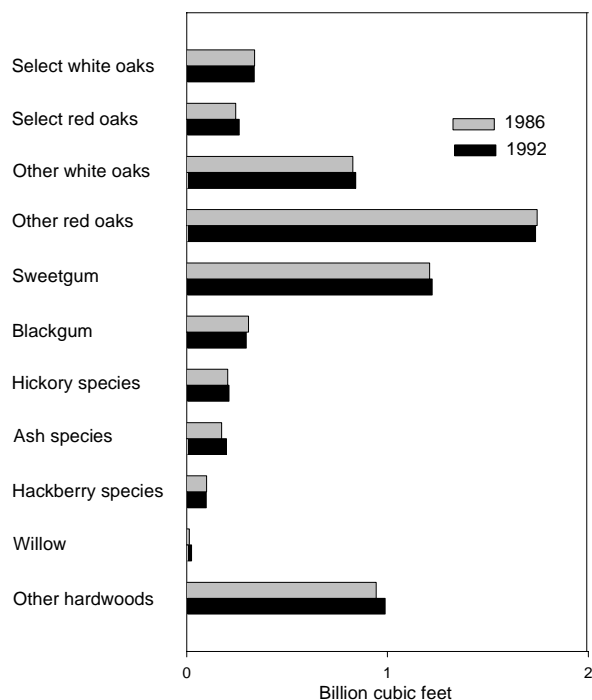


Figure 15—Hardwood live-tree volume by species, east Texas, 1986 and 1992.
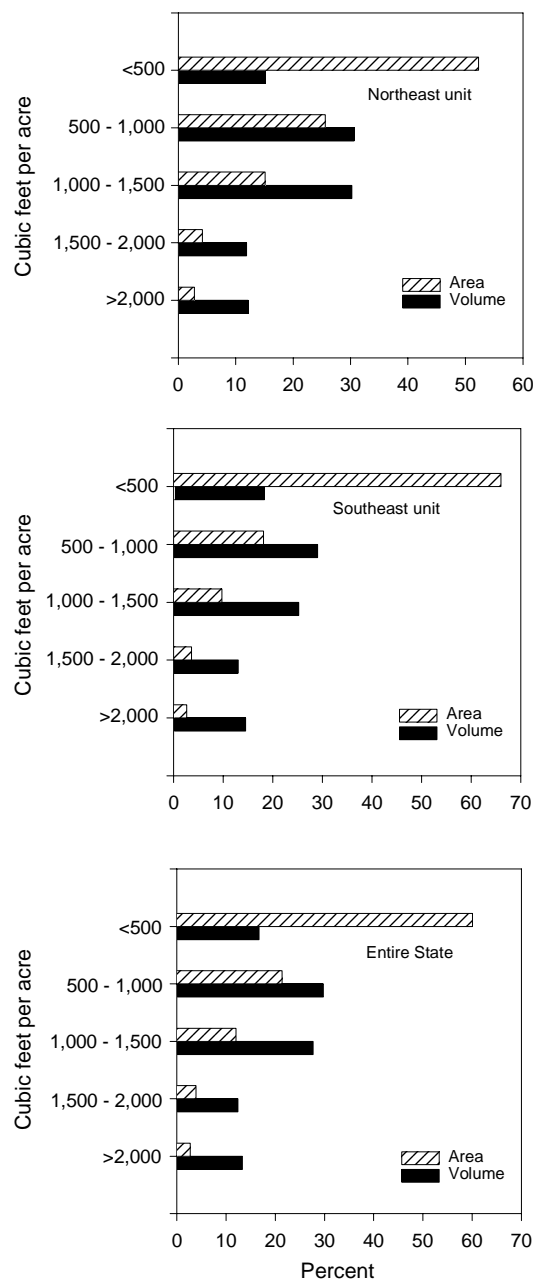


Figure 16—Timberland area and live-tree volume of hardwoods by stand-volume class, east Texas, 1992.

**Hardwood Sawtimber Volume**

East Texas hardwood sawtimber volume increased by 379.9 million board feet (2 percent). The 1992 inventory was 15,578.5 million board feet (table VII). Sawtimber volume was evenly distributed between the survey units, with the Southeast unit holding slightly more (approximately 827.7 million board feet). Noteworthy was the 425.6-million-board-feet increase in the Northeast unit.

The NIPF owners held 10,399.3 million board feet (67 percent) of the hardwood sawtimber resource (table VIII), forest industry held 4,024.9 million board feet (26 percent), and public ownership held 1,154.3 million board feet (only 8 percent). There was a 213.6-million-board-feet decrease in the forest industry resource. However, this was more than offset by 405.5, 125.5, and 62.5 million board feet increases in NIPF, national forest, and other public ownerships, respectively.

More than 60 percent of the timberland in east Texas had stand volumes of less than 1,000 board feet per acre (fig. 17). Very little timberland was in stands of more than 5,000 board feet per acre (less than 10 percent), although those stands included almost 40 percent of the total hardwood sawtimber volume. Therefore, it is possible that few stands will contain high-quality hardwoods, i.e., trees of large size and most contributing large amounts of sawtimber volume per acre.
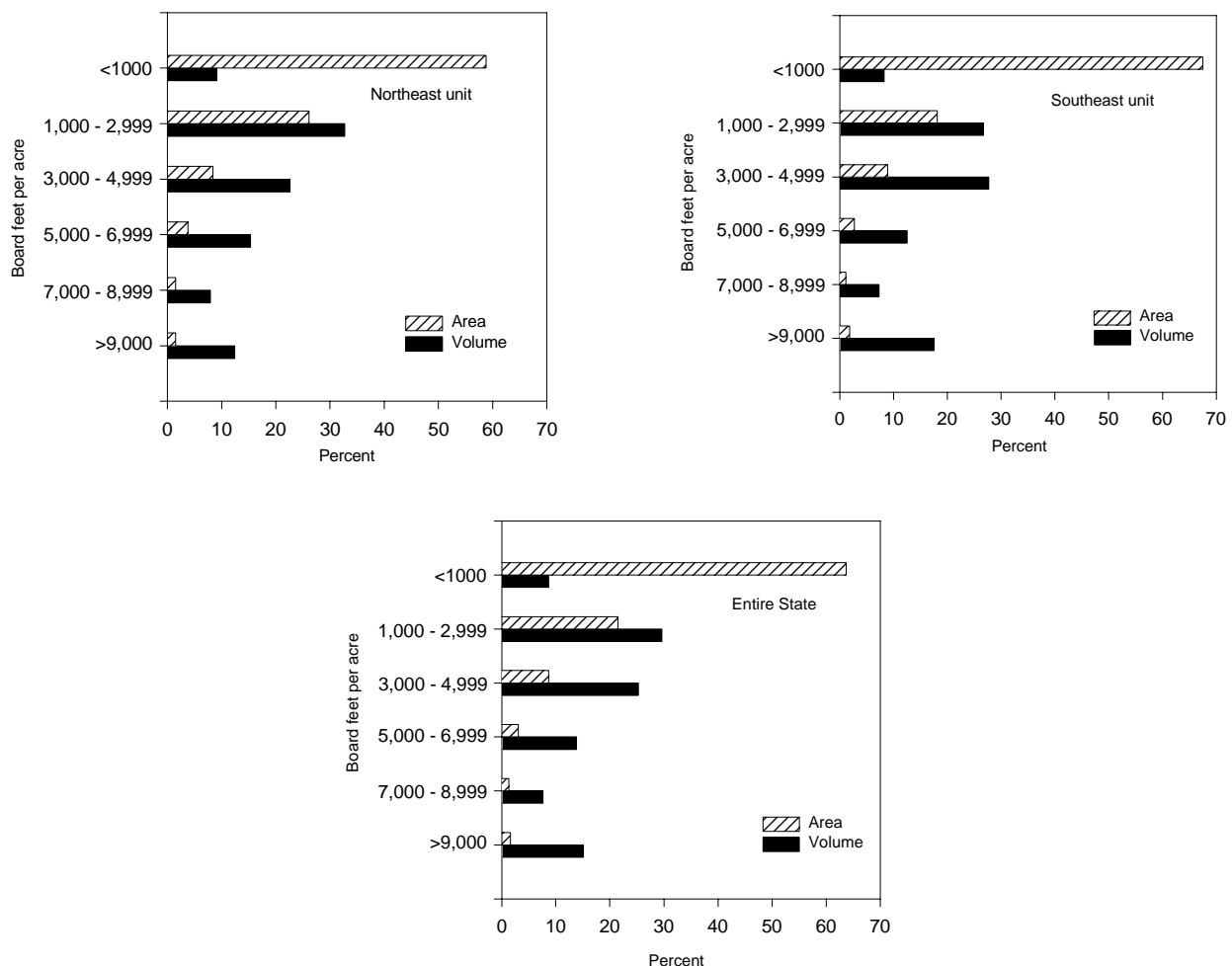


Figure 17—Timberland area and sawtimber volume of hardwoods by stand volume class, east Texas, 1992.

## Stand Structure

### Stand Size

Shifts and resulting trends in stand-size class can be complex. Some poletimber-size stands grew into sawtimber size, while some reverted to sapling-seedling stands through cutting. Likewise, some sawtimber-size stands may have reverted to poletimber size as a result of thinning, or to sapling-seedling size after a clearcut harvest. Many stands remained in the same stand-size class. However, many stands may shift into another size class without showing an increase or decrease in acreage among 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.

Most east Texas timberland was in sawtimber-size stands (fig. 18). Both survey units were dominated by sawtimber stands—2.3 million acres (46 percent) in the Northeast unit and 2.9 million acres (44 percent) in the Southeast unit. Poletimber-size stands were the smallest component at both the State and unit levels. Poletimber stands made up 1.2 million acres in the Northeast (24 percent) and 1.4 million acres in the Southeast (20 percent).
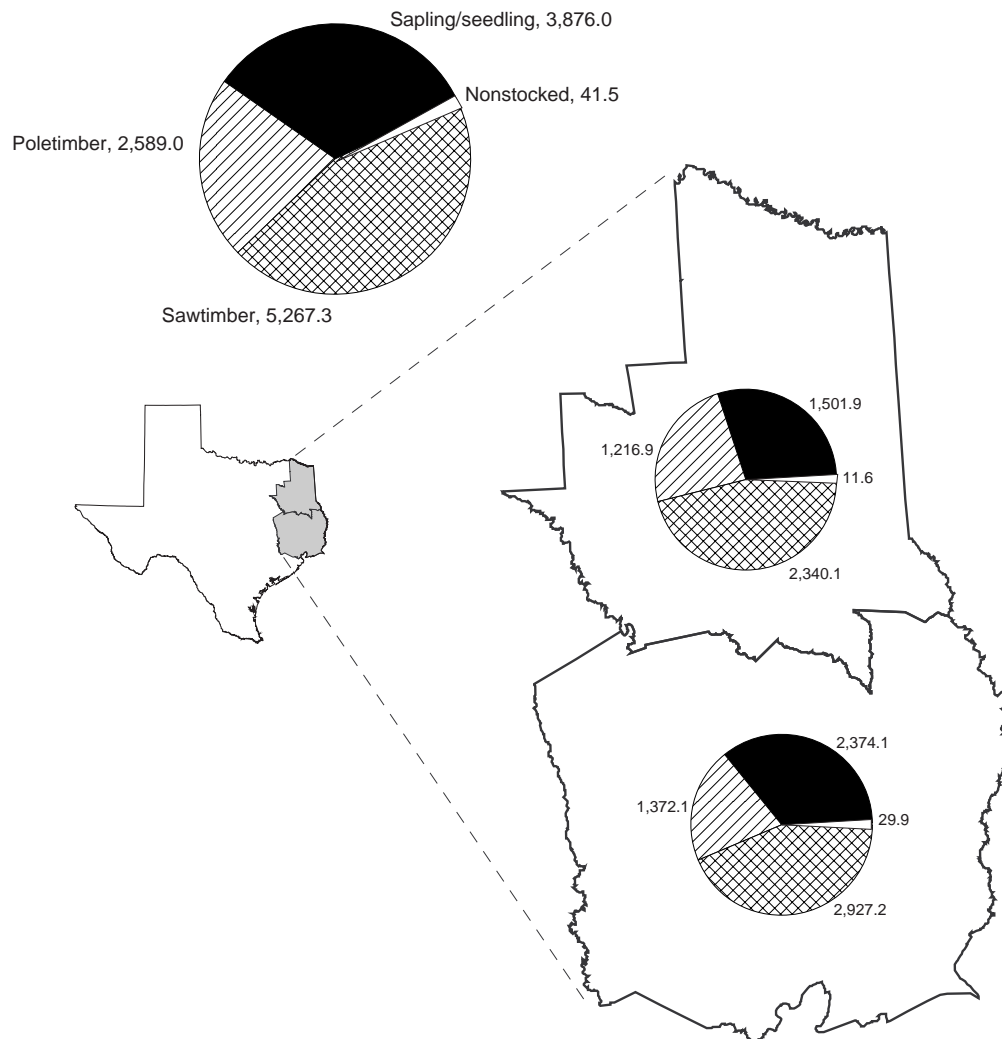


Figure 18—Proportion of timberland, in thousand acres, by stand-size class, east Texas, 1992.

Most of the sawtimber- and sapling-seedling-size stands were in the Southeast unit. Even with a 485,100-acre decline of sawtimber stands, the Southeast unit still had 587,100 acres more of that size class than the Northeast unit. Again, there were 872,200 acres more sapling-seedling-size stands in the Southeast unit. Substantial forestry activity continued in the Southeast unit, as evidenced by the 410,200-acre increase in sapling-seedling stands; this was in contrast to very little change in the Northeast unit.

The most dramatic shifts in stand size were a 485,100-acre decrease of sawtimber stands and a 410,200-acre increase in sapling-seedling stands in the Southeast unit (table IX). The single most important reason for such shifts would be harvesting activity, although shifts could also come from

natural causes, such as growth (stands growing into the next higher size class) and natural mortality from weather, pathogens, or insects (which may reduce stands to a smaller-size class).

Most of the decline in sawtimber stands was in forest industry ownership, 342,700 acres, with an additional 106,200 acres lost in NIPF (table X). No other large decreases occurred in the other two stand-size classes, with the exception of a 97,400-acre decrease in poletimber stands on NIPF lands. This partially offset the 226,500-acre increase in poletimber on forest industry land. The largest increase in any stand-size class was the sapling-seedling-size stands on NIPF. Here, 437,900 acres were added to the inventory.

Table IX.—*Change in timberland by forest survey unit and stand size, east Texas, 1986 to 1992\**

| Forest survey unit | Sawtimber | | Poletimber | | Sapling and seedling | | Nonstocked | |
|---|---|---|---|---|---|---|---|---|
| | Area | Change | Area | Change | Area | Change | Area | Change |
| | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |||||||||
| Northeast | 2,340.1 | 30.8 | 1,216.9 | 40.7 | 1,501.9 | 81.6 | 11.6 | 11.6 |
| Southeast | 2,927.2 | -485.1 | 1,372.1 | 100.0 | 2,374.1 | 410.2 | 29.9 | 13.1 |
| All units | 5,267.3 | -454.3 | 2,589.0 | 140.6 | 3,876.0 | 491.7 | 41.5 | 24.6 |

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

Table X.—*Change in timberland by ownership and stand size, east Texas, 1986 to 1992\**

| Ownership | Sawtimber | | Poletimber | | Sapling and seedling | | Nonstocked | |
|---|---|---|---|---|---|---|---|---|
| | Area | Change | Area | Change | Area | Change | Area | Change |
| | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |||||||||
| National forest | 423.4 | -34.3 | 45.1 | -3.0 | 108.2 | 3.8 | 0.0 | 0.0 |
| Other public | 110.7 | 28.9 | 43.8 | 14.6 | 46.4 | 4.7 | 5.9 | 5.9 |
| Forest industry | 1,158.3 | -342.7 | 877.1 | 226.5 | 1,677.7 | 45.3 | 6.5 | -5.1 |
| Nonindustrial private | 3,574.9 | -106.2 | 1,623.0 | -97.4 | 2,043.7 | 437.9 | 29.1 | 23.9 |
| All owners | 5,267.3 | -454.3 | 2,589.0 | 140.6 | 3,876.0 | 491.7 | 41.5 | 24.6 |

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

## Basal Area

The average basal area of all live trees in east Texas was 75.6 square feet per acre. Forty-four percent of basal area was in the softwood component and 56 percent was in the hardwood component. Structurally, softwood sawtimber and hardwood sawtimber contributed equally to total basal area, 25 and 23 percent, respectively. Interestingly, there was more basal-area contribution from the hardwood sapling-seedling component than from either the softwood poletimber or sapling-seedling components.

The average basal area on national forest lands was 97.9 square feet per acre, highest among all ownership classes.

Over half of that was in softwood sawtimber. The lowest basal area, 65.7 square feet per acre, was on forest industry land. This was expected because 1.7 million acres of their holdings were sapling-seedling-sized stands (table X). Slightly more basal area was in softwood poletimber than softwood sawtimber.

Stand basal area by diameter classes (all species and size classes combined) are illustrated in figure 19. Basal area increased in all but the 10- through 16-inch diameter classes. The most noteworthy decreases were in the 12-, 14-, and 16-inch diameter classes; noteworthy increases were in the 2-inch diameter class and the diameter classes made up of trees 24 inches and larger.
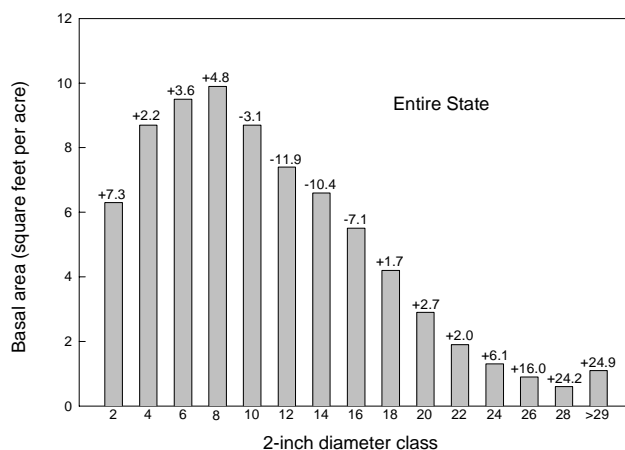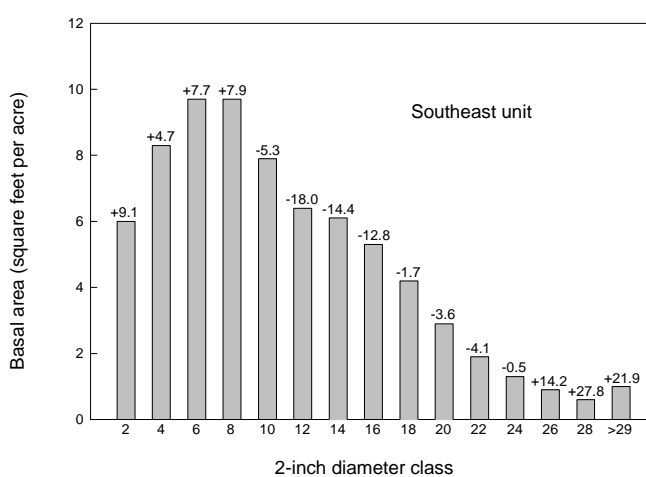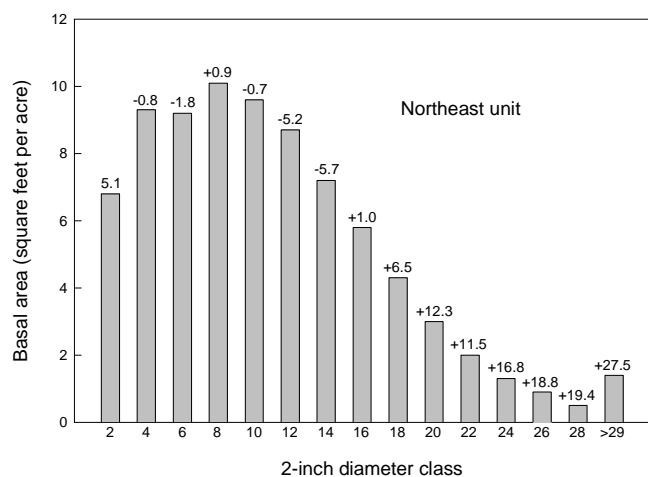


Figure 19—Basal area of all live trees by diameter class, east Texas, 1992. Numbers above the bars are percentage changes since the 1986 survey.

Trends and shifts in timberland area by stand basal-area classes are illustrated in tables XI through XVI. As with stand-size classes, the shifts in basal area also were complex. The largest shifts in area were an increase of 111,400 acres in the 0- to 20-square-feet-per-acre class in the Southeast unit and, in contrast, a 139,400-acre decrease in the 101- to 120-square-feet-per-acre class.

Forest industry ownership decreased by 177,300 acres in the 0- to 20-square-feet-per-acre class, and increased substantially in the 41- to 60-square-feet-per-acre and 121- to 140-square-feet-per-acre classes, 117,500 and 119,400 acres,

respectively (table XII). The NIPF ownership had a very large increase in the 0- to 20-square-feet-per-acre class— 323,400 acres, the largest shift of any ownership class, and a substantial increase in the greater than 140-square-feet-per-acre class—141,300 acres. Sizeable decreases occurred on NIPF ownership in the 81- to 100- and 41- to 60-square-feet-per-acre classes.

The most prominent change in stand-size class was in sawtimber stands in the 81- to 100-square-feet-per-acre basal-area class (table XIII), where 230,800 acres were lost. The area of 41- to 60- and 101- to 120-square-feet-per-acre classes of sawtimber stands also dropped.

Table XI.—*Area of timberland by forest survey unit and basal area class of live trees, east Texas, 1986 and 1992\**

| Forest survey unit | Basal area class (*Square feet per acre*) | | | | | | | | | | | | | | | |
| | >140 | | 121-140 | | 101-120 | | 81-100 | | 61-80 | | 41-60 | | 21-40 | | 0-20 | |
| | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 |
| | *Thousand acres* | | | | | | | | | | | | | | | |
| Northeast | 313.4 | 364.3 | 377.5 | 465.1 | 778.2 | 776.8 | 1,017.7 | 960.5 | 941.3 | 977.8 | 641.7 | 610.4 | 423.5 | 455.5 | 412.5 | 460.0 |
| Southeast | 304.5 | 402.6 | 593.2 | 624.6 | 984.3 | 844.9 | 1,170.1 | 1,107.8 | 1,233.5 | 1,136.1 | 757.5 | 841.7 | 686.0 | 698.1 | 936.2 | 1,047.6 |
| All units | 618.0 | 766.9 | 970.7 | 1,089.7 | 1,762.6 | 1,621.7 | 2,187.8 | 2,068.3 | 2,174.8 | 2,133.9 | 1,399.2 | 1,452.1 | 1,109.5 | 1,153.6 | 1,348.7 | 1,507.6 |

*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, east Texas, 1986 and 1992\**

| Ownership | Basal area class (*Square feet per acre*) | | | | | | | | | | | | | | | |
| | >140 | | 121-140 | | 101-120 | | 81-100 | | 61-80 | | 41-60 | | 21-40 | | 0-20 | |
| | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 |
| | *Thousand acres* | | | | | | | | | | | | | | | |
| Public | 83.0 | 111.1 | 163.4 | 136.6 | 168.8 | 117.7 | 108.6 | 149.3 | 108.9 | 86.7 | 45.1 | 76.4 | 30.5 | 38.2 | 54.7 | 67.5 |
| Forest industry | 155.0 | 134.5 | 196.8 | 316.2 | 484.7 | 423.6 | 611.4 | 577.8 | 577.6 | 592.2 | 402.4 | 519.9 | 424.0 | 388.7 | 944.0 | 766.7 |
| Nonindustrial private | 380.0 | 521.3 | 610.5 | 637.0 | 1,109.1 | 1,080.4 | 1,467.8 | 1,341.1 | 1,488.2 | 1,435.0 | 951.8 | 855.8 | 655.0 | 726.7 | 350.0 | 673.4 |
| All owners | 618.0 | 766.9 | 970.7 | 1,089.7 | 1,762.6 | 1,621.7 | 2,187.8 | 2,068.3 | 2,174.8 | 2,113.9 | 1,399.2 | 1,452.1 | 1,109.5 | 1,153.6 | 1,348.7 | 1,507.6 |

*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, east Texas, 1986 and 1992\**

| Size class | Basal area class (*Square feet per acre*) | | | | | | | | | | | | | | | |
| | ≥140 | | 121-140 | | 101-120 | | 81-100 | | 61-80 | | 41-60 | | 21-40 | | 0-20 | |
| | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 |
| | *Thousand acres* | | | | | | | | | | | | | | | |
| Sapling and seedling | 0.0 | 0.0 | 22.7 | 12.3 | 36.7 | 46.2 | 114.1 | 172.3 | 326.4 | 423.9 | 633.9 | 758.8 | 927.8 | 1,013.2 | 1,322.7 | 1,449.3 |
| Poletimber | 64.1 | 151.3 | 157.6 | 285.4 | 438.2 | 387.2 | 628.4 | 681.4 | 721.3 | 640.3 | 345.3 | 364.0 | 87.2 | 68.9 | 6.3 | 10.5 |
| Sawtimber | 553.9 | 615.6 | 790.4 | 792.0 | 1,287.7 | 1,188.3 | 1,445.3 | 1,214.5 | 1,127.1 | 1,049.7 | 420.1 | 329.4 | 94.4 | 71.6 | 2.8 | 6.2 |
| 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 | 16.8 | 41.5 |
| All classes | 618.0 | 766.9 | 970.7 | 1,089.7 | 1,762.6 | 1,621.7 | 2,187.8 | 2,068.3 | 2,174.8 | 2,113.9 | 1,399.2 | 1,452.1 | 1,109.5 | 1,153.6 | 1,348.7 | 1,507.6 |

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

Most of the substantial basal-area shifts were in the loblolly-shortleaf pine forest-type group, although there was a 119,600-acre decrease in the 81- to 100-square-feet-per-acre basal-area class of the oak-hickory forest-type group (table XIV). Something that stood out in the forest-type group strata was the proportion of loblolly-shortleaf pine forest-type group stands in the higher basal-area classes. Sixty-six percent of timberland in the highest basal-area class was in the loblolly-shortleaf pine forest-type group; additionally, 54 percent of the area of this type was in the 121- to 140-square feet per acre basal-area class.

The live-tree volume on east Texas timberland was most obvious in the higher basal-area classes. Volume was evenly distributed among the 61- to 80-square-feet-per-acre and higher basal-area classes. Predictably, little volume was in the lower basal-area classes (tables XV and XVI). Substantial shifts in live-tree volume strata occurred in the higher basal-area classes. Decreases of 235.1 million cubic feet and 295.2 million cubic feet were noted in the 81- to 100- and 101- to 120-square-feet-per-acre classes, respectively. In contrast, increases of 287.3 million cubic feet and 431.9 million cubic feet occurred in the 121- to 140- and more than 140-square-feet-per-acre basal-area classes, respectively (table XV). A similar pattern was observed in sawtimber volume (table XVI).

Table XIV.—*Area of timberland by forest type group and basal area class of live trees, east Texas, 1986 and 1992**

| | Basal area class (*Square feet per acre*) | | | | | | | | | | | | | | | |
| | >140 | | 121-140 | | 101-120 | | 81-100 | | 61-80 | | 41-60 | | 21-40 | | 0-20 | |
| Forest type group | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | | | | | | | | |
| Longleaf-slash | 0.0 | 9.8 | 15.9 | 22.5 | 68.3 | 20.5 | 63.7 | 36.7 | 43.1 | 78.3 | 51.5 | 28.8 | 34.5 | 24.0 | 11.4 | 11.6 |
| Loblolly-shortleaf | 396.4 | 502.7 | 582.3 | 585.5 | 745.9 | 643.9 | 671.2 | 603.0 | 617.3 | 613.4 | 333.2 | 424.0 | 243.0 | 283.0 | 379.1 | 409.1 |
| Oak-pine | 93.6 | 111.1 | 193.0 | 229.6 | 373.0 | 380.3 | 430.2 | 476.3 | 433.5 | 387.9 | 265.2 | 325.2 | 252.9 | 265.0 | 334.6 | 326.7 |
| Oak-hickory | 51.7 | 18.7 | 85.1 | 110.3 | 318.8 | 282.0 | 606.4 | 486.8 | 736.7 | 672.2 | 567.0 | 494.3 | 439.2 | 441.9 | 565.2 | 621.0 |
| Oak-gum-cypress[†] | 76.3 | 124.6 | 94.4 | 141.8 | 256.6 | 294.9 | 416.3 | 465.4 | 344.2 | 362.0 | 182.3 | 179.9 | 139.8 | 139.8 | 41.6 | 97.7 |
| Nontyped | 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 | 16.8 | 41.5 |
| All types | 618.0 | 766.9 | 970.7 | 1,089.7 | 1,762.6 | 1,621.7 | 2,187.8 | 2,068.3 | 2,174.8 | 2,113.9 | 1,399.2 | 1,452.1 | 1,109.5 | 1,153.6 | 1,348.7 | 1,507.6 |

*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, east Texas, 1986 and 1992**

| | Basal area class (*Square feet per acre*) | | | | | | | | | | | | | | | |
| | >140 | | 121-140 | | 101-120 | | 81-100 | | 61-80 | | 41-60 | | 21-40 | | 0-20 | |
| Forest survey unit | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - *Million cubic feet* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | | | | | | | | |
| Northeast | 939.8 | 1,140.3 | 808.8 | 1,004.3 | 1,387.7 | 1,385.1 | 1,224.0 | 1,172.5 | 799.6 | 897.6 | 352.7 | 329.8 | 121.6 | 138.2 | 28.8 | 30.1 |
| Southeast | 1,041.7 | 1,273.1 | 1,445.0 | 1,536.8 | 1,979.1 | 1,686.5 | 1,825.9 | 1,642.3 | 1,370.8 | 1,191.2 | 527.3 | 517.8 | 224.8 | 215.1 | 54.9 | 68.3 |
| All units | 1,981.5 | 2,413.4 | 2,253.8 | 2,541.1 | 3,366.8 | 3,071.6 | 3,049.9 | 2,814.8 | 2,170.4 | 2,088.7 | 880.0 | 847.6 | 346.3 | 353.3 | 83.7 | 98.5 |

*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, east Texas, 1986 and 1992**

| | Basal area class (*Square feet per acre*) | | | | | | | | | | | | | | | |
| | >140 | | 121-140 | | 101-120 | | 81-100 | | 61-80 | | 41-60 | | 21-40 | | 0-20 | |
| Forest survey unit | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 | 1986 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - *Million board feet*[†] - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | | | | | | | | |
| Northeast | 3,860.4 | 4,696.9 | 3,135.0 | 3,620.5 | 4,988.0 | 5,008.4 | 3,815.1 | 3,357.2 | 2,161.3 | 2,534.2 | 847.2 | 716.3 | 209.4 | 271.9 | 39.8 | 57.4 |
| Southeast | 4,700.8 | 5,512.1 | 6,076.8 | 6,122.6 | 7,854.0 | 6,560.9 | 6,800.8 | 5,868.2 | 4,847.6 | 4,013.9 | 1,593.2 | 1,541.9 | 648.5 | 659.4 | 102.2 | 169.8 |
| All units | 8,561.3 | 10,209.0 | 9,211.8 | 743.1 | 12,842.0 | 11,569.3 | 10,615.9 | 9,225.4 | 7,008.9 | 6,548.0 | 2,440.4 | 2,258.2 | 857.9 | 931.3 | 141.9 | 227.2 |

*Numbers in columns may not sum to totals due to rounding.
[†]International 1/4-inch rule.

## Species Distribution

The spatial distribution of six important softwoods is shown in figure 20. Longleaf and slash pines were restricted to the Southeast portion of the survey area where conditions were most favorable for these two species. Loblolly and shortleaf pines had a broader ecological amplitude and were distrib- uted widely across the survey area. Loblolly pine seemed to thrive further north and south than shortleaf pine. Eastern redcedar had an affinity for the western and northwestern portions of the survey area. Limited rainfall and harsh soil conditions favored the survival of this species further west in Texas.



Figure 20—Distribution of six important softwoods, east Texas, 1992. Each dot represents 5,000,000 cubic feet, except for eastern redcedar where each dot represents 500,000 cubic feet.

Six important oaks are shown in figure 21. Water oak and southern red oak exhibited the most even distribution throughout the two survey units. White oak and cherrybark oak favored the eastern part of the region. Willow oak seemed to favor conditions in the northern part of the survey region. Post oak showed a wide distribution but, as expected, had increasing densities toward the west. None of these oak species showed a strong affinity for the extreme southern coastal region.

White oak

Southern red oak

Cherrybark oak

Water oak

Willow oak

Post oak

Figure 21—Distribution of six important oaks, east Texas, 1992. Each dot represents 500,000 cubic feet.

## Species Importance

In terms of volume of all live trees 1.0 inch or more in d.b.h., loblolly pine was the number one species in east Texas. It was clearly dominant, having three times more volume than the number two ranked species—shortleaf pine (table XVIIa). The highest ranked hardwood was sweetgum, followed by water oak, post oak, and southern red oak. To illustrate the overwhelming dominance of loblolly pine and shortleaf pine in east Texas forests, the volume of water oak, post oak, and southern red oak, together, barely equaled the volume of shortleaf pine. It would take 15 of the next highest ranked species to equal loblolly pine and 43 species to equal loblolly and shortleaf pine combined.

Table XVIIa.—*Ranking of tree species\* (by volume) for each forest survey unit and the State, east Texas, 1992*

| State | | | |
|---|---|---|---|
| Species | Volume† | Species | Volume† |
| Loblolly pine | 6,245.3 | Southern magnolia | 20.8 |
| Shortleaf pine | 2,054.7 | Common persimmon | 20.8 |
| Sweetgum | 1,538.9 | Black cherry | 19.5 |
| Water oak | 848.2 | Redbay | 17.8 |
| Post oak | 798.7 | Honey locust | 17.7 |
| Southern red oak | 594.0 | Nuttall oak | 17.2 |
| Winged elm | 340.2 | Bitternut hickory | 16.6 |
| Willow oak | 315.1 | Water-elm | 14.4 |
| White oak | 312.5 | Florida maple | 13.3 |
| Blackgum | 309.8 | Boxelder | 13.0 |
| Slash pine | 275.9 | Pecan | 12.1 |
| Cherrybark oak | 265.8 | Water locust | 11.0 |
| Green ash | 173.1 | Red mulberry | 10.9 |
| Red maple | 145.8 | Plums and cherries‡ | 10.4 |
| Overcup oak | 133.3 | Eastern redbud | 9.8 |
| Sugarberry | 133.2 | Sparkleberry | 8.8 |
| Laurel oak | 133.0 | Black walnut | 7.5 |
| Baldcypress | 117.4 | American basswood | 7.4 |
| Longleaf pine | 109.0 | Osage-orange | 6.9 |
| American hornbeam | 106.4 | Chittamwoods | 6.8 |
| Mockernut hickory | 100.6 | Pignut hickory | 5.2 |
| Black hickory | 100.1 | Other species§ | 3.6 |
| American elm | 93.4 | Black locust | 3.5 |
| Cedar elm | 85.4 | Shellbark hickory | 2.9 |
| Eastern hophornbeam | 81.9 | Shagbark hickory | 2.3 |
| Eastern redcedar | 81.1 | Hackberry | 2.3 |
| Blackjack oak | 77.9 | Sugar maple | 1.7 |
| White ash | 73.8 | Live oak | 1.7 |
| Flowering dogwood | 70.5 | Chinaberry | 1.3 |
| Chinese tallowtree | 61.2 | Cucumbertree | 1.0 |
| Water hickory | 58.1 | Chinkapins | 0.8 |
| Swamp chestnut oak | 56.9 | Turkey oak | 0.7 |
| American holly | 55.9 | Swamp white oak | 0.6 |
| American beech | 55.1 | Catalpa | 0.6 |
| Black oak | 51.8 | Chinkapin oak | 0.5 |
| Sweetbay | 49.9 | Sourwood | 0.4 |
| Water tupelo | 49.6 | Chestnut oak | 0.4 |
| Slippery elm | 45.6 | Durand oak | 0.3 |
| River birch | 45.4 | Scarlet oak | 0.3 |
| Hickory spp. | 43.8 | Swamp tupelo | 0.2 |
| Hawthorn spp. | 40.4 | White mulberry | 0.2 |
| Sassafras | 38.2 | Bur oak | 0.1 |
| Willow | 33.2 | Allegheny chinkapin | 0.1 |
| Cottonwood | 28.0 | Silver maple | 0.1 |
| Bluejack oak | 27.5 | White basswood | ¶ |
| American sycamore | 25.7 | Serviceberries | ¶ |
| Shumard oak | 24.5 | Pin oak | ¶ |

\*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 than black cherry.
§Other species includes noncommercial and unidentified species.
¶Volume greater than 0.0 but less than 0.1 million cubic feet.

Analysis of the individual survey units showed that rankings were somewhat different, but the relative dominance of loblolly and shortleaf pines changed substantially. In the Northeast unit, loblolly pine and shortleaf pine maintained their dominance over other species but not as strongly (table XVIIb). There, loblolly pine made up 60 percent of the

combined volume of these two pines versus 84 percent in the Southeast unit (table XVIIc). Loblolly pine was clearly a much stronger dominant in the Southeast unit. This unit contained 69 percent of loblolly pine volume. Slash pine was of minor importance in the Northeast unit. Longleaf pine had very minor importance in the Northeast unit and was near the bottom of the ranking.

Table XVIIb.—*Ranking of tree species\* (by volume) for each forest survey unit and the State, east Texas, 1992*

| **Northeast Unit** | | | |
|---|---|---|---|
| Species | Volume[†] | Species | Volume[†] |
| Loblolly pine | 1,913.1 | Shumard oak | 10.9 |
| Shortleaf pine | 1,259.3 | Florida maple | 10.6 |
| Sweetgum | 819.1 | Boxelder | 10.3 |
| Post oak | 443.3 | Water-elm | 9.9 |
| Southern red oak | 350.3 | Red mulberry | 8.5 |
| Water oak | 345.4 | Eastern redbud | 7.5 |
| Winged elm | 203.5 | Plums and cherries[‡] | 6.4 |
| Willow oak | 189.1 | American beech | 6.2 |
| White oak | 162.9 | American holly | 6.0 |
| Blackgum | 118.2 | Laurel oak | 5.9 |
| Green ash | 104.1 | Osage-orange | 5.6 |
| Cherrybark oak | 95.2 | Black walnut | 5.3 |
| Overcup oak | 93.0 | American sycamore | 5.1 |
| Sugarberry | 75.9 | Pignut hickory | 5.1 |
| Red maple | 70.0 | Water locust | 4.1 |
| Black hickory | 64.4 | Black locust | 3.5 |
| Baldcypress | 60.3 | Pecan | 3.4 |
| Eastern redcedar | 53.6 | Sparkleberry | 3.3 |
| Cedar elm | 52.7 | Chinese tallowtree | 2.8 |
| Blackjack oak | 51.8 | Nuttall oak | 2.4 |
| Mockernut hickory | 51.5 | Shellbark hickory | 2.2 |
| American elm | 49.7 | Swamp chestnut oak | 1.9 |
| American hornbeam | 45.9 | American basswood | 1.9 |
| Black oak | 44.8 | Chittamwoods | 1.8 |
| Flowering dogwood | 42.4 | Sweetbay | 1.5 |
| White ash | 39.1 | Other species[§] | 1.4 |
| Eastern hophornbeam | 38.9 | Chinaberry | 1.1 |
| River birch | 35.6 | Shagbark hickory | 1.0 |
| Slash pine | 33.6 | Longleaf pine | 0.8 |
| Hickory spp. | 32.0 | Chinkapins | 0.8 |
| Slippery elm | 27.7 | Turkey oak | 0.7 |
| Sassafras | 26.3 | Hackberry | 0.7 |
| Cottonwood | 25.4 | Swamp white oak | 0.6 |
| Water hickory | 22.2 | Chinkapin oak | 0.5 |
| Bluejack oak | 18.7 | Sourwood | 0.4 |
| Bitternut hickory | 15.2 | Sugar maple | 0.2 |
| Willow | 14.8 | Southern magnolia | 0.2 |
| Hawthorn spp. | 14.4 | White mulberry | 0.2 |
| Common persimmon | 12.9 | Bur oak | 0.1 |
| Black cherry | 12.6 | Allegheny chinkapin | [¶] |
| Honey locust | 11.6 | | |

\*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 than black cherry.
[§]Other species includes noncommercial and unidentified species.
[¶]Volume greater than 0.0 but less than 0.1 million cubic feet.

The more dominant hardwoods showed no strong affinities for either survey unit. Sweetgum maintained its third-place ranking in both units. Post oak surpassed water oak in the Northeast unit. Similar occurrences were found in the top 10 ranked hardwoods in both survey units. Sweetgum, post oak, southern red oak, water oak, winged elm, willow oak, blackgum, and cherrybark oak were all common. Differences were in the occurrence of white oak and green ash in the Northeast unit's top 10 and laurel oak in the Southeast unit's top 10.

Table XVIIc.—*Ranking of tree species\* (by volume) for each forest survey unit and the State, east Texas, 1992*

| Southeast Unit | | | |
|---|---|---|---|
| Species | Volume† | Species | Volume† |
| Loblolly pine | 4,332.2 | Hickory spp. | 11.8 |
| Shortleaf pine | 795.4 | River birch | 9.8 |
| Sweetgum | 719.7 | Bluejack oak | 8.8 |
| Water oak | 502.7 | Pecan | 8.6 |
| Post oak | 355.5 | Common persimmon | 7.9 |
| Southern red oak | 243.7 | Black oak | 7.0 |
| Slash pine | 242.3 | Black cherry | 6.9 |
| Blackgum | 191.5 | Water locust | 6.9 |
| Cherrybark oak | 170.6 | Honey locust | 6.0 |
| White oak | 149.6 | American basswood | 5.5 |
| Winged elm | 136.7 | Sparkleberry | 5.5 |
| Laurel oak | 127.1 | Chittamwoods | 5.0 |
| Willow oak | 126.0 | Water-elm | 4.5 |
| Longleaf pine | 108.1 | Plums and cherries‡ | 4.0 |
| Red maple | 75.8 | Boxelder | 2.7 |
| Green ash | 69.1 | Florida maple | 2.7 |
| American hornbeam | 60.5 | Cottonwood | 2.6 |
| Chinese tallowtree | 58.4 | Red mulberry | 2.4 |
| Sugarberry | 57.3 | Eastern redbud | 2.4 |
| Baldcypress | 57.1 | Black walnut | 2.3 |
| Swamp chestnut oak | 55.0 | Other species§ | 2.2 |
| American holly | 49.9 | Live oak | 1.7 |
| Water tupelo | 49.6 | Hackberry | 1.6 |
| Mockernut hickory | 49.1 | Sugar maple | 1.5 |
| American beech | 48.9 | Bitternut hickory | 1.4 |
| Sweetbay | 48.4 | Osage-orange | 1.3 |
| American elm | 43.7 | Shagbark hickory | 1.3 |
| Eastern hophornbeam | 43.0 | Cucumbertree | 1.0 |
| Overcup oak | 40.3 | Shellbark hickory | 0.7 |
| Water hickory | 35.9 | Catalpa | 0.6 |
| Black hickory | 35.7 | Chestnut oak | 0.4 |
| White ash | 34.7 | Durand oak | 0.3 |
| Cedar elm | 32.7 | Scarlet oak | 0.3 |
| Flowering dogwood | 28.2 | Swamp tupelo | 0.2 |
| Eastern redcedar | 27.5 | Pignut hickory | 0.2 |
| Blackjack oak | 26.1 | Chinaberry | 0.2 |
| Hawthorn spp. | 26.0 | Allegheny chinkapin | 0.1 |
| American sycamore | 20.6 | Silver maple | 0.1 |
| Southern magnolia | 20.6 | White basswood | ¶ |
| Willow | 18.4 | Serviceberries | ¶ |
| Slippery elm | 17.9 | Pin oak | ¶ |
| Redbay | 17.8 | Chinkapin oak | ¶ |
| Nuttall oak | 14.8 | Swamp white oak | ¶ |
| Shumard oak | 13.6 | White mulberry | ¶ |
| Sassafras | 11.9 | Sourwood | ¶ |

\*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 than black cherry.
§Other species includes noncommercial and unidentified species.
¶Volume greater than 0.0 but less than 0.1 million cubic feet.

**Change in Number of Trees**

Notable changes in the number of trees by diameter class occurred in east Texas forests (fig. 22). As expected, these changes tracked fairly closely with changes in volume by diameter class (figs. 9, 14) and basal-area trends by diameter class (fig. 19).

Analysis of figure 22 shows three distinct phases of diameter classes for softwoods: an increase in 2- through 8-inch diameter classes, little change or decreases in the 10- through 22-inch classes, and increases in the 24-inch and larger classes. Two impacts were expected based on this trend. First, adequate immature softwoods were available to replace the declines in mid-diameter class ranges. Second, declines in the mid-diameter ranges meant fewer opportunities for quality softwoods to move into the larger size classes, because there was a high probability that the higher quality softwoods would be harvested. The analysis did not consider the impact that certain stands, e.g., the national forest stands with their higher basal areas and larger trees, have on data presented in figure 22. Such stands may heavily influence the larger diameter classes.
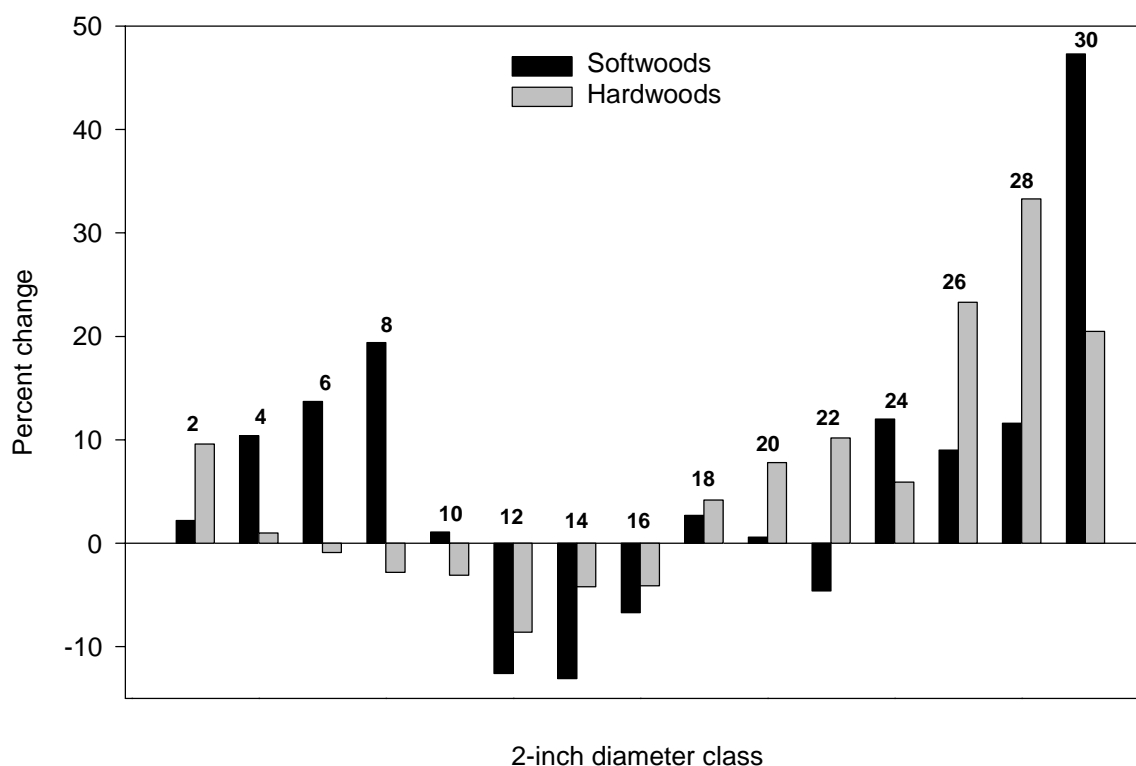


Figure 22—Percentage change in number of live trees between 1986 and 1992, east Texas.

Hardwood and softwood trends differed. Hardwoods usually show prolific sprouting regeneration (after harvest), as illustrated by the 2-inch diameter class. However, stand treatments favoring softwoods can reduce the numbers of hardwood over time. This fact, combined with harvesting of the 8- through 16-inch diameter classes, probably caused the decline in hardwood numbers. As with softwoods, dwindling numbers in the mid-diameter ranges meant fewer hardwoods would be available to grow into larger size classes. This is especially important for hardwood quality because trees cannot qualify for tree grade 1 until they are at least 16 inches in d.b.h.

Figures 23 and 24 illustrate compositional changes in stands between the survey periods. Conservationists are concerned that many hardwood stands will be converted to pine stands over time, especially after harvest. Figure 23 contains all of east Texas timberland whereas figure 24 includes only upland timberland. Bottomland hardwoods affected only the acres in the 65-percent and higher hardwood classes. Both figures are shown to illustrate this impact of bottomland hardwoods—areas where pines are not normally planted.

Proportion of stand in hardwoods (percent)

| 95 | 85 | 75 | 65 | 55 | 45 | 35 | 25 | 15 | 5 |

Proportion of stand in softwoods (percent)

| 5 | 3,405.9 (3,160.2) |
| 15 | 911.0 (894.4) |
| 25 | 757.6 (878.1) |
| 35 | 731.8 (762.6) |
| 45 | 856.3 (727.7) |
| 55 | 760.6 (925.6) |
| 65 | 773.7 (749.7) |
| 75 | 982.4 (877.5) |
| 85 | 948.5 (890.5) |
| 95 | 1,261.0 (1,308.3) |
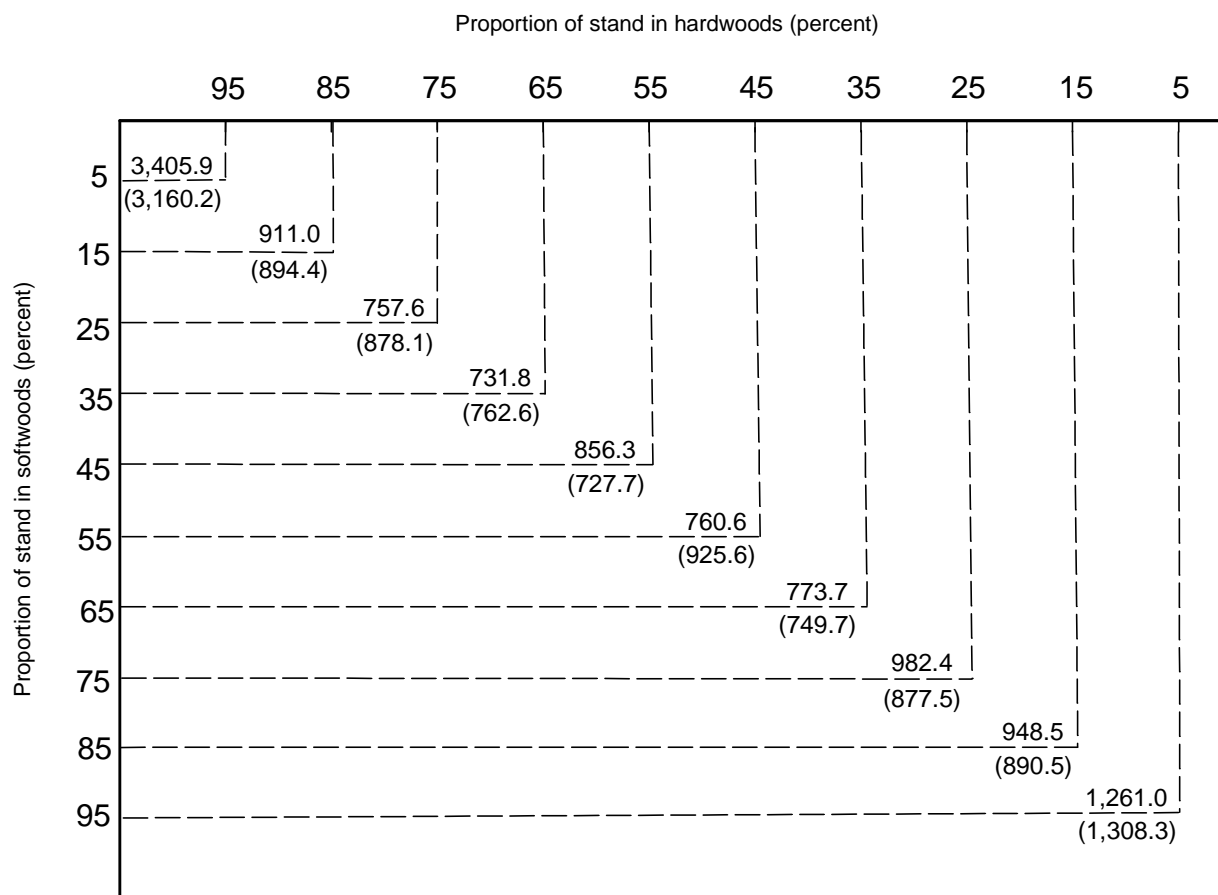
Figure 23—Area of timberland by proportion of stand in softwoods and hardwoods, east Texas, 1992. The percentage values are the midpoints of the deciles. Thus, 85 percent includes values greater than or equal to 80 percent but less than 90 percent. Area is in thousand acres; the acreage enclosed in parentheses is from the 1986 survey. Proportions are based on basal area, and only stands with trees greater than or equal to 1.0 inch in diameter at breast height are included.

There was an increase in stands composed of 95-percent hardwoods. Most of this was due to the bottomland component—3.4 million acres in figure 23 versus 2.0 million acres in figure 24. The increase was 245,700 acres when all timberland was considered and 67,400 acres when only upland stands were considered (fig. 24). There has been concern that timber management favors pines to the exclu-

sion of hardwoods. The area of timberland composed of more than 90 percent softwoods decreased 52,800 acres. However, the area of timberland with stands composed of more than 60 percent but less than 90 percent softwoods increased slightly in each class (fig. 24). The increase equaled 169,500 acres for all three percentile classes (65, 75, and 85 percentiles).



Proportion of stand in hardwoods (percent)
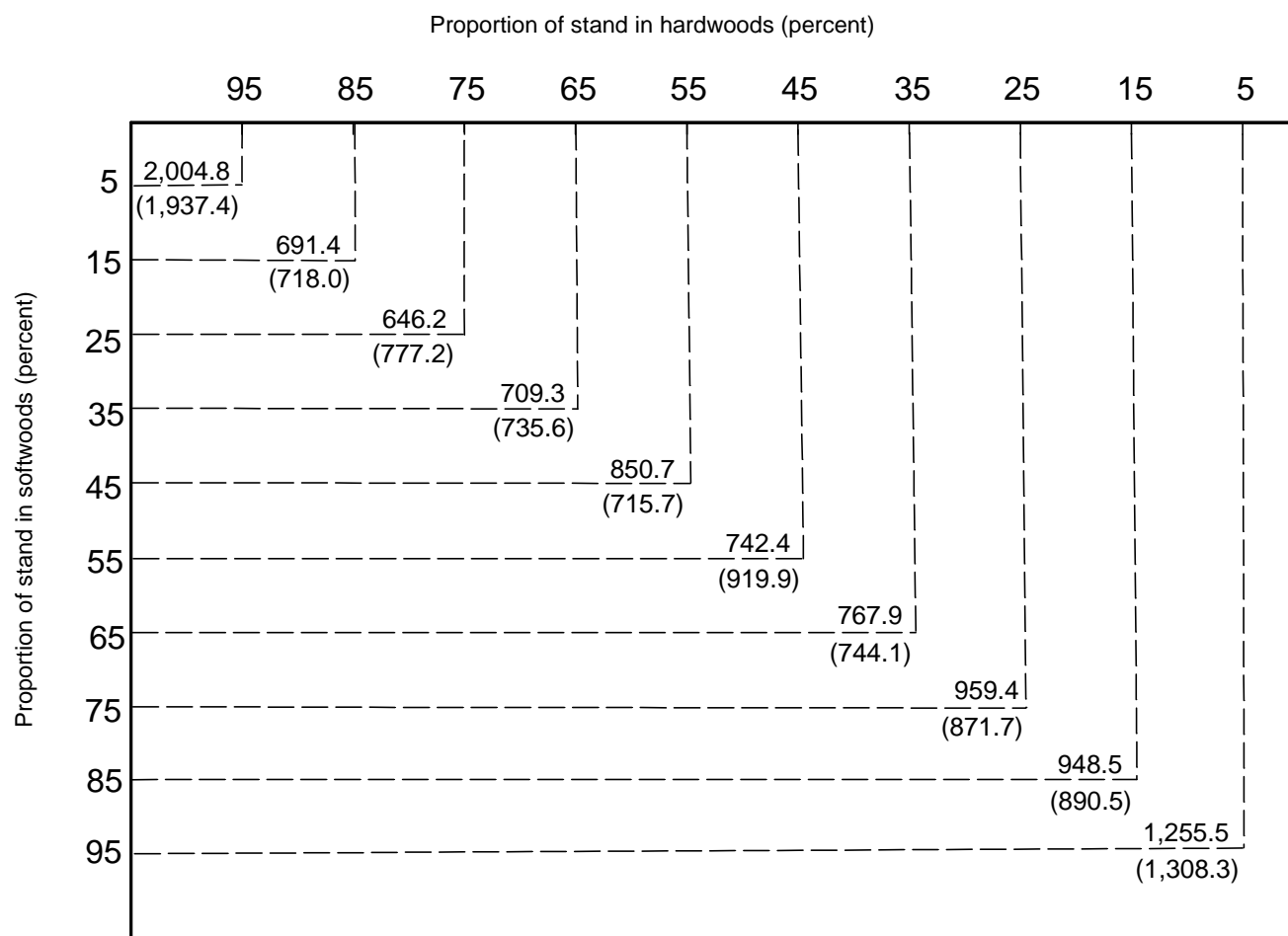
Figure 24—Area of upland timberland by proportion of stand in softwoods and hardwoods, east Texas, 1992. The percentage values are the midpoints of the deciles. Thus, 85 percent includes values greater than or equal to 80 percent but less than 90 percent. Area is in thousand acres; the acreage enclosed in parentheses is from the 1986 survey. Proportions are based on basal area, and only upland stands with trees greater than or equal to 1.0 inch in diameter at breast height are included.

## Growth, Removals, and Mortality

In the forest survey of east Texas, three major components of change in the timber inventory were monitored: growth, removals, and mortality. Complex interactions among these components resulted in a decrease or increase in inventory. Because of the dynamic nature of these components, estimates were given as the periodic annual average, i.e., the average over the survey period and not over the life of the trees being sampled (see Inventory Methods in the appendix for methodology).

One problem with successive large-scale forest surveys is in getting the volume of the initial survey (survey at time 1), plus growth (the growth between the initial survey and the second survey), to equal the volume of the second survey. A portion of this problem was corrected by using a plot-growth method described by Van Deusen and others (1986). However, this resolved only the problem inherent with variable-radius plot sampling (see Inventory Methods in the appendix).

The second portion of the growth balance problem concerns the assignment of the area weighting factor (commonly called the expansion factor). The expansion factor is the amount of timberland area that each 3- by 3-mile sample plot represents. Multiplying the per acre estimate of volume (or growth, removals, mortality) by the expansion factor expands the estimate to the number of timberland acres the plot represents. However, a problem occurs when the plot population (number of sample plots) of the initial survey differs substantially from the plot population of the second survey. This is usually a result of plots diverting (from forest to nonforest) or reverting (from nonforest to forest) since the initial survey. If this happens, the magnitude of the difference between expansion factors for the initial and second surveys becomes very large. Therefore, because these expansion factors (labeled resurveyed expansion factor for time-1 growth and expansion factor for time-2 volume) differ widely (depending on how different the plot populations are), it is not possible to balance the growth of the initial survey inventory with the inventory of the second survey.

Currently, there is not a solution for this type of imbalance problem. Manipulating expansion factors to solve the growth imbalance problem would create imbalance problems when the plot populations do not change substantially between surveys. The expansion factor problem occurs regardless of the sample plot design, be it variable radius or fixed area.

Fortunately, the growth imbalance for east Texas was negligible. Even so, the following documentation is offered. The time-2 volume derived by growing the initial survey volume is computed by the following formula:

$$
\begin{aligned}
\text{time-2 volume} = \ & \text{volume at time 1} \\
& + (\text{annual volume of net growth} \\
& \times \text{elapsed time}) \\
& - (\text{annual volume of removals} \\
& \times \text{elapsed time}) \, .
\end{aligned}
$$

This derived time-2 volume is compared with the new volume from the time-2 inventory. Any difference is considered an imbalance. The average elapsed time for the survey was 6.58 years (for plots that were forested at time 1 and time 2). For example, total live-tree volume for time 2 (computed by growth) was:

$$
\begin{aligned}
\text{time-2 volume} = \ & 14{,}132.6 + (192.8 \times 6.58) \\
& - (688.4 \times 6.58) \\
= \ & 14{,}216.8 \text{ million cubic feet} \, .
\end{aligned}
$$

Comparing this with the new inventory (14,229.0 million cubic feet) resulted in a difference of 12.2 million cubic feet, a minus 0.09-percent imbalance. This would be considered a very close balance. The growth imbalance for softwoods and hardwoods was minus 0.76 and plus 0.33 percent, respectively.

## Softwoods

Gross growth for all live trees was 566.5 million cubic feet per year. Net growth (gross growth minus mortality) was 508.3 million cubic feet per year. Sixty-one percent of gross growth was in the Southeast unit (table XVIII), mostly on NIPF land, where gross growth averaged 307.3 million cubic feet per year (54 percent). Timber on forest industry land contributed 36 percent of growth, while that on public lands contributed about 10 percent (table XIX). A total of 186.2

Table XVIII.—*Components of annual change in the volume of live trees by forest survey unit and species group, east Texas, 1986 to 1992\**

| Forest survey unit | Species group | Growth component | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Survivor growth† | Ingrowth‡ | Growth on removals | Growth on mortality | Mortality | Timberland removals | Land-clearing removals | Net change§ |
| | | - - - - - - - - - - - - - - - - - - - - - - - - - - *Million cubic feet* - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | |
| Northeast | | | | | | | | | |
| | Softwood | 155.4 | 31.1 | 27.1 | 4.7 | 23.3 | 156.8 | 8.0 | 30.2 |
| | Hardwood | 104.7 | 19.2 | 10.3 | 4.5 | 31.6 | 73.2 | 8.0 | 25.9 |
| | Total | 260.1 | 50.3 | 37.4 | 9.2 | 54.9 | 230.0 | 16.0 | 56.1 |
| Southeast | | | | | | | | | |
| | Softwood | 216.1 | 66.3 | 58.8 | 7.0 | 34.9 | 339.0 | 11.4 | -37.0 |
| | Hardwood | 92.9 | 19.8 | 10.2 | 4.6 | 41.8 | 82.7 | 9.4 | -6.3 |
| | Total | 309.1 | 86.1 | 69.0 | 11.6 | 76.7 | 421.7 | 20.7 | -43.3 |
| All units | | | | | | | | | |
| | Softwood | 371.6 | 97.3 | 85.9 | 11.7 | 58.2 | 495.8 | 19.4 | -6.9 |
| | Hardwood | 197.6 | 39.0 | 20.5 | 9.1 | 73.4 | 155.9 | 17.4 | 19.6 |
| | Total | 569.1 | 136.4 | 106.4 | 20.8 | 131.5 | 651.6 | 36.8 | 12.8 |

\*Numbers in rows and 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, east Texas, 1986 to 1992\**

| 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* - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | |
| National forest | | | | | | | | | |
| | Softwood | 38.6 | 4.1 | 2.4 | 0.9 | 7.0 | 26.1 | 0.0 | 12.8 |
| | Hardwood | 9.5 | 1.3 | 0.4 | 0.6 | 3.8 | 3.4 | 0.0 | 4.6 |
| | Total | 48.1 | 5.4 | 2.8 | 1.4 | 10.8 | 29.5 | 0.0 | 17.4 |
| Other public | | | | | | | | | |
| | Softwood | 5.0 | 0.4 | 1.4 | 0.2 | 1.7 | 6.7 | 1.2 | -2.5 |
| | Hardwood | 3.5 | 0.8 | 0.2 | 0.1 | 1.7 | 1.5 | 0.6 | 0.8 |
| | Total | 8.4 | 1.2 | 1.6 | 0.4 | 3.4 | 8.2 | 1.8 | -1.7 |
| Forest industry | | | | | | | | | |
| | Softwood | 100.8 | 60.5 | 40.2 | 4.6 | 16.1 | 225.4 | 2.2 | -37.4 |
| | Hardwood | 39.7 | 8.2 | 5.8 | 2.5 | 21.0 | 52.5 | 2.0 | -19.3 |
| | Total | 140.5 | 68.7 | 46.1 | 7.1 | 37.1 | 277.9 | 4.1 | -56.7 |
| Nonindustrial private | | | | | | | | | |
| | Softwood | 227.2 | 32.3 | 41.8 | 6.0 | 33.4 | 237.6 | 16.0 | 20.2 |
| | Hardwood | 145.0 | 28.8 | 14.1 | 6.0 | 47.0 | 98.4 | 14.9 | 33.5 |
| | Total | 372.1 | 61.0 | 55.9 | 12.0 | 80.4 | 336.0 | 30.9 | 53.8 |
| All owners | | | | | | | | | |
| | Softwood | 371.6 | 97.3 | 85.9 | 11.7 | 58.2 | 495.8 | 19.4 | -6.9 |
| | Hardwood | 197.6 | 39.0 | 20.5 | 9.1 | 73.4 | 155.9 | 17.4 | 19.6 |
| | Total | 569.1 | 136.4 | 106.4 | 20.8 | 131.5 | 651.6 | 36.8 | 12.8 |

\*Numbers in rows and 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).

million cubic feet per year came from growth on plantations (table XX)—most was on forest industry lands (70 percent).

Softwood mortality for all live trees was 58.2 million cubic feet per year; again, mostly in the Southeast unit (60 percent). Additionally, 57 percent of mortality was on NIPF lands. The softwood mortality on plantations was 8.6 million cubic feet per year, only 15 percent of total softwood mortality.

A total of 515.2 million cubic feet per year of softwoods was removed from the inventory. A very small amount of this was land clearings, 19.4 million cubic feet per year. Most removals were in the Southeast unit, 350.4 million cubic feet per year (68 percent). The bulk of removals from both units was evenly divided between forest industry and NIPF

ownerships—227.6 and 253.6 million cubic feet per year, respectively. Only 5 percent of removals for east Texas came from national forest lands. Although a very small portion of the sample, this was a 7-percent increase. Twenty-four percent of the removals from all ownerships came from plantations, 125.6 million cubic feet per year. The majority was from forest industry plantations, 94.7 million cubic feet per year (75 percent).

With the high rate of removals in east Texas, the balance of growth-to-removals was minus 6.9 million cubic feet per year. The survey units offset each other, however. The Northeast unit was plus 30.2 million cubic feet per year, while the Southeast unit was minus 37.0 million cubic feet per year. Ownerships offset each other also; forest industry was minus 37.4 million cubic feet per year, national forests

Table XX.—*Components of annual change in the volume of live trees in plantations by ownership and species group, east Texas, 1986 to 1992\**

| 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* - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | |
| National forest | | | | | | | | | |
| | Softwood | 7.9 | 3.6 | 0.4 | 0.2 | 0.4 | 5.1 | 0.0 | 6.5 |
| | Hardwood | 0.8 | 0.1 | 0.2 | 0.1 | 0.1 | 1.6 | 0.0 | -0.5 |
| | Total | 8.6 | 3.7 | 0.6 | 0.3 | 0.5 | 6.7 | 0.0 | 6.0 |
| Other public | | | | | | | | | |
| | Softwood | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 1.7 | 0.0 | -1.7 |
| | Hardwood | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | -0.1 |
| | Total | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 1.8 | 0.0 | -1.8 |
| Forest industry | | | | | | | | | |
| | Softwood | 55.4 | 55.2 | 16.7 | 2.9 | 5.2 | 94.7 | 0.0 | 30.2 |
| | Hardwood | 3.7 | 2.2 | 1.7 | 0.4 | 2.3 | 21.7 | 0.0 | -16.0 |
| | Total | 59.1 | 57.3 | 18.4 | 3.3 | 7.5 | 116.4 | 0.0 | 14.3 |
| Nonindustrial private | | | | | | | | | |
| | Softwood | 25.9 | 11.6 | 5.5 | 0.8 | 2.8 | 21.5 | 2.5 | 17.0 |
| | Hardwood | 2.9 | 1.3 | 0.6 | 0.6 | 1.5 | 6.8 | 0.0 | -2.9 |
| | Total | 28.9 | 12.8 | 6.1 | 1.4 | 4.3 | 28.3 | 2.5 | 14.1 |
| All owners | | | | | | | | | |
| | Softwood | 89.2 | 70.4 | 22.7 | 3.9 | 8.6 | 123.1 | 2.5 | 52.0 |
| | Hardwood | 7.4 | 3.5 | 2.6 | 1.1 | 3.9 | 30.1 | 0.0 | -19.5 |
| | Total | 96.6 | 73.9 | 25.3 | 5.0 | 12.5 | 153.2 | 2.5 | 32.6 |

\*Numbers in rows and 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).

and NIPF, together, were plus 33.0 million cubic feet per year. The growth-to-removals balance in plantations was plus 52.0 million cubic feet per year with all ownerships (except other public with minus 1.7 million cubic feet per year) reporting positive net changes in their softwood inventories.

Growth-to-removal ratios and removal-to-growth ratios were used to illustrate the relationship between growth and removals. If growth was larger than removals, the ratio was shown as growth-to-removal. If removals exceeded growth, the ratio was shown as removal-to-growth. The ratios were reversed because if the ratio was always shown in a growth-to-removal format, then when removals exceeded growth, the ratio would be compressed between 0.0 and 1.0. This could be misleading because a removal-to-growth ratio of 3.50 to 1.0 would be 0.29 to 1.0 when expressed in a growth-to-removal format. If removals are doubled, the ratio becomes 7.0 to 1.0 in a removal-to-growth format or 0.14 to 1.0 in a growth-to-removal format. The latter does not clearly illustrate the relative magnitude of the ratio.

Softwood inventory removals slightly exceeded net growth. The removal-to-growth ratio was 1.01 to 1.0. With the balance so close to being even, it is likely that there were abundant softwoods in some local areas and shortages in others. Forest industry ownership had a removal-to-growth ratio of 1.20 to 1.0; NIPF growth-to-removal was 1.08 to 1.0. Plantations were on the positive side of the growth equation, but this may have been because many of these stands were immature and not ready for harvest. In 1992, their growth-to-removal ratio was 1.41 to 1.0.

### Softwood Sawtimber

Softwood sawtimber gross growth was 2,449.6 million board feet per year; net growth was 2,222.1 million board feet per year. There was hardly any change from that reported for 1986—2,397.7 and 2,212.7 million board feet per year, respectively. Most softwood sawtimber growth was in the Southeast unit, 61 percent (table XXI).

Sixty-one percent of sawtimber growth was on NIPF lands, while 27 percent was on forest industry lands. Eleven

Table XXI.—*Components of annual change in the volume of sawtimber by forest survey unit and species group, east Texas, 1986 to 1992\**

| 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¶* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | |
| Northeast | | | | | | | | | | |
| | Softwood | 539.6 | 247.5 | 149.3 | 16.6 | 3.9 | 89.2 | 739.2 | 30.3 | 98.1 |
| | Hardwood | 148.3 | 131.7 | 42.9 | 6.5 | 45.7 | 46.3 | 242.5 | 12.8 | 73.5 |
| | Total | 687.9 | 379.2 | 192.2 | 23.1 | 49.6 | 135.5 | 981.7 | 43.1 | 171.6 |
| Southeast | | | | | | | | | | |
| | Softwood | 828.7 | 324.2 | 310.4 | 20.4 | 9.0 | 138.3 | 1,626.4 | 50.3 | -322.3 |
| | Hardwood | 177.7 | 101.5 | 36.6 | 9.1 | 51.5 | 83.9 | 253.6 | 22.3 | 16.6 |
| | Total | 1,006.4 | 425.8 | 347.0 | 29.4 | 60.5 | 222.2 | 1,880.0 | 72.7 | -305.7 |
| All units | | | | | | | | | | |
| | Softwood | 1,368.3 | 571.8 | 459.7 | 36.9 | 12.9 | 227.5 | 2,365.6 | 80.7 | -224.2 |
| | Hardwood | 326.0 | 233.3 | 79.5 | 15.6 | 97.2 | 130.2 | 496.1 | 35.1 | 90.1 |
| | Total | 1,694.3 | 805.0 | 539.2 | 52.5 | 110.1 | 357.7 | 2,861.7 | 115.8 | -134.1 |

\*Numbers in rows and 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.

percent of growth came from public lands and, of that, 90 percent came from national forests. Noteworthy among ownership patterns was that sawtimber growth declined by 74.9 million board feet per year on forest industry land and increased by 110.0 million board feet per year on NIPF land (table XXII).

Softwood sawtimber removals increased by 522.1 million board feet per year to 2,446.3 million board feet per year. This represents a 27-percent increase. With hardly any change in net growth and a large increase in removals, the inventory's net change decreased from positive 288.6 million board feet per year in 1986 to minus 224.2 million board feet

per year. This represents a removal-to-growth ratio of 1.10 to 1.0. Forest industry had a net change of minus 444.3 million board feet per year and a removal-to-growth ratio of 1.73 to 1.0. The positive net change on NIPF lands (169 million board feet per year) helped offset the high negative drain on softwood sawtimber growth.

Of the 2,222.1 million board feet per year of softwood sawtimber growth, 422.5 million board feet per year came from plantations—19 percent. In contrast to the ownership trends for all of east Texas, forest industry ownership led NIPF holdings substantially in softwood growth, 261.9 versus 123.6 million board feet per year. Sixty-two percent

Table XXII.—*Components of annual change in the volume of sawtimber by ownership and species group, east Texas, 1986 to 1992**

| 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*¶ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | |
| National forest | | | | | | | | | | |
| | Softwood | 202.9 | 28.3 | 14.6 | 2.8 | 3.5 | 31.9 | 151.9 | 0.0 | 68.3 |
| | Hardwood | 19.0 | 4.7 | 0.9 | 1.0 | 6.3 | 7.6 | 8.5 | 0.0 | 15.9 |
| | Total | 221.9 | 33.0 | 15.5 | 3.8 | 9.8 | 39.4 | 160.4 | 0.0 | 84.2 |
| Other public | | | | | | | | | | |
| | Softwood | 21.8 | 3.1 | 8.2 | 1.2 | -0.3 | 8.6 | 36.2 | 6.4 | -17.4 |
| | Hardwood | 1.6 | 4.5 | 0.5 | 0.8 | 0.8 | 3.9 | 3.7 | 1.3 | -0.7 |
| | Total | 23.4 | 7.6 | 8.8 | 2.0 | 0.5 | 12.6 | 39.9 | 7.7 | -18.0 |
| Forest industry | | | | | | | | | | |
| | Softwood | 263.6 | 189.5 | 202.2 | 9.9 | 2.6 | 57.0 | 1,044.2 | 11.0 | -444.3 |
| | Hardwood | 91.7 | 40.3 | 19.1 | 4.5 | 42.8 | 46.8 | 155.5 | 5.1 | -9.0 |
| | Total | 355.3 | 229.8 | 221.3 | 14.5 | 45.3 | 103.7 | 1,199.7 | 16.0 | -453.3 |
| Nonindustrial private | | | | | | | | | | |
| | Softwood | 880.0 | 350.9 | 234.7 | 23.0 | 7.2 | 130.1 | 1,133.3 | 63.3 | 169.1 |
| | Hardwood | 213.6 | 183.7 | 59.0 | 9.3 | 47.3 | 71.9 | 328.4 | 28.8 | 83.9 |
| | Total | 1,093.6 | 534.6 | 293.7 | 32.3 | 54.5 | 202.0 | 1,461.7 | 92.0 | 253.0 |
| All owners | | | | | | | | | | |
| | Softwood | 1,368.3 | 571.8 | 459.7 | 36.9 | 12.9 | 227.5 | 2,365.6 | 80.7 | -224.2 |
| | Hardwood | 326.0 | 233.3 | 79.5 | 15.6 | 97.2 | 130.2 | 496.1 | 35.1 | 90.1 |
| | Total | 1,694.3 | 805.0 | 539.2 | 52.5 | 110.1 | 357.7 | 2,861.7 | 115.8 | -134.1 |

*Numbers in rows and 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.

of sawtimber growth on plantations came from forest industry lands (table XXIII). Growth on plantations increased by 34 percent from 315.2 to 422.5 million board feet per year. Removals decreased from 598.4 to 522.1 million board feet per year. Together with the decrease in removals, net growth improved the net change in the softwood sawtimber resource on plantations. Net change improved from minus 283.2 million board feet per year to minus 99.6 million board feet per year. There was still a negative drain on the plantation resource, but this should continue to improve as young plantation trees grow large enough to be included in future forest survey growth computations.

**Hardwoods**

Hardwood gross growth for live trees was 266.2 million cubic feet; net growth was 192.8 million cubic feet. This was

a slight increase from the 252.5 and 178.9 million cubic feet per year reported in 1986. Slightly more hardwood growth appeared in the Northeast unit than the Southeast unit, 107.1 versus 85.7 million cubic feet per year, respectively.

As with softwoods, more hardwood growth occurred on NIPF land than any other ownership—76 percent. Forest industry followed with 18 percent, and public lands with 6 percent.

Hardwood removals and mortality increased only slightly. With the slight increase in growth, the result was an addition to the inventory of 19.6 million cubic feet per year. However, forest industry had a net change of minus 19.3 million board feet per year that was offset by a plus 33.5 million board feet per year on NIPF lands. Overall, forest industry had a removal-to-growth ratio of 1.55 to 1.0, while NIPF

Table XXIII.—*Components of annual change in the volume of sawtimber in plantations by ownership and species group, east Texas, 1986 to 1992\**

| Ownership | Species group | Survivor growth† | Ingrowth‡ | Growth on removals | Growth on mortality | Cull increment | Mortality | Timberland removals | Land-clearing removals | Net change§ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | - - - - - - - - - - - - - - - - - - - - - - - - - - - *Million board feet¶* - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | |
| National forest | | | | | | | | | | |
| | Softwood | 19.5 | 14.6 | 2.7 | 0.1 | 0.1 | 0.5 | 29.5 | 0.0 | 7.0 |
| | Hardwood | 0.3 | 0.4 | 0.4 | 0.0 | 0.3 | 0.0 | 3.6 | 0.0 | -2.2 |
| | Total | 19.8 | 15.0 | 3.1 | 0.1 | 0.5 | 0.5 | 33.1 | 0.0 | 4.8 |
| Other public | | | | | | | | | | |
| | Softwood | 0.0 | 0.0 | 1.3 | 0.1 | 0.0 | 0.9 | 11.1 | 0.0 | -10.5 |
| | Hardwood | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | -0.1 |
| | Total | 0.0 | 0.0 | 1.3 | 0.1 | 0.0 | 0.9 | 11.3 | 0.0 | -10.7 |
| Forest industry | | | | | | | | | | |
| | Softwood | 52.5 | 130.0 | 83.5 | 3.4 | 0.3 | 7.8 | 396.5 | 0.0 | -134.7 |
| | Hardwood | 3.4 | 4.1 | 7.1 | 0.7 | 1.9 | 3.5 | 59.6 | 0.0 | -45.9 |
| | Total | 56.0 | 134.1 | 90.6 | 4.1 | 2.2 | 11.3 | 456.1 | 0.0 | -180.6 |
| Nonindustrial private | | | | | | | | | | |
| | Softwood | 53.0 | 47.5 | 25.4 | 1.6 | -2.1 | 1.8 | 74.3 | 10.7 | 38.7 |
| | Hardwood | 3.7 | 3.9 | 3.0 | 1.0 | 1.6 | 2.4 | 19.0 | 0.0 | -8.2 |
| | Total | 56.7 | 51.4 | 28.4 | 2.6 | -0.5 | 4.1 | 93.3 | 10.7 | 30.5 |
| All owners | | | | | | | | | | |
| | Softwood | 125.0 | 192.1 | 112.9 | 5.2 | -1.7 | 11.0 | 511.4 | 10.7 | -99.6 |
| | Hardwood | 7.5 | 8.4 | 10.5 | 1.7 | 3.8 | 5.9 | 82.3 | 0.0 | -56.4 |
| | Total | 132.5 | 200.5 | 123.4 | 6.9 | 2.1 | 16.9 | 593.7 | 10.7 | -156.0 |

\*Numbers in rows and 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.

**Hardwood Sawtimber**

Gross growth for hardwood sawtimber was 751.6 million board feet per year; net growth was 621.4 million board feet per year. This was a decrease of 64.9 million board feet per year and 87.2 million board feet per year, respectively, below that reported for 1986. The decreases were attributed to both growth downturns and increases in hardwood mortality. Mortality alone increased by 21 percent. Even with the declines, both the Northeast and Southeast units had net changes of plus 73.5 and plus 16.6 million board feet per year to their respective inventories.

However, the trend by ownership was somewhat different. Forest industry had a net change of minus 9.0 million board feet per year and NIPF a net change of plus 83.9 million board feet per year. This was a decrease for forest industry from plus 50.5 million board feet per year. The decrease was even larger on NIPF land, from plus 265.7 down to plus 83.9 million board feet per year.

## Plantations

Plantation area (see definition of plantations in appendix) totaled 2.5 million acres—22 percent of all timberland. This was a 597,500-acre increase over that reported for the 1986

survey. Seventy-two percent of plantation area was in the Southeast unit.

The predominant forest-type group was loblolly-shortleaf pine, 1.7 million acres (table XXIV). There were 175,000 acres of the longleaf-slash pine forest-type group, an increase since the last survey. The survey showed 516,100 acres of the oak-pine, 160,300 acres of the oak-hickory, and 40,500 acres of the bottomland hardwood forest-type groups. In all likelihood, these were probably pine plantings where hardwood encroachment was high enough to allow the stands to be classified as hardwood, i.e., hardwood stocking was higher than pine. Unfortunately, the survey field methods did not discern between softwood and hardwood plantation establishment.

Most plantation establishment was on forest industry lands—1.8 million acres (72 percent of all plantations). Forest industry plantations increased by 438,500 acres since the last survey.

The plantations of east Texas are young. About 1.1 million acres were less than 10 years old and another 683,900 acres were between the ages of 10 and 20 years (table XXV). This was 71 percent of all plantations. In all likelihood, many plantations in the 5-year age class did not contribute to the forest survey volume and growth estimates, because many of the trees would have been less than 5.0 inches in d.b.h.

Table XXIV.—*Area of timberland on plantations by ownership and forest type group, east Texas, 1992\**

| Ownership | All types | Forest-type group | | | | |
| | | Longleaf-slash | Loblolly-shortleaf | Oak-pine | Oak-hickory | Bottomland hardwoods† |
|---|---|---|---|---|---|---|
| | | - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - | | | | |
| Public | 134.7 | 3.8 | 114.1 | 12.5 | 4.4 | 0.0 |
| Forest industry | 1,821.5 | 148.1 | 1,159.4 | 371.0 | 126.6 | 16.5 |
| Nonindustrial private | 589.3 | 23.1 | 380.1 | 132.6 | 29.4 | 24.0 |
| All owners | 2,545.5 | 175.0 | 1,653.6 | 516.1 | 160.3 | 40.5 |

\*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 XXV.—*Area of timberland on plantations by ownership and age class, east Texas, 1992\**

| Ownership | All classes | Age class *(Years)*† | | | | | | |
| | | 5 | 15 | 25 | 35 | 45 | 46-92 | Mixed age‡ |
|---|---|---|---|---|---|---|---|---|
| | | - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - | | | | | | |
| Public | 134.7 | 47.6 | 23.3 | 22.5 | 4.4 | 0.0 | 0.0 | 37.0 |
| Forest industry | 1,821.5 | 841.3 | 580.8 | 86.9 | 18.2 | 0.0 | 0.0 | 294.5 |
| Nonindustrial private | 589.3 | 224.1 | 79.8 | 23.5 | 24.1 | 0.0 | 5.6 | 232.1 |
| All owners | 2,545.5 | 1,112.9 | 683.9 | 132.8 | 46.7 | 0.0 | 5.6 | 563.6 |

\*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.

Softwood stocking below 60 percent of the stocking standard was considered understocked (adequate stocking is 360 seedlings per acre). There were 799,700 acres understocked in the survey area (table XXVI). Seventy percent of those were in the Southeast unit, 72 percent were on forest industry land.

Softwood live-tree volume on plantations totaled 1,506.9 million cubic feet (table XXVII). This was a 504.9-million-cubic-feet increase since 1986, most of which was in trees 5.0 inches or larger but less than 10 inches in d.b.h. (457.3 million cubic feet). There was a 77.1-million-cubic-feet increase in the 10.0 inches or larger but less than 15-inch diameter class. Slight decreases in softwood volume oc-curred in the diameter classes larger than 15.0 inches in d.b.h.

Although all ownerships had increases in their softwood volume in plantations, only forest industry lands had substantial gains—here volume increased 448.3 million cubic feet. Forest industry held 64 percent of live softwood volume on plantations in east Texas.

Of the 2.5 million acres of plantations, 792,200 acres qualified for some form of stand treatment (table XXVIII). These findings were based upon arbitrarily determined stocking and stand-size guidelines (see the Treatment Opportunities section). East Texas had 299,800 plantation

Table XXVI.—*Softwood stocking on plantations by ownership, east Texas, 1992\**

| | | Stocking class *(Percent)* | | | | |
|---|---|---|---|---|---|---|
| Ownership | All classes | <30 | 30-59 | 60-89 | 90-119 | ≥120 |
| | | - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - | | | | |
| Public | 134.7 | 4.4 | 10.3 | 30.0 | 64.8 | 25.3 |
| Forest industry | 1,821.5 | 122.6 | 452.2 | 524.8 | 541.4 | 180.5 |
| Nonindustrial private | 589.3 | 58.4 | 151.8 | 190.1 | 122.9 | 66.1 |
| All owners | 2,545.5 | 185.4 | 614.3 | 744.9 | 729.1 | 271.8 |

*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, east Texas, 1992\**

| | | Diameter class *(Inches at breast height)* | | | |
|---|---|---|---|---|---|
| Ownership | All classes | 5.0-9.9 | 10.0-14.9 | 15.0-19.9 | ≥20 |
| | | - - - - - - - - - - - - - - - - - - *Million cubic feet* - - - - - - - - - - - - - - | | | |
| Public | 146.3 | 72.4 | 47.6 | 21.3 | 5.1 |
| Forest industry | 969.9 | 712.1 | 227.6 | 27.2 | 3.1 |
| Nonindustrial private | 390.7 | 197.7 | 136.6 | 44.8 | 11.6 |
| All owners | 1,506.9 | 982.2 | 411.7 | 93.2 | 19.8 |

*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, east Texas, 1992\**

| | Treatment | | |
|---|---|---|---|
| Ownership | All treatments | Commercial harvest† | Thinning/stand improvement‡ |
| | - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - | | |
| Public | 60.5 | 24.8 | 35.7 |
| Forest industry | 559.1 | 198.4 | 360.7 |
| Nonindustrial private | 172.6 | 76.6 | 96.0 |
| All owners | 792.2 | 299.8 | 492.4 |

*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 natural disturbance.

acres qualifying for harvest. This included both pulpwood and saw-log operations. About 492,400 additional acres qualified for thinning or stand improvement.

## Disturbance

### Harvesting

Between 1986 and 1992, 3.3 million acres of east Texas timberland underwent some form of harvest (table XXIX).

Partial harvest, followed by clearcuts, were the leading methods, accounting for 63 and 30 percent, respectively, of all commercial harvests.

Most harvesting was in the loblolly-shortleaf pine forest-type group, 1.5 million acres (45 percent of all harvests) followed by oak-pine, 837,900 acres (25 percent); oak-hickory, 599,400 acres (18 percent); bottomland hardwoods, 233,200 acres (7 percent); and longleaf-slash pine, 138,300 acres (4 percent). Forty percent of all loblolly-shortleaf pine forest-

Table XXIX.—*Area of timberland by forest type group prior to harvesting, ownership, and harvesting activity, east Texas, 1992\**

| Forest type group and ownership | All classes | Commercial harvesting activity | | | | |
|---|---|---|---|---|---|---|
| | | None | Partial | Seed tree/ shelterwood | Clearcut | Salvage cut |
| | | | - - - - Thousand acres - - - - | | | |
| **Longleaf-slash pine** | | | | | | |
| Public | 21.0 | 17.2 | 3.8 | 0.0 | 0.0 | 0.0 |
| Forest industry | 199.6 | 94.4 | 49.3 | 11.0 | 44.9 | 0.0 |
| Nonindustrial private | 57.1 | 27.7 | 12.3 | 0.0 | 17.1 | 0.0 |
| All owners | 277.6 | 139.3 | 65.3 | 11.0 | 62.0 | 0.0 |
| **Loblolly-shortleaf pine** | | | | | | |
| Public | 450.8 | 323.1 | 54.8 | 14.2 | 30.9 | 27.7 |
| Forest industry | 1,470.5 | 848.2 | 294.0 | 34.1 | 287.9 | 6.2 |
| Nonindustrial private | 1,855.6 | 1,111.5 | 565.5 | 28.9 | 138.9 | 10.8 |
| All owners | 3,776.9 | 2,282.8 | 914.4 | 77.2 | 457.7 | 44.7 |
| **Oak-pine** | | | | | | |
| Public | 96.6 | 84.6 | 5.2 | 0.0 | 6.8 | 0.0 |
| Forest industry | 811.9 | 522.2 | 170.2 | 11.7 | 107.9 | 0.0 |
| Nonindustrial private | 1,352.6 | 816.4 | 392.7 | 17.5 | 120.7 | 5.2 |
| All owners | 2,261.1 | 1,423.2 | 568.1 | 29.2 | 235.4 | 5.2 |
| **Oak-hickory** | | | | | | |
| Public | 114.8 | 96.7 | 6.0 | 0.0 | 5.9 | 6.3 |
| Forest industry | 761.7 | 616.4 | 35.2 | 15.8 | 94.3 | 0.0 |
| Nonindustrial private | 2,222.7 | 1,786.8 | 333.0 | 6.2 | 89.7 | 7.0 |
| All owners | 3,099.3 | 2,499.9 | 374.2 | 22.1 | 189.9 | 13.2 |
| **Bottomland hardwoods†** | | | | | | |
| Public | 65.0 | 65.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Forest industry | 431.1 | 380.5 | 34.1 | 0.0 | 16.5 | 0.0 |
| Nonindustrial private | 964.4 | 781.9 | 138.7 | 0.0 | 38.5 | 5.4 |
| All owners | 1,460.5 | 1,227.3 | 172.8 | 0.0 | 55.0 | 5.4 |
| **Nontyped** | | | | | | |
| Public | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Forest industry | 5.3 | 5.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nonindustrial private | 5.4 | 5.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| All owners | 10.6 | 10.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| **All forest types** | | | | | | |
| Public | 748.2 | 586.7 | 69.8 | 14.2 | 43.6 | 34.0 |
| Forest industry | 3,680.1 | 2,466.9 | 582.8 | 72.7 | 551.4 | 6.2 |
| Nonindustrial private | 6,457.8 | 4,529.7 | 1,442.2 | 52.6 | 405.0 | 28.3 |
| All owners | 10,886.1 | 7,583.3 | 2,094.8 | 139.5 | 1,000.0 | 68.5 |

\*Numbers in rows and columns may not sum to totals due to rounding.
†Includes oak-gum-cypress and elm-ash-cottonwood forest type groups.

type group timberland had harvesting activity. However, the highest proportion of harvesting was in the longleaf-slash pine group, where 50 percent underwent some form of harvest.

A total of 1.0 million acres was harvested by clearcutting. Here too, most of the clearcuts were in the loblolly-shortleaf pine forest-type group (46 percent). Forest industry led in the amount of clearcut acreage in all forest-type groups with 55 percent, followed by NIPF at 41 percent and publicly owned land at 4 percent.

Seed tree and shelterwood harvest methods were little used, occurring on roughly 139,500 acres. However, it was difficult for data collection personnel to always accurately identify harvest and management methods on the ground in such a large survey. It is likely that some of the partial harvest acreage may have been in a form of shelterwood or selection harvest.

A more detailed study of harvesting in east Texas is under-way.[1] Table XXX is taken from that study and shows harvesting magnitude by year of harvest. Of note is the 952,900 acres harvested in 1989, which seems to have been a banner year for timber harvesting in the South. Louisiana reported 1.1 million acres cut that year (Rosson 1994). Clearcut acreage also peaked in east Texas in 1989 with 215,100 acres (table XXXI).

Table XXX*.—*Area of timberland commercially harvested by year of harvest and ownership, east Texas, 1986 to 1992*†

| Year of harvest | All classes | Ownership | | | |
| | | National forest | Other Public | Forest industry | Nonindustrial private |
| --- | --- | --- | --- | --- | --- |
| | | - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - | | | |
| 1987 | 261.5 | 0.0 | 0.0 | 128.4 | 133.1 |
| 1988 | 414.3 | 12.4 | 0.0 | 135.3 | 266.6 |
| 1989 | 952.9 | 77.7 | 6.0 | 320.2 | 549.0 |
| 1990 | 761.4 | 7.2 | 5.9 | 248.4 | 500.0 |
| 1991 | 725.7 | 23.2 | 21.4 | 311.2 | 369.9 |
| 1992 | 117.7 | 7.9 | 0.0 | 36.4 | 73.4 |
| All years | 3,233.6 | 128.4 | 33.2 | 1,180.0 | 1,892.0 |

*Modified from "Current stand characteristics of east Texas timberland harvested between 1977 and 1992" (Rosson, in preparation). Timberland totaling 69,200 acres was not included in this table because of overlap in dates with the 1986 survey.
†Numbers in rows and columns may not sum to totals due to rounding.

Table XXXI*.—*Area of clearcut upland timberland by year of harvest and forest type group, east Texas, 1986 to 1992*†

| Year of harvest | All types | Forest-type group‡ | | | |
| | | Longleaf-slash pine | Loblolly-shortleaf pine | Oak-pine | Oak-hickory |
| --- | --- | --- | --- | --- | --- |
| | | - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - | | | |
| 1987 | 136.7 | 0.0 | 96.3 | 23.8 | 16.6 |
| 1988 | 134.6 | 0.0 | 35.8 | 34.7 | 64.2 |
| 1989 | 215.1 | 5.8 | 118.5 | 63.1 | 27.8 |
| 1990 | 174.4 | 6.0 | 62.9 | 74.9 | 30.6 |
| 1991 | 203.2 | 44.0 | 92.4 | 26.0 | 40.8 |
| 1992 | 46.4 | 6.2 | 35.0 | 0.0 | 5.2 |
| All years | 910.4 | 62.0 | 440.9 | 222.5 | 185.1 |

*Modified from "Current stand characteristics of east Texas timberland harvested between 1977 and 1992" (Rosson, in preparation). Timberland totaling 89,600 acres was not included in this table because of overlap in dates with the 1986 survey.
†Numbers in rows and columns may not sum to totals due to rounding.
‡Forest-type group prior to harvest.

[1]Rosson, James F., Jr. Current stand characteristics of east Texas timberland harvested between 1977 and 1992. Manuscript in preparation.

## Management

Three major stand-management activities were identified: thinning, stand improvement, and site preparation. Thinning is regarded as an activity without substantial effort to identify target trees for future stand development. It involves mechanically reducing stocking by an arbitrary method, e.g., row thinning (removing every other row). Stand improvement usually involves more on-the-ground decisions by forest managers, e.g., deciding if a tree has too much cull potential or poor form to be left for the final rotation harvest. Site preparation work includes activities done prior to regeneration following timber harvest.

Table XXXII presents the acreage by forest-type group and ownership, where timber management activities occurred. Only those areas that were forested in 1986 and 1992 are included (10.9 million acres). About 9.5 million acres, most

Table XXXII.—*Area of timberland by forest type group prior to activity, ownership, and management activity, east Texas, 1992\**

| Forest type group and ownership | All classes | Management activity | | | |
|---|---|---|---|---|---|
| | | None | Thinning operation | Stand improvement | Site preparation |
| | | - - - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - | | | |
| **Longleaf-slash pine** | | | | | |
| Public | 21.0 | 9.9 | 0.0 | 11.0 | 0.0 |
| Forest industry | 199.6 | 112.0 | 23.0 | 52.6 | 12.0 |
| Nonindustrial private | 57.1 | 45.0 | 0.0 | 12.1 | 0.0 |
| All owners | 277.6 | 167.0 | 23.0 | 75.7 | 12.0 |
| **Loblolly-shortleaf pine** | | | | | |
| Public | 450.8 | 276.1 | 10.7 | 148.4 | 15.6 |
| Forest industry | 1,470.5 | 1,030.8 | 89.1 | 239.8 | 110.7 |
| Nonindustrial private | 1,855.6 | 1,662.3 | 57.0 | 118.8 | 17.5 |
| All owners | 3,776.9 | 2,969.3 | 156.8 | 506.9 | 143.9 |
| **Oak-pine** | | | | | |
| Public | 96.6 | 87.3 | 0.0 | 9.3 | 0.0 |
| Forest industry | 811.9 | 690.2 | 23.5 | 39.9 | 58.3 |
| Nonindustrial private | 1,352.6 | 1,233.9 | 17.8 | 70.0 | 30.8 |
| All owners | 2,261.1 | 2,011.4 | 41.3 | 119.3 | 89.1 |
| **Oak-hickory** | | | | | |
| Public | 114.8 | 90.0 | 0.0 | 14.6 | 10.3 |
| Forest industry | 761.7 | 641.4 | 0.0 | 62.3 | 58.0 |
| Nonindustrial private | 2,222.7 | 2,147.1 | 11.5 | 52.4 | 11.7 |
| All owners | 3,099.3 | 2,878.5 | 11.5 | 129.3 | 80.0 |
| **Bottomland hardwoods†** | | | | | |
| Public | 65.0 | 65.0 | 0.0 | 0.0 | 0.0 |
| Forest industry | 431.1 | 420.4 | 0.0 | 0.0 | 10.7 |
| Nonindustrial private | 964.4 | 953.6 | 0.0 | 10.9 | 0.0 |
| All owners | 1,460.5 | 1,439.0 | 0.0 | 10.9 | 10.7 |
| **Nontyped** | | | | | |
| Public | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Forest industry | 5.3 | 5.3 | 0.0 | 0.0 | 0.0 |
| Nonindustrial private | 5.4 | 5.4 | 0.0 | 0.0 | 0.0 |
| All owners | 10.6 | 10.6 | 0.0 | 0.0 | 0.0 |
| **All forest types** | | | | | |
| Public | 748.2 | 528.3 | 10.7 | 183.3 | 25.9 |
| Forest industry | 3,680.1 | 2,900.1 | 135.6 | 394.6 | 249.7 |
| Nonindustrial private | 6,457.8 | 6,047.3 | 86.4 | 264.2 | 60.0 |
| All owners | 10,886.1 | 9,475.7 | 232.6 | 842.1 | 335.6 |

\*Numbers in rows and columns may not sum to totals due to rounding.
†Includes oak-gum-cypress and elm-ash-cottonwood forest type groups.

of which was on NIPF land (64 percent), showed no evidence of management activity. A total of 1.4 million acres had evidence of activity, most of which was on forest industry land (55 percent).

Most management activity was in stand-improvement operations. There were 842,100 acres in this category, accounting for 60 percent of management activity. Most stand-improvement operations were in the loblolly-shortleaf pine forest-type group—506,900 acres (60 percent of all stand improvement treatments). Forty-seven percent of these acres were on forest industry land, 31 percent on NIPF land, and 22 percent on public lands.

There were 232,600 acres of thinning operations. Again, most of this activity was in the loblolly-shortleaf pine forest-type group—67 percent. Forest industry thinning operations constituted 58 percent of total thinning in all forest-type groups, followed by NIPF at 37 percent and public at only 5 percent.

A total of 335,600 acres showed evidence of site preparation activity. While 1.0 million acres were clearcut harvested, it is not certain what proportion needed site preparation work. Seventy-four percent of site preparation work was on forest industry land, while only 60,000 acres (18 percent) were completed on NIPF land. The ratio of clearcut area to site preparation area for forest industry was 2.21 to 1.0; for NIPF land, 6.75 to 1.0. It seems that forest industry ownership gave regeneration activity on clearcut lands much more consideration than did NIPF landowners.

## Treatment Opportunities

Possible treatment opportunities are shown in table XXXIII. These estimates were derived solely from 1992 survey data by means of a computer algorithm. No field assessments from data collectors were used. Several stand-level variables were important in making these estimates: stocking level of growing-stock trees, amount of cull, species composition, stand-size class, amount of volume by species groups, and amount of damage. Although threshold levels for the various treatment classes were arbitrary, the assessment did help discern where potential improvements could be made. The assessment included three broad categories with subcategories under each: stand establishment, intermediate treatment, and final harvest (table XXXIII).

A total of 7.1 million acres were shown to be adequately stocked, to have desirable species composition, and to contain limited damage or resultant cull volume. No treat-

ment was specified for that acreage; therefore, only 4.7 million acres of timberland needed some form of treatment.

The largest area categorized as needing treatment was where there had been inadequate regeneration. Approximately 2.4 million acres were understocked to the degree that additional regeneration efforts would be needed. This included any stand less than 50-percent stocked with growing-stock trees, or any stand greater than 50- but less than 60-percent stocked with growing-stock trees, and in which the stocking of rough and rotten trees was greater than 30 percent. The stocking condition was based on all growing-stock trees. Often, surveyed stands recently harvested or regenerated will be less than 50-percent stocked. Because harvesting has occurred on so much acreage since 1986, the timberland area in this treatment category was obviously high.

Three subcategories of intermediate treatment were considered: precommercial thinning (sapling-seedling size), poletimber thinning, and other stocking control. Sapling-seedling stands greater than 150-percent stocked with growing-stock trees were considered in need of thinning. Only 40,200 acres were in this condition. Poletimber stands greater than 110-percent stocked were considered candidates for thinning. There were 502,400 acres of timberland in this condition. Most of this acreage was on forest industry land (69 percent), and most areas needing thinning were in the loblolly-shortleaf pine forest-type group (85 percent).

The other stocking-control category included any stands that were smaller than the sawtimber-size class and that had greater than 110-percent stocking, and where more than 30 percent of that stocking was composed of rough and rotten trees. In 1992, 932,900 acres were in that condition, mostly on NIPF land—70 percent. The oak-hickory and oak-pine forest-type groups had the most acreage in this category— 724,800 acres. This was primarily due to the increased likelihood of hardwoods contracting diseases, pathogens, or other agents that directly or indirectly led to increased cull and classification as rough or rotten.

About 807,200 acres were suitable for final harvest using two treatment types—regeneration cuts and salvage cuts. A regeneration cut was prescribed for stands of sawtimber size with more than 110 percent stocking in growing-stock trees and more than 5,000 board feet per acre. There were 739,000 acres in this category. Salvage cuts are prescribed for 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 68,200 acres qualified for salvage harvest.

Table XXXIII.—*Area of timberland by forest type group, ownership, and treatment opportunity, east Texas, 1992\**

| Forest type group and ownership | 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 | 21.0 | 11.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.8 | 0.0 |
| Forest industry | 164.9 | 135.2 | 6.2 | 0.0 | 0.0 | 17.3 | 0.0 | 6.2 | 0.0 |
| Nonindustrial private | 46.3 | 28.3 | 12.1 | 0.0 | 0.0 | 0.0 | 6.0 | 0.0 | 0.0 |
| All owners | 232.2 | 174.7 | 18.3 | 0.0 | 0.0 | 17.3 | 6.0 | 16.0 | 0.0 |
| **Loblolly-shortleaf pine** | | | | | | | | | |
| Public | 438.4 | 261.3 | 3.1 | 0.0 | 4.2 | 25.2 | 3.1 | 137.2 | 4.4 |
| Forest industry | 1,673.2 | 1,156.6 | 84.1 | 0.0 | 36.0 | 310.8 | 35.8 | 49.9 | 0.0 |
| Nonindustrial private | 1,953.0 | 1,348.8 | 149.8 | 0.0 | 0.0 | 93.5 | 42.2 | 318.7 | 0.0 |
| All owners | 4,064.6 | 2,766.8 | 237.0 | 0.0 | 40.2 | 429.5 | 81.1 | 505.8 | 4.4 |
| **Oak-pine** | | | | | | | | | |
| Public | 135.4 | 101.6 | 10.0 | 0.0 | 0.0 | 0.0 | 6.2 | 11.4 | 6.2 |
| Forest industry | 834.5 | 574.4 | 119.3 | 0.0 | 0.0 | 12.8 | 115.8 | 12.3 | 0.0 |
| Nonindustrial private | 1,532.2 | 1,060.5 | 226.4 | 0.0 | 0.0 | 13.4 | 135.9 | 95.9 | 0.0 |
| All owners | 2,502.1 | 1,736.6 | 355.7 | 0.0 | 0.0 | 26.2 | 258.0 | 119.5 | 6.2 |
| **Oak-hickory** | | | | | | | | | |
| Public | 90.7 | 60.7 | 14.3 | 0.0 | 0.0 | 0.0 | 5.2 | 5.2 | 5.2 |
| Forest industry | 602.7 | 339.3 | 157.9 | 0.0 | 0.0 | 5.8 | 99.7 | 0.0 | 0.0 |
| Nonindustrial private | 2,433.9 | 1,061.1 | 964.5 | 5.2 | 0.0 | 11.8 | 361.9 | 11.7 | 17.5 |
| All owners | 3,127.2 | 1,461.2 | 1,136.7 | 5.2 | 0.0 | 17.6 | 466.8 | 17.0 | 22.7 |
| **Bottomland hardwoods†** | | | | | | | | | |
| Public | 92.0 | 50.4 | 37.2 | 0.0 | 0.0 | 0.0 | 4.4 | 0.0 | 0.0 |
| Forest industry | 437.9 | 285.8 | 99.8 | 0.0 | 0.0 | 0.0 | 5.8 | 28.7 | 17.9 |
| Nonindustrial private | 1,276.2 | 601.0 | 483.3 | 0.0 | 0.0 | 11.9 | 111.0 | 52.1 | 17.0 |
| All owners | 1,806.2 | 937.1 | 620.3 | 0.0 | 0.0 | 11.9 | 121.2 | 80.8 | 34.9 |
| **Nontyped** | | | | | | | | | |
| Public | 5.9 | 0.0 | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Forest industry | 6.5 | 0.0 | 6.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nonindustrial private | 29.1 | 0.0 | 29.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| All owners | 41.5 | 0.0 | 41.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **All forest types** | | | | | | | | | |
| Public | 783.5 | 485.3 | 70.4 | 0.0 | 4.2 | 25.2 | 18.9 | 163.6 | 15.8 |
| Forest industry | 3,719.7 | 2,491.4 | 473.8 | 0.0 | 36.0 | 346.6 | 257.0 | 97.0 | 17.9 |
| Nonindustrial private | 7,270.7 | 4,099.7 | 1,865.3 | 5.2 | 0.0 | 130.6 | 657.0 | 478.4 | 34.5 |
| All owners | 11,773.8 | 7,076.3 | 2,409.5 | 5.2 | 40.2 | 502.4 | 932.9 | 739.0 | 68.2 |

\*Numbers in rows and columns may not sum to totals due to rounding.
†Includes oak-gum-cypress and elm-ash-cottonwood forest type groups.

## Conclusions

Many natural and human-induced factors influence the dynamics of east Texas forest resources. When evaluating and monitoring forest resources over time, two primary events that affect change need to be considered. First is a change in forest land area, resulting in either the loss of or addition to the timberland base. Second is a change in resource attributes, such as declines or increases in standing volume, growth, basal area, and stand density. These are influenced by harvesting, management practices, and natural mortality.

The change in forest area was a positive attribute to the east Texas forest resource situation. This was because the area of timberland increased by 202,700 acres since 1986, and this additional acreage will be producing forest resources in the near future. Nonetheless, considerable lag time may occur, along with substantial financial effort, in getting this new acreage into a productive state. However, these possibly negative factors are more than offset by the potential for the increase in availability of forest resources in future years. Because most land-use changes continue to result from reversion of agricultural land, the probability that the total forest land base will increase is high, especially from marginally productive farmlands that often cannot compete with increases in timber prices. Since passage of the Farm Bill in the 1980's, there has been heightened interest in the Conservation Reserve Program (CRP) and the impact of this program on reforestation efforts in the Southern States. In this survey, information identifying CRP activity was not gathered. However, very little east Texas land qualified, because most nonforest lands in the region were in pasture (not croplands) and, therefore, ineligible for inclusion in the CRP.

In comparison to other recently completed Midsouth surveys, east Texas showed a moderate increase in timberland area. Other neighboring States had much larger increases. Alabama timberland increased by 273,100 acres in 10 years (McWilliams 1992); east Oklahoma increased by 154,300 acres since its 1986 survey.[2] Mississippi and Arkansas showed even larger increases—Mississippi timberland increased by 1.6 million acres since 1987[3] and Arkansas by 1.1 million acres since 1988.[4] There seems to

be a continuing trend of increasing timberland area in the Midsouth States. Louisiana was the only State recently surveyed that showed a loss of timberland area, and that loss was very small—89,600 acres (Rosson 1995).

The east Texas survey region was made up of arbitrarily selected counties, although it is obvious that some timberland exists to the west. Some land was suitable for pine production, but much of the area is suitable only for production of low-quality hardwoods. To determine whether this marginal timberland would be sustainable in a continuous commodity-producing sense is difficult, but at the least, as one moves further west in Texas, sustainable productivity becomes questionable. Future FIA inventories will probably attempt to evaluate resources in central and west Texas.

The second primary event affecting forest resources was changes in stand attributes such as volume, growth, basal area, and stand size. Timber harvesting was the single most important agent of such change.

Some form of commercial harvesting has occurred on 3.3 million acres of east Texas timberland, 28 percent of the total timberland base. Alabama had harvesting activity on 29 percent of its timberland; Louisiana, 32 percent; Oklahoma, 14 percent; Mississippi, 33 percent; and Arkansas, 21 percent. When harvesting ratios approach 33 percent of the total timberland base in an 8-year survey period, it is imperative that harvested lands be regenerated in a timely manner and that adequate stocking be established and maintained. With such high levels of harvesting activity, a 2- to 3-year deferral of stand establishment per harvest cycle will affect total productivity over several stand cycles. There were 799,700 acres of plantations less than 60-percent stocked. While 200 trees per acre may be considered adequate stocking in many plantation operations, stocking levels lower than that may be questionable. Opinions differ locally concerning the lower limit of adequate stocking. The stocking standard for seedlings in this survey was 600 trees per acre—100 percent stocking. About 185,400 acres of the survey area had fewer than 180 trees per acre, or one-third of the stocking considered adequate.

Softwood live-tree volume decreased by 11.5 million cubic feet, while hardwood live-tree volume increased by 107.9 million cubic feet. Total inventory remained stable at 14,299.0 million cubic feet. The net change was minus 6.9

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[2]Rosson, James F., Jr. Forest resources of Oklahoma, 1993. Manuscript in preparation.

[3]Rosson, James F., Jr. Forest resources of Mississippi, 1994. Manuscript in preparation.

[4]Rosson, James F., Jr. Forest resources of Arkansas, 1995. Manuscript in preparation.

million cubic feet per year for softwood and plus 19.6 million cubic feet per year for hardwoods. Growth and removals were in balance, or nearly so. However, a close growth-to-removal balance indicated that there may be local shortages of certain forest resource materials.

The 1.1 million acres of plantations less than 10 years old will be contributing substantially to timber volume reported in the next forest survey. However, it is not likely that removals will decrease substantially from the 688.4 million cubic feet per year reported for this survey. With this in mind, it is important that harvested acres be regenerated quickly and with adequate stocking.

There are opportunities to maintain or increase the inventory volume. For example, there were only 2.4 million acres with more than 5,000 board feet per acre of softwood volume and 712,300 acres of more than 5,000 board feet per acre in hardwood volume—20 and 6 percent, respectively, of all timberland in east Texas. It will become increasingly more difficult to maintain these proportions if harvesting levels continue to increase and rotations are shortened. The result could be that stand sizes in east Texas will become smaller and smaller over time. For that reason landowners may want to maintain optimum stocking levels. Therefore, it is important that focus is directed to maintaining optimum levels of stocking in east Texas forest stands throughout all stand rotations. This will create the opportunity of more options for resource use in the future; be they forest products, recreation, wildlife, ecosystem values, watershed protection, or esthetic values.

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## Appendix

### Inventory Methods

Forest resource statistics were obtained by a two-phase sampling method employing a forest or 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 one 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 was based on interpreting dot grid counts, overlaid on recent aerial photographs with each dot classified as forest or nonforest. Each dot represented approximately 230 acres. The forest or nonforest estimate was then adjusted by ground-truth checks at all permanent sample locations. Permanent sample locations consisted of two types of plots: intensification plots (used only as ground truths for forest and nonforest classifications), and 3- by 3-mile plots (plots on a 3- by 3-mile square grid) where tree measurements and plot characteristics were recorded. The proportion of dots classified as forest was applied to U.S. Census land area data to develop an estimate of forest area in individual counties. Appropriate expansion factors (the timberland area each plot represents) for each forested 3- by 3-mile plot were assigned. The expansion factor was dependent on the number of forested plots in a county, but averaged 5,760 acres per plot for the State.

Each forested 3- by 3-mile sample plot consisted of 10 satellite points spread over an area of approximately 1 acre (fig. 25). This design improved portrayal of stand conditions by eliminating the effect that vegetation clumping and open gaps would cause if only 1 point or a fixed plot were used at each location.

At each forested sample plot, trees 5.0 inches in d.b.h. and larger were selected with a 37.5-basal-area-factor prism at each of the 10 satellite points; each tree selected with the prism represented 3.75 square feet of basal area per acre. Trees less than 5.0 but greater than or equal to 1.0 inch in d.b.h. were tallied on a 1/275-acre circular fixed plot centered at the first 3 satellite points (fig. 26).

Volumes in east Texas were derived from deterministic measurements of trees on forested sample locations. These deterministic measurements included d.b.h., bark thickness,
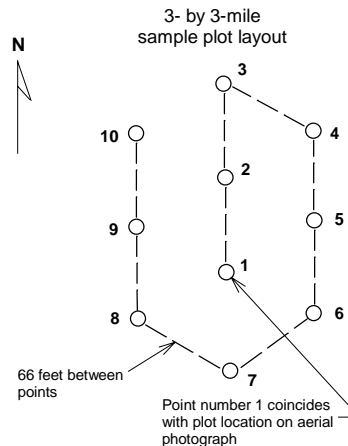


Figure 25—Configuration of the 10 satellite points at a sample location, east Texas, 1992.

total height, bole length, log length, and 4 upper stem diameters. Smalian's formula was used to compute volume. In addition, volume equations were 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 included estimates of site productivity, stand origin, slope, aspect, disturbance, management, and nontimber resources. Ownership information was obtained for each plot from county tax
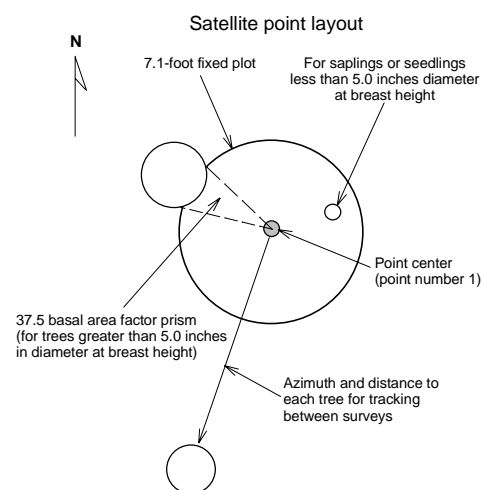


Figure 26—Configuration of a satellite point, east Texas, 1992.

assessors' records and contact with landowners. Personnel from public agencies and other knowledgeable people were consulted when classifying absentee farmers, individuals, corporations, or lessors.

Components of inventory volume change (growth, removals, and mortality) were estimated from tally tree data on remeasured sample plots. The remeasurement of sample plots allowed tracking of the history and volume change of each tally tree over time. This information was then used in assigning tally tree volumes and changes in volume to one of nine components of change: survivor growth, nongrowth, ingrowth, ongrowth, growth on removals, growth on mortality, mortality, timberland removals, and land-clearing removals.

Estimates of timberland area, volume, growth, removals, and mortality were based on the application of essentially the same inventory techniques to each survey measurement. However, there were important differences between the methods used in the 1986 and 1992 inventories. In many cases, improvements in methodology for deriving current estimates can raise concerns about reported trends between survey periods. Because such differences might discourage comparisons between 1986 and 1992 results, the major differences in procedures are documented in the following paragraph.

Classification of trees into growing-stock, rough, or rotten classes was modified in two ways to ensure compatibility among the eastern FIA work units: (1) in the 1992 survey, any tree that contained or was capable of producing one 12-foot or two 8-foot logs anywhere in the saw-log portion of the tree was classified as growing stock. The 1986 survey classified growing-stock trees as those that had or were capable of producing a 12-foot log only in the butt 16-foot section; and (2) the 1986 survey required that over one-half of the saw-log volume had to be utilizable for the tree to be classified as growing stock. The 1992 standard was that one-third of the saw-log volume in the saw-log portion of the tree had to be utilizable.

The change in the growing-stock definition (concerning log position) did affect direct comparisons between 1986 and 1992 estimates. To compensate for this definition change, the 1986 inventory data were reprocessed to make them compatible with the 1992 growing-stock standard. The total number of trees affected was small, and most were hard-woods because of growth habit. It was not possible to consistently reclassify all trees selected in the 1986 survey to the new growing-stock definition. Some died or had been

cut. Because those trees were gone, the survey staff had no way of determining how they would have been classified under the new standard. Therefore, trend information for growing-stock trees in such cases was uncertain.

Expanding the definition of growing stock to include trees with saw-log portions that are one-third sound had virtually no impact; only a very few trees were affected by the definition change. A small number of sawtimber sample trees had between 33 and 50 percent of their saw-log portions sound, but most were reprocessed to resolve log position differences. 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 should be aware of the impact of the growing-stock definition change; incompatibil-ity arises from trees that were cut or died, affecting growth, removals, and mortality estimates. The magnitude was probably small but not possible to define with certainty.

Growing-stock comparisons between the 1986 and 1992 data sets were probably valid for most broad applications. In a more rigorous analysis, or where postdefined strata are selected (resulting in smaller data sets) and analyzed, one should determine that the changes are real and not due to definition or procedural changes. In such instances, the comparisons between surveys should be done using all live trees. This procedure eliminates any uncertainties caused by the growing-stock definition changes. Finally, to further enhance trend analysis, a slight improvement in precision was made in the 1986 volume estimates by using all the determin-istic tree measurements from the 1992 survey to develop new volume coefficients for use where needed. Because of the change in the growing-stock standard and the improved volume coefficients, estimates for the reprocessed 1986 data may differ slightly from those previously published.

Some area and volume estimates in this bulletin may not match those published in "Forest statistics for East Texas counties–1992" (Miller and Hartsell 1992). This is because some minor corrections have been made to the data since release of that publication.

**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 keypunching errors for all plots. It is not possible to determine measurement error statistically, but the 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 XXXIV are based on one 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.

Table XXXIV.—*Sampling errors, at one standard error, for estimates of total timberland area\* (1992), volume†, average net annual growth† (1986 to 1992), average annual removals† (1986 to 1992), and average annual mortality† (1986 to 1992), east Texas*

| Item | Component total | Units | Percent sampling error |
|---|---|---|---|
| Timberland area | 11,773.8 | Thousand acres | 0.3 |
| Total live trees | | | |
|   Volume | 14,229.0 | Million cubic feet | 1.9 |
|   Average net annual growth | 701.2 | Million cubic feet | 2.2 |
|   Average annual removals | 688.4 | Million cubic feet | 4.4 |
|   Average annual mortality | 131.5 | Million cubic feet | 4.5 |
| Total sawtimber | | | |
|   Volume | 50,711.6 | Million board feet‡ | 2.9 |
|   Average net annual growth | 2,843.4 | Million board feet‡ | 2.8 |
|   Average annual removals | 2,977.5 | Million board feet‡ | 4.8 |
|   Average annual mortality | 357.7 | Million board feet‡ | 7.3 |
| Softwood live trees | | | |
|   Volume | 8,008.6 | Million cubic feet | 3.1 |
|   Average net annual growth | 508.3 | Million cubic feet | 2.9 |
|   Average annual removals | 515.2 | Million cubic feet | 5.0 |
|   Average annual mortality | 58.2 | Million cubic feet | 7.2 |
| Softwood sawtimber | | | |
|   Volume | 35,133.1 | Million board feet‡ | 3.9 |
|   Average net annual growth | 2,222.1 | Million board feet‡ | 3.4 |
|   Average annual removals | 2,446.3 | Million board feet‡ | 5.3 |
|   Average annual mortality | 227.5 | Million board feet‡ | 9.4 |
| Hardwood live trees | | | |
|   Volume | 6,220.4 | Million cubic feet | 2.5 |
|   Average net annual growth | 192.8 | Million cubic feet | 3.9 |
|   Average annual removals | 173.3 | Million cubic feet | 6.6 |
|   Average annual mortality | 73.4 | Million cubic feet | 5.8 |
| Hardwood sawtimber | | | |
|   Volume | 15,578.5 | Million board feet‡ | 3.6 |
|   Average net annual growth | 621.4 | Million board feet‡ | 5.4 |
|   Average annual removals | 531.2 | Million board feet‡ | 8.0 |
|   Average annual mortality | 130.2 | Million board feet‡ | 11.3 |

\*By binomial formula.
†By random sampling formula.
‡International 1/4-inch rule.

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 XXXV, which shows the sampling error to which the estimates are liable, two chances out of three.

Table XXXV.—*Sampling error approximations to which estimates are liable at one standard error, east Texas, 1992\**

| Sampling error | Timberland area | Live trees | | | | Sawtimber | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Volume | Average net annual growth | Average annual removals | Average annual mortality | Volume | Average net annual growth | Average annual removals | Average annual mortality |
| *Percent* | *Thousand acres* | - - - - - - - - - - - - - -*Million cubic feet* - - - - - - - - - - - - | | | | - - - - - - - - - - - - -*Million board feet*† - - - - - - - - - - | | | |
| 1.0 | 1,059.6 | | | | | | | | |
| 2.0 | 264.9 | 12,841.7 | | | | | | | |
| 3.0 | 117.7 | 5,704.4 | 351.5 | | | 47,387.4 | 2,319.5 | | |
| 4.0 | 66.2 | 3,210.4 | 197.7 | | | 26,655.4 | 1,304.7 | | |
| 5.0 | 42.4 | 2,054.7 | 126.6 | 477.4 | 98.3 | 17,059.5 | 835.0 | 2,492.0 | |
| 10.0 | 10.6 | 513.7 | 31.6 | 119.4 | 24.6 | 4,264.9 | 208.8 | 623.0 | 177.5 |
| 15.0 | 4.7 | 228.3 | 14.1 | 53.0 | 10.9 | 1,895.5 | 92.8 | 276.9 | 78.9 |
| 20.0 | 2.6 | 128.4 | 7.9 | 29.8 | 6.1 | 1,066.2 | 52.2 | 155.8 | 44.4 |
| 25.0 | 1.7 | 82.2 | 5.1 | 19.1 | 3.9 | 682.4 | 33.4 | 99.7 | 28.4 |

\*Components for given sampling error derived by ratio approximation.
†International 1/4-inch rule.

# Definitions

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

**Average net annual growth.** Average net annual volume increase of growing-stock or live trees during 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.

## 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.

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

**Cull increment.** The change in growing-stock volume due to growing-stock, rough, or rotten trees changing tree class between surveys.

**Cull trees.** Rough or rotten trees.

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

**Diameter class.** A classification of trees based on tree d.b.h. Two-inch diameter classes are commonly used by Forest Inventory and Analysis, with the even inch as the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0-6.9 inches in d.b.h.

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

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

**Forest land.** Land at least 10 percent stocked (10 percent canopy stocking is equivalent to 16.7 percent sample plot stocking) 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.

**Forest-type group.** A grouping of several detailed forest types. The grouping is based upon forest types with similar physiographic and physiognomic characteristics.

*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 oaks, hickories, and gums.

*Oak-gum-cypress.* Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or baldcypress, singly or in combination, comprise a plurality of the stocking, except where pines comprise 25 percent or more but less than 50 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 percent or greater but less than 50 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 baldcypress, comprise 25 percent or greater but less than 50 percent of the stocking. Common associates include gums, hickories, and yellow-poplar.

**Gross growth.** Total annual increase in stand volume computed on growing-stock trees or live trees 5.0 inches or greater in d.b.h. Gross growth equals survivor growth, plus ingrowth, plus nongrowth, plus ongrowth, plus growth on removals, plus growth on mortality, plus cull increment (cull increment only used for growing-stock computations).

**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 saw-log 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 noncommercial species.

**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 or live trees that died from natural causes during a specified period.

**National forest land.** Federal land that has been legally designated as national forest or purchase units and other land under the administration of the U.S. Department of Agriculture, Forest Service, including experimental areas.

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

**Net change.** Increase or decrease in stand volume computed on growing-stock trees or live trees 5.0 or more 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 5.0 inches or more in d.b.h. Net growth is equal to gross growth minus mortality.

**NIPF.** Abbreviation for nonindustrial private forest land, including corporate and individual ownerships.

**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.

**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.

**Nonstocked stands.** Stands less than 10 percent (canopy) or 16.7 percent (sample plot) stocked with live trees (see Stocking definition).

**Nontyped.** Timberland currently with no trees or occupied by live trees or seedlings where plot stocking is less than 16.7 percent.

**Other Federal land.** Federal land other than national forests.

**Other public land.** All Federal land, other than national forest land, and all State, county, and municipal lands.

**Plantations.** Forest stands that currently show evidence of being planted or artificially seeded. In this bulletin, stands that were classified as plantations in the previous survey and which had no commercial harvesting activity between survey periods were left classified as plantations. This definition is slightly different from that used in the usual representation of Forest Inventory and Analysis data. In that situation, the field person decides if a plantation is still present (based upon visible evidence).

**Poletimber-size trees.** Softwoods 5.0 inches or larger but less than 9.0 inches in d.b.h. and hardwoods 5.0 inches or larger but less than 11.0 inches in d.b.h.

**Poletimber stands.** Stands at least 10 percent (canopy) stocked with live trees, with half or more of this stocking in sawtimber or poletimber trees, with poletimber stocking exceeding that of sawtimber stocking (see Stocking definition).

**Productive-reserved forest land.** (see: Reserved timberland).

**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.

**Reserved timberland.** Public timberland withdrawn from timber utilization through statute or administrative designation.

**Rotten trees.** Live trees of commercial species that do not contain at least one 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because less than one-third of the gross board-foot tree volume is in sound material. See Growing-stock trees.

**Rough trees.** Live trees of commercial species that are unmerchantable for saw logs, currently or potentially, because of roughness or poor form in the saw-log 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 5.0 inches d.b.h. or larger to qualify. If sawtimber size, a tree must have one 12-foot or two 8-foot logs meeting minimum log-grade standards and one-third of gross board-foot volume sound for softwoods and at least one-half sound for hardwoods. If poletimber size, a tree must have at least one-half of its volume sound.

**Sapling-seedling stands.** Stands at least 10 percent (canopy) stocked with live trees, with more than half of this stocking in saplings or seedlings (see Stocking definition).

**Sapling-size trees.** Trees 1.0 inch or larger but less than 5.0 inches in d.b.h.

**Saw-log portion.** That portion of the bole of a sawtimber tree between a 1-foot stump and the saw-log top.

**Saw-log top.** The point on the bole of a sawtimber tree above which a saw log cannot be produced. The minimum

saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

**Sawtimber-size trees.** Softwoods 9.0 inches or larger in d.b.h. and hardwoods 11.0 inches or larger in d.b.h.

**Sawtimber stands.** Stands at least 10 percent (canopy) 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.

**Seedling-size trees.** Trees less than 1.0 inch in d.b.h. and taller than 1 foot for hardwoods, taller than 6 inches for softwoods, and less than 0.5 inch in diameter at ground level for longleaf pine.

**Select red oaks.** A group of several red oak species that includes 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 that includes 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.

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

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

**Stocking.** Stocking is a measure of the extent to which growth potential of the site is used 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. Note that 10 percent canopy stocking is approximately equal to 16.7 percent sample-plot stocking.

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

| D.b.h. class | Trees per acre |
|---|---|
| *Inches* | |
| Seedlings | 600 |
| 2 | 560 |
| 4 | 460 |
| 6 | 340 |
| 8 | 240 |
| 10 | 155 |
| 12 | 115 |
| 14 | 90 |
| 16 | 72 |
| 18 | 60 |
| 20 | 51 |
| 22 | 42 |
| 24 | 36 |
| 26 | 31 |
| 28 | 27 |
| 30 | 24 |

Stocking categories are arbitrarily defined as follows:

*Optimally stocked*. Stands 61 to 100 percent stocked with growing-stock trees. Such stands are growing toward a fully stocked condition (the 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 become stagnant and mortality of individuals increases as stocking levels rise above 100 percent.

*Understocked*. Stands 0 to 60 percent stocked with growing-stock trees. Such stands will take a very long time to reach full stocking. Meanwhile, poor bole form will result, and much of the productive growth will occur on heavy limbs instead of on the bole.

**Timberland.** Forest land that is producing, or is capable of producing 20 cubic feet of industrial wood per acre per year and is not withdrawn from timber utilization. Timberland is synonymous with "commercial forest land" in prior reports.

**Tree grade.** A classification of the saw-log 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 saw-log portion.

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

**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 5.0 inches or greater 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 5.0 inches or greater 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 saw-log portion.** The cubic-foot volume of sound wood in the saw-log 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 saw-log 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 5.0 inches or greater 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.

**Woodland.** Forest land incapable of producing 20 cubic feet of industrial wood per acre per year.

## Conversion Factors

## Metric equivalents of units used in this report

1 acre = 4,046.86 square meters or 0.404686 hectare
1 cubic foot = 0.028317 cubic meter
1 inch = 2.54 centimeters or 0.0254 meter
Breast height = 1.4 meters aboveground level
1 square foot = 929.03 square centimeters or 0.0929 square meter
1 square foot per acre basal area = 0.229568 square meter per hectare
1 pound = 0.454 kilogram
1 ton = 0.907 metric ton

# Species List[a]

## Commercial Species

| Scientific Name[b] | Common name |
|---|---|
| **Softwoods** | |
| *Juniperus virginiana* | Eastern redcedar |
| *Pinus echinata* | Shortleaf pine |
| *P. elliottii* | Slash pine |
| *P. palustris* | Longleaf pine |
| *P. taeda* | Loblolly pine |
| *Taxodium distichum* | Baldcypress |
| **Hardwoods** | |
| *Acer barbatum* | Florida maple |
| *A. negundo* | Boxelder |
| *A. rubrum* | Red maple |
| *A. saccharinum* | Silver maple |
| *A. saccharum* | Sugar maple |
| *Betula nigra* | River birch |
| *Carya* spp. | Hickories |
| *C. aquatica* | Water hickory |
| *C. cordiformis* | Bitternut hickory |
| *C. glabra* | Pignut hickory |
| *C. illinoensis* | Pecan |
| *C. laciniosa* | Shellbark hickory |
| *C. ovata* | Shagbark hickory |
| *C. texana* | Black hickory |
| *C. tomentosa* | Mockernut hickory |
| *Castanea pumila* | Allegheny chinkapin |
| *Catalpa* spp. | Catalpa |
| *Celtis laevigata* | Sugarberry |
| *C. occidentalis* | Hackberry |
| *Cornus florida* | Flowering dogwood |
| *Diospyros virginiana* | Common persimmon |
| *Fagus grandifolia* | American beech |
| *Fraxinus americana* | White ash |
| *F. pennsylvanica* | Green ash |
| *Gleditsia aquatica* | Waterlocust |
| *G. triacanthos* | Honeylocust |
| *Ilex opaca* | American holly |
| *Juglans nigra* | Black walnut |
| *Liquidambar styraciflua* | Sweetgum |
| *Maclura pomifera* | Osage-orange |
| *Magnolia acuminata* | Cucumbertree |
| *M. grandiflora* | Southern magnolia |
| *M. virginiana* | Sweetbay |
| *Morus rubra* | Red mulberry |
| *Nyssa aquatica* | Water tupelo |
| *N. sylvatica* | Blackgum |
| *N. sylvatica* var. *biflora* | Swamp tupelo |
| *Persea borbonia* | Redbay |
| *Platanus occidentalis* | American sycamore |
| *Populus deltoides* | Eastern cottonwood |
| *Prunus serotina* | Black cherry |
| *Quercus alba* | White oak |
| *Q. bicolor* | Swamp white oak |

## Commercial Species

| Scientific Name[b] | Common name |
|---|---|
| **Hardwoods** (continued) | |
| *Q. coccinea* | Scarlet oak |
| *Q. durandii* | Durand oak |
| *Q. falcata* | Southern red oak |
| *Q. falcata* var. *pagodifolia* | Cherrybark oak |
| *Q. laurifolia* | Laurel oak |
| *Q. lyrata* | Overcup oak |
| *Q. macrocarpa* | Bur oak |
| *Q. michauxii* | Swamp chestnut oak |
| *Q. muehlenbergii* | Chinkapin oak |
| *Q. nigra* | Water oak |
| *Q. nuttallii* | Nuttall oak |
| *Q. palustris* | Pin oak |
| *Q. phellos* | Willow oak |
| *Q. prinus* | Chestnut oak |
| *Q. shumardii* | Shumard oak |
| *Q. stellata* | Post oak |
| *Q. velutina* | Black oak |
| *Robinia pseudoacacia* | Black locust |
| *Salix* spp. | Willow |
| *Sassafras albidum* | Sassafras |
| *Tilia americana* | American basswood |
| *T. heterophylla* | White basswood |
| *Ulmus alata* | Winged elm |
| *U. americana* | American elm |
| *U. crassifolia* | Cedar elm |
| *U. rubra* | Slippery elm |

## Noncommercial Species

| Scientific Name[b] | Common name |
|---|---|
| *Amelanchier* spp. | Serviceberry |
| *Bumelia* spp. | Chittamwood |
| *Carpinus caroliniana* | American hornbeam |
| *Castanea* spp. | Chinkapin |
| *Cercis canadensis* | Eastern redbud |
| *Crataegus* spp. | Hawthorn |
| *Melia azedarach* | Chinaberry |
| *Morus alba* | White mulberry |
| *Ostrya virginiana* | Eastern hophornbeam |
| *Oxydendrum arboreum* | Sourwood |
| *Planera aquatica* | Water-elm |
| *Prunus* spp. | Plums, cherries, (other than black cherry) |
| *Quercus incana* | Bluejack oak |
| *Q. laevis* | Turkey oak |
| *Q. marilandica* | Blackjack oak |
| *Q. virginiana* | Live oak |
| *Sapium sebiferum* | Tallowtree |
| *Vaccinium arboreum* | Sparkleberry |

[a]Scientific and common names of tree species ≥1.0 inch in d.b.h. occurring in the FIA sample, east Texas, 1992.
[b]Nomenclature (Little 1979).

# Index of Detailed Tables

Table 1.–*Area by land class, east Texas, 1992*

| Land class | Area |
|---|---|
| | *Thousand acres* |
| Forest | |
|    Timberland | 11,773.8 |
|    Reserved timberland | 125.1 |
|    Woodland | 44.3 |
|      Total forest | 11,943.2 |
| Nonforest | |
|   Cropland* | 3,432.6 |
|   Other | 6,218.2 |
|     Total nonforest | 9,650.8 |
|     All land† | 21,594.0 |

*U.S. Department of Commerce, Bureau of the Census, 1987
Census of Agriculture: State and county data, issued 1989.
Vol. 1, part 43.
†U.S. Department of Commerce, Bureau of the Census, 1980
(issued October 1981). See Figure 1 for counties included in
the east Texas survey.

Table 2.—*Area of timberland by ownership class, east Texas, 1992\**

| Ownership class | Area |
|---|---|
| | *Thousand acres* |
| Public | |
|   National forest | 576.7 |
|   Other Federal | 91.8 |
|   State | 68.1 |
|   County | 46.9 |
|     Total public | 783.5 |
| Private | |
|   Forest industry | 3,719.7 |
|   Miscellaneous private | |
|     Individual | 6,316.7 |
|     Corporate | 954.0 |
|     Total private | 10,990.4 |
|     All ownerships | 11,773.8 |

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

Table 3.—*Area of timberland by stand size and ownership class, east Texas, 1992\**

| Stand size class | All ownerships | National forest | Other public | Forest industry | Nonindustrial private |
|---|---|---|---|---|---|
| | - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - |
| Sawtimber | 5,267.3 | 423.4 | 110.7 | 1,158.3 | 3,574.9 |
| Poletimber stands | 2,589.0 | 45.1 | 43.8 | 877.1 | 1,623.1 |
| Sapling and seedling | 3,876.0 | 108.2 | 46.4 | 1,677.7 | 2,043.8 |
| Nonstocked areas | 41.5 | 0.0 | 5.9 | 6.5 | 29.0 |
|   All classes | 11,773.8 | 576.7 | 206.7 | 3,719.7 | 7,270.7 |

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

Table 4.—*Area of timberland by stand volume and ownership class, east Texas, 1992\**

| Stand volume per acre | All ownerships | National forest | Other public | Forest industry | Nonindustrial private |
|---|---|---|---|---|---|
| *Board feet* † | - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - - - | | | | |
| Less than 1,500 | 4,924.4 | 103.1 | 66.3 | 2,019.8 | 2,735.2 |
| 1,500 to 5,000 | 3,267.4 | 53.8 | 79.1 | 834.0 | 2,300.4 |
| More than 5,000 | 3,582.1 | 419.8 | 61.4 | 865.9 | 2,235.0 |
| All classes | 11,773.8 | 576.7 | 206.7 | 3,719.7 | 7,270.7 |

*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, east Texas, 1992\**

| Growing-stock trees | Cull trees (Percent stocking) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60+ |
| *Percent stocking* | - - - - - - - - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | |
| 0-10 | 177.9 | 46.7 | 17.3 | 30.8 | 11.3 | 4.3 | 5.8 | 61.6 |
| 10-20 | 106.9 | 17.6 | 11.9 | 10.9 | 16.3 | 17.9 | 7.8 | 24.5 |
| 20-30 | 282.0 | 11.0 | 23.2 | 31.2 | 27.2 | 45.1 | 41.0 | 103.3 |
| 30-40 | 402.6 | 36.1 | 10.9 | 55.4 | 104.6 | 54.9 | 66.0 | 74.8 |
| 40-50 | 682.9 | 46.9 | 100.3 | 78.0 | 159.4 | 157.0 | 71.9 | 69.3 |
| 50-60 | 1,106.2 | 101.0 | 137.3 | 238.5 | 274.3 | 202.2 | 110.1 | 42.8 |
| 60-70 | 1,352.0 | 133.8 | 270.1 | 334.3 | 262.6 | 210.8 | 109.8 | 30.7 |
| 70-80 | 1,654.9 | 282.0 | 384.4 | 478.0 | 305.3 | 166.2 | 27.8 | 11.1 |
| 80-90 | 1,624.9 | 383.5 | 482.0 | 481.6 | 189.0 | 77.0 | 11.8 | 0.0 |
| 90-100 | 1,206.6 | 415.2 | 449.1 | 248.7 | 63.7 | 17.8 | 12.0 | 0.0 |
| 100-110 | 1,192.3 | 554.0 | 396.3 | 177.8 | 52.9 | 11.2 | 0.0 | 0.0 |
| 110-120 | 975.3 | 521.0 | 335.9 | 107.1 | 5.6 | 5.8 | 0.0 | 0.0 |
| 120-130 | 486.9 | 374.7 | 106.4 | 0.0 | 5.8 | 0.0 | 0.0 | 0.0 |
| 130-140 | 345.7 | 274.6 | 64.9 | 6.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| 140-150 | 136.7 | 130.9 | 5.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 150-160 | 40.2 | 40.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| >160 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 11,773.8 | 3,369.1 | 2,795.6 | 2,278.7 | 1,478.1 | 970.2 | 464.0 | 418.1 |

*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, east Texas, 1992\**

| Ownership and tree class | All species | Softwood | | | Hardwood | | |
|---|---|---|---|---|---|---|---|
| | | Sapling and seedling | Poletimber | Sawtimber | Sapling and seedling | Poletimber | Sawtimber |
| | | | | *Square feet per acre* | | | |
| **National forest** | | | | | | | |
| Growing stock | 86.3 | 3.6 | 9.7 | 50.7 | 2.8 | 9.4 | 10.1 |
| Rough and rotten | 11.6 | 1.0 | 0.7 | 0.1 | 5.4 | 2.6 | 1.8 |
| Total | 97.9 | 4.6 | 10.4 | 50.8 | 8.3 | 11.9 | 11.9 |
| **Other public** | | | | | | | |
| Growing stock | 58.8 | 1.5 | 3.1 | 18.5 | 4.7 | 14.8 | 16.3 |
| Rough and rotten | 20.0 | 0.3 | 0.2 | 0.3 | 8.1 | 4.9 | 6.2 |
| Total | 78.8 | 1.8 | 3.3 | 18.8 | 12.8 | 19.7 | 22.5 |
| **Forest industry** | | | | | | | |
| Growing stock | 54.8 | 7.4 | 14.3 | 13.3 | 4.1 | 6.3 | 9.4 |
| Rough and rotten | 10.9 | 0.6 | 0.4 | 0.2 | 4.4 | 2.9 | 2.4 |
| Total | 65.7 | 8.0 | 14.6 | 13.6 | 8.5 | 9.1 | 11.8 |
| **Nonindustrial private** | | | | | | | |
| Growing stock | 58.6 | 2.8 | 5.1 | 19.1 | 3.8 | 8.6 | 19.1 |
| Rough and rotten | 20.3 | 0.3 | 0.5 | 1.2 | 3.2 | 5.0 | 10.1 |
| Total | 78.8 | 3.0 | 5.6 | 20.3 | 7.0 | 13.6 | 29.3 |
| **All owners** | | | | | | | |
| Growing stock | 58.7 | 4.1 | 8.8 | 18.4 | 4.3 | 10.5 | 12.6 |
| Rough and rotten | 16.9 | 0.8 | 0.4 | 0.5 | 5.8 | 4.4 | 5.0 |
| Total | 75.6 | 4.9 | 9.3 | 18.8 | 10.1 | 14.9 | 17.6 |

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

Table 7.—*Area of timberland by site and ownership class, east Texas, 1992\**

| Site class | All ownerships | National forest | Other public | Forest industry | Nonindustrial private |
|---|---|---|---|---|---|
| | | | *Thousand acres* | | |
| ∫ 165 ft$^3$ | 655.7 | 84.4 | 27.7 | 205.2 | 338.4 |
| 120 to 165 ft$^3$ | 3,066.2 | 214.3 | 33.1 | 928.0 | 1,890.8 |
| 85 to 120 ft$^3$ | 4,769.2 | 228.2 | 90.6 | 1,720.0 | 2,730.5 |
| 50 to 85 ft$^3$ | 2,707.0 | 49.8 | 38.1 | 798.3 | 1,820.9 |
| <50 ft$^3$ | 575.6 | 0.0 | 17.3 | 68.2 | 490.2 |
| All classes | 11,773.8 | 576.7 | 206.7 | 3,719.7 | 7,270.7 |

\*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, east Texas, 1992\**

| Forest type group | All ownerships | National forest | Other public | Forest industry | Nonindustrial private |
|---|---|---|---|---|---|
| | - - - - - - - - - - - - - - - - - - - - - *Thousand acres* - - - - - - - - - - - - - - - - - - - - - -- - - - - | | | | |
| Longleaf-slash pine | 232.2 | 21.0 | 0.0 | 164.9 | 46.4 |
| Loblolly-shortleaf pine | 4,064.6 | 394.5 | 43.9 | 1,673.2 | 1,953.0 |
| Oak-pine | 2,502.1 | 94.6 | 40.8 | 834.5 | 1,532.2 |
| Oak-hickory | 3,127.2 | 35.5 | 55.2 | 602.6 | 2,433.9 |
| Oak-gum-cypress | 1,740.8 | 31.1 | 50.1 | 437.9 | 1,221.7 |
| Elm-ash-cottonwood | 65.3 | 0.0 | 10.9 | 0.0 | 54.4 |
| Nontyped | 41.5 | 0.0 | 5.9 | 6.5 | 29.0 |
| All types | 11,773.8 | 576.7 | 206.7 | 3,719.7 | 7,270.7 |

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

Table 9.—*Area of noncommercial forest land by forest type group, east Texas, 1992\**

| Forest type group | All areas | Productive reserved areas | Unproductive areas |
|---|---|---|---|
| | - - - - - - - - - - - *Thousand acres* - - - - - - - - - | | |
| Longleaf-slash pine | 5.7 | 5.7 | 0.0 |
| Loblolly-shortleaf pine | 41.7 | 41.7 | 0.0 |
| Oak-pine | 38.5 | 38.5 | 0.0 |
| Oak-hickory | 47.6 | 3.3 | 44.3 |
| Oak-gum-cypress | 36.0 | 36.0 | 0.0 |
| All types | 169.4 | 125.1 | 44.3 |

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

Table 10.—*Number of growing-stock trees on timberland by species and diameter class, east Texas, 1992\**

| Species | 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 | 8,644 | 3,138 | 2,628 | 848 | 711 | 586 | 331 | 288 | 56 | 58 | 0 |
| Slash pine | 26,780 | 10,864 | 7,825 | 4,816 | 1,987 | 823 | 220 | 119 | 75 | 52 | 0 |
| Shortleaf pine | 111,195 | 28,116 | 24,532 | 18,718 | 16,906 | 10,937 | 6,773 | 3,248 | 1,300 | 654 | 10 |
| Loblolly pine | 474,653 | 201,261 | 126,659 | 55,423 | 32,404 | 22,004 | 15,727 | 9,710 | 5,402 | 5,619 | 446 |
| Redcedar | 8,606 | 4,515 | 1,656 | 1,291 | 479 | 416 | 104 | 111 | 18 | 16 | 0 |
| Cypress | 6,168 | 1,549 | 1,493 | 756 | 692 | 585 | 339 | 317 | 188 | 224 | 25 |
| Total softwoods | 636,046 | 249,443 | 164,792 | 81,851 | 53,180 | 35,350 | 23,494 | 13,793 | 7,040 | 6,622 | 480 |
| | | | | | | | | | | | |
| Select white oaks† | 20,639 | 5,522 | 5,086 | 3,500 | 1,861 | 1,472 | 921 | 1,021 | 476 | 704 | 76 |
| Select red oaks‡ | 13,987 | 4,085 | 2,872 | 1,958 | 1,471 | 1,078 | 751 | 440 | 454 | 740 | 137 |
| Other white oaks | 76,194 | 24,973 | 19,120 | 13,904 | 7,205 | 4,503 | 2,712 | 1,728 | 937 | 1,062 | 50 |
| Other red oaks | 112,999 | 34,517 | 22,754 | 19,096 | 11,871 | 8,121 | 6,260 | 3,967 | 2,604 | 3,380 | 429 |
| Sweet pecan | 768 | 347 | 222 | 40 | 81 | 23 | 15 | 23 | 0 | 17 | 0 |
| Water hickory | 4,032 | 1,302 | 1,175 | 572 | 385 | 261 | 147 | 83 | 38 | 47 | 21 |
| Other hickories | 21,569 | 7,645 | 4,992 | 4,444 | 2,000 | 1,246 | 834 | 177 | 145 | 85 | 0 |
| Persimmon | 898 | 405 | 292 | 126 | 74 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hard maples | 799 | 307 | 348 | 0 | 89 | 27 | 15 | 13 | 0 | 0 | 0 |
| Soft maples | 11,195 | 6,733 | 2,567 | 1,284 | 331 | 175 | 45 | 35 | 11 | 14 | 0 |
| Boxelder | 833 | 459 | 110 | 208 | 29 | 0 | 15 | 12 | 0 | 0 | 0 |
| Beech | 2,202 | 365 | 483 | 260 | 330 | 208 | 245 | 150 | 70 | 86 | 5 |
| Sweetgum | 131,943 | 56,028 | 35,191 | 20,269 | 8,552 | 6,291 | 2,714 | 1,322 | 804 | 705 | 66 |
| Blackgum | 23,288 | 8,937 | 6,508 | 3,330 | 1,521 | 1,253 | 765 | 475 | 198 | 285 | 16 |
| Other gums/tupelos | 2,884 | 485 | 824 | 499 | 370 | 227 | 278 | 106 | 52 | 44 | 0 |
| White ash | 3,787 | 1,199 | 702 | 623 | 477 | 373 | 205 | 123 | 55 | 31 | 0 |
| Other ashes | 12,672 | 4,930 | 2,849 | 1,987 | 868 | 1,075 | 478 | 251 | 124 | 94 | 17 |
| Sycamore | 1,228 | 552 | 185 | 192 | 25 | 104 | 48 | 43 | 10 | 52 | 17 |
| Cottonwood | 1,056 | 442 | 0 | 106 | 146 | 80 | 73 | 55 | 73 | 74 | 7 |
| Basswood | 232 | 117 | 0 | 43 | 54 | 19 | 0 | 0 | 0 | 0 | 0 |
| Magnolia | 1,122 | 401 | 64 | 152 | 137 | 140 | 75 | 113 | 9 | 27 | 5 |
| Sweetbay | 3,042 | 1,176 | 722 | 876 | 175 | 61 | 15 | 0 | 10 | 7 | 0 |
| Willow | 3,103 | 1,200 | 1,051 | 556 | 46 | 75 | 111 | 22 | 18 | 18 | 7 |
| Black walnut | 536 | 105 | 44 | 246 | 111 | 21 | 0 | 0 | 9 | 0 | 0 |
| Black cherry | 921 | 344 | 186 | 330 | 26 | 24 | 0 | 11 | 0 | 0 | 0 |
| American elm | 6,173 | 2,659 | 1,342 | 950 | 291 | 430 | 176 | 163 | 36 | 125 | 3 |
| Other elms | 35,800 | 18,080 | 9,400 | 4,390 | 1,779 | 1,343 | 443 | 242 | 64 | 45 | 13 |
| River birch | 3,614 | 1,630 | 763 | 577 | 199 | 184 | 101 | 84 | 40 | 30 | 6 |
| Hackberry | 8,492 | 3,319 | 2,464 | 1,277 | 451 | 338 | 291 | 204 | 91 | 57 | 0 |
| Black locust | 71 | 0 | 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other locusts | 1,561 | 318 | 785 | 196 | 64 | 81 | 51 | 35 | 11 | 21 | 0 |
| Sassafras | 2,289 | 1,857 | 368 | 0 | 26 | 0 | 30 | 0 | 0 | 8 | 0 |
| Dogwood | 1,169 | 971 | 152 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Holly | 3,334 | 2,219 | 636 | 366 | 54 | 42 | 17 | 0 | 0 | 0 | 0 |
| Other commercial | 410 | 91 | 129 | 128 | 63 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total hardwoods | 514,841 | 193,720 | 124,454 | 82,530 | 41,162 | 29,272 | 17,832 | 10,900 | 6,338 | 7,758 | 876 |
| All species | 1,150,888 | 443,163 | 289,246 | 164,381 | 94,342 | 64,623 | 41,327 | 24,692 | 13,378 | 14,380 | 1,356 |

\*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 and Shumard oaks.

Table 11.—*Volume of timber on timberland by class of timber and by softwoods and hardwoods, east Texas, 1992\**

| Class of timber | All species | Softwood | Hardwood |
|---|---|---|---|
| | - - - - - - - - - - - - - - *Million cubic feet* - - - - - - - - - - - - | | |
| Sawtimber trees | | | |
|   Sawlog portion | 8,205.7 | 5,605.9 | 2,599.8 |
|   Upper-stem portion | 1,224.8 | 680.5 | 544.3 |
|     Total | 9,430.5 | 6,286.5 | 3,144.0 |
| | | | |
| Poletimber trees | 3,508.2 | 1,592.2 | 1,916.1 |
|   All growing stock | 12,938.7 | 7,878.6 | 5,060.1 |
| | | | |
| Rough trees | 1,122.9 | 124.1 | 998.8 |
| Rotten trees | 167.3 | 5.8 | 161.5 |
| Salvable dead trees | 62.5 | 47.9 | 14.6 |
|   All timber | 14,291.4 | 8,056.4 | 6,234.9 |

*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, east Texas, 1992\**

| Ownership class | Growing stock | | | Sawtimber | | |
|---|---|---|---|---|---|---|
| | All species | Softwood | Hardwood | All species | Softwood | Hardwood |
| | - - - - - - - - - - - *Million cubic feet* - - - - - - - - | | | - - - - - - - - - - - *Million board feet* † - - - - - - - - - - | | |
| National forest | 1,379.3 | 1,143.4 | 235.9 | 7,211.3 | 6,403.3 | 808.0 |
| Other public | 245.8 | 127.9 | 117.8 | 1,011.2 | 664.9 | 346.3 |
| Forest industry | 3,291.0 | 2,126.3 | 1,164.7 | 11,608.9 | 7,584.0 | 4,024.9 |
| Nonindustrial private | 8,022.6 | 4,481.0 | 3,541.7 | 30,880.3 | 20,480.9 | 10,399.2 |
|   All ownerships | 12,938.7 | 7,878.6 | 5,060.1 | 50,711.6 | 35,133.1 | 15,578.5 |

*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, east Texas, 1992**

| Species | 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 and larger |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Million cubic feet* | | | | | | |
| Longleaf pine | 104.3 | 7.4 | 15.9 | 10.0 | 15.3 | 18.2 | 13.1 | 15.3 | 3.7 | 5.4 | 0.0 |
| Slash pine | 234.8 | 28.1 | 49.4 | 62.8 | 42.1 | 26.6 | 8.4 | 6.7 | 5.7 | 4.9 | 0.0 |
| Shortleaf pine | 1,935.1 | 80.7 | 181.7 | 266.9 | 384.2 | 369.8 | 310.4 | 190.8 | 90.7 | 58.4 | 1.5 |
| Loblolly pine | 5,445.1 | 497.6 | 701.7 | 659.8 | 657.7 | 672.4 | 678.8 | 535.6 | 383.5 | 578.5 | 79.6 |
| Redcedar | 49.8 | 9.6 | 7.5 | 12.4 | 5.9 | 7.7 | 2.7 | 2.7 | 0.7 | 0.6 | 0.0 |
| Cypress | 109.5 | 3.6 | 9.0 | 9.3 | 10.8 | 12.7 | 11.6 | 15.1 | 11.2 | 21.6 | 4.5 |
| Total softwoods | 7,878.6 | 627.0 | 965.1 | 1,021.1 | 1,116.0 | 1,107.6 | 1,024.9 | 766.2 | 495.5 | 669.5 | 85.7 |
| | | | | | | | | | | | |
| Select white oaks† | 310.8 | 15.8 | 30.6 | 38.6 | 32.4 | 35.7 | 31.4 | 43.9 | 25.8 | 47.3 | 9.3 |
| Select red oaks‡ | 238.4 | 10.6 | 16.3 | 19.3 | 23.3 | 25.3 | 23.5 | 19.3 | 23.2 | 57.3 | 20.4 |
| Other white oaks | 654.8 | 54.1 | 91.8 | 116.4 | 95.2 | 83.3 | 66.0 | 52.3 | 35.3 | 55.4 | 5.0 |
| Other red oaks | 1,499.1 | 81.2 | 124.0 | 189.0 | 190.7 | 180.6 | 183.6 | 152.3 | 124.1 | 224.7 | 48.9 |
| Sweet pecan | 6.4 | 0.7 | 1.4 | 0.2 | 1.0 | 0.4 | 0.3 | 0.8 | 0.0 | 1.4 | 0.0 |
| Water hickory | 43.2 | 3.5 | 6.5 | 7.1 | 5.5 | 5.6 | 4.1 | 3.0 | 2.1 | 3.3 | 2.6 |
| Other hickories | 169.5 | 16.2 | 22.8 | 37.0 | 28.6 | 24.0 | 20.6 | 6.2 | 7.9 | 6.2 | 0.0 |
| Persimmon | 4.4 | 1.0 | 1.5 | 0.9 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Hard maples | 5.5 | 0.8 | 1.9 | 0.0 | 1.2 | 0.5 | 0.5 | 0.6 | 0.0 | 0.0 | 0.0 |
| Soft maples | 57.0 | 19.7 | 13.5 | 11.9 | 5.0 | 3.6 | 1.1 | 1.4 | 0.2 | 0.5 | 0.0 |
| Boxelder | 4.4 | 1.0 | 0.5 | 1.8 | 0.4 | 0.0 | 0.4 | 0.3 | 0.0 | 0.0 | 0.0 |
| Beech | 37.1 | 0.7 | 3.0 | 2.6 | 5.0 | 4.5 | 7.4 | 5.0 | 2.9 | 5.2 | 0.6 |
| Sweetgum | 1,104.6 | 125.6 | 198.6 | 217.3 | 148.8 | 159.6 | 89.1 | 58.4 | 45.0 | 51.7 | 10.4 |
| Blackgum | 213.3 | 21.6 | 33.6 | 33.8 | 24.6 | 28.5 | 22.9 | 18.3 | 10.3 | 18.1 | 1.6 |
| Other gums/tupelos | 34.9 | 0.7 | 2.6 | 4.5 | 5.0 | 4.6 | 8.6 | 3.7 | 2.5 | 2.6 | 0.0 |
| White ash | 43.3 | 3.1 | 3.8 | 6.1 | 7.6 | 7.9 | 5.9 | 4.6 | 2.6 | 1.7 | 0.0 |
| Other ashes | 117.8 | 12.5 | 16.9 | 19.5 | 13.1 | 23.2 | 12.4 | 8.5 | 5.2 | 5.2 | 1.3 |
| Sycamore | 17.8 | 1.8 | 1.1 | 1.9 | 0.5 | 2.5 | 1.5 | 1.7 | 0.4 | 4.3 | 2.1 |
| Cottonwood | 26.7 | 0.6 | 0.0 | 1.4 | 2.6 | 2.3 | 3.0 | 3.2 | 5.2 | 7.5 | 0.9 |
| Basswood | 1.9 | 0.4 | 0.0 | 0.3 | 0.8 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Magnolia | 16.1 | 0.8 | 0.3 | 1.5 | 2.0 | 3.1 | 1.9 | 4.0 | 0.4 | 1.8 | 0.4 |
| Sweetbay | 21.0 | 2.8 | 3.8 | 8.6 | 3.4 | 1.0 | 0.4 | 0.0 | 0.6 | 0.3 | 0.0 |
| Willow | 21.0 | 2.6 | 4.9 | 5.1 | 0.7 | 1.4 | 2.4 | 0.8 | 0.9 | 1.3 | 0.7 |
| Black walnut | 5.2 | 0.3 | 0.3 | 2.3 | 1.5 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 |
| Black cherry | 6.1 | 0.7 | 0.9 | 2.7 | 0.7 | 0.7 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 |
| American elm | 56.5 | 6.8 | 6.3 | 9.0 | 4.3 | 9.4 | 5.6 | 5.4 | 1.4 | 6.7 | 1.5 |
| Other elms | 208.5 | 41.3 | 49.7 | 38.5 | 25.4 | 27.5 | 11.2 | 7.8 | 3.1 | 2.7 | 1.2 |
| River birch | 30.6 | 5.1 | 4.9 | 5.7 | 2.8 | 3.9 | 2.9 | 2.6 | 1.1 | 1.2 | 0.3 |
| Hackberry | 64.9 | 8.5 | 11.7 | 11.2 | 6.5 | 6.4 | 7.4 | 7.2 | 3.3 | 2.8 | 0.0 |
| Black locust | 0.4 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other locusts | 13.5 | 0.7 | 3.8 | 2.0 | 1.0 | 1.8 | 1.3 | 1.0 | 0.4 | 1.6 | 0.0 |
| Sassafras | 7.2 | 4.1 | 1.8 | 0.0 | 0.4 | 0.0 | 0.7 | 0.0 | 0.0 | 0.2 | 0.0 |
| Dogwood | 2.4 | 1.5 | 0.5 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Holly | 13.2 | 4.7 | 3.1 | 3.3 | 0.7 | 0.9 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other commercial | 2.6 | 0.2 | 0.6 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total hardwoods | 5,060.1 | 451.7 | 663.6 | 800.8 | 642.9 | 649.0 | 516.8 | 412.8 | 304.5 | 510.9 | 107.2 |
| All species | 12,938.7 | 1,078.7 | 1,628.8 | 1,821.9 | 1,758.9 | 1,756.6 | 1,541.6 | 1,179.0 | 800.0 | 1,180.4 | 192.9 |

*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 and Shumard oaks.

Table 14.–*Volume of sawtimber on timberland by species and diameter class, east Texas, 1992\**

| Species | 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 and larger |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Million board feet †* | | | | |
| Longleaf pine | 450.2 | 41.7 | 81.3 | 105.0 | 76.5 | 93.1 | 21.3 | 31.2 | 0.0 |
| Slash pine | 825.5 | 284.3 | 228.7 | 157.3 | 50.0 | 40.6 | 34.5 | 30.0 | 0.0 |
| Shortleaf pine | 9,555.0 | 1,232.5 | 2,137.3 | 2,186.7 | 1,878.3 | 1,175.2 | 560.0 | 374.6 | 10.4 |
| Loblolly pine | 23,658.3 | 2,771.4 | 3,424.7 | 3,792.4 | 4,002.4 | 3,189.6 | 2,334.8 | 3,633.2 | 509.7 |
| Redcedar | 149.0 | 52.5 | 26.0 | 38.7 | 12.9 | 13.1 | 2.8 | 3.1 | 0.0 |
| Cypress | 495.0 | 29.0 | 42.5 | 58.4 | 58.9 | 80.9 | 61.3 | 134.4 | 29.6 |
| Total softwoods | 35,133.1 | 4,411.4 | 5,940.5 | 6,338.5 | 6,079.0 | 4,592.4 | 3,014.8 | 4,206.6 | 549.7 |
| | | | | | | | | | |
| Select white oaks‡ | 1,171.1 | 0.0 | 143.4 | 169.9 | 156.2 | 241.4 | 142.5 | 265.2 | 52.4 |
| Select red oaks§ | 997.9 | 0.0 | 90.2 | 116.3 | 121.1 | 103.1 | 122.8 | 326.1 | 118.3 |
| Other white oaks | 1,997.5 | 0.0 | 420.1 | 407.3 | 348.0 | 280.1 | 196.4 | 316.4 | 29.3 |
| Other red oaks | 5,509.1 | 0.0 | 761.9 | 846.8 | 935.4 | 791.0 | 668.8 | 1,231.0 | 274.2 |
| Sweet pecan | 19.9 | 0.0 | 4.2 | 1.8 | 2.0 | 4.8 | 0.0 | 7.1 | 0.0 |
| Water hickory | 130.1 | 0.0 | 20.6 | 26.3 | 19.3 | 17.2 | 12.6 | 16.7 | 17.4 |
| Other hickories | 471.6 | 0.0 | 131.1 | 117.1 | 107.5 | 33.5 | 44.3 | 38.0 | 0.0 |
| Persimmon | 3.5 | 0.0 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Hard maples | 14.0 | 0.0 | 7.1 | 1.8 | 2.0 | 3.1 | 0.0 | 0.0 | 0.0 |
| Soft maples | 51.4 | 0.0 | 19.5 | 15.9 | 5.9 | 6.7 | 1.3 | 2.0 | 0.0 |
| Boxelder | 4.1 | 0.0 | 1.1 | 0.0 | 1.5 | 1.5 | 0.0 | 0.0 | 0.0 |
| Beech | 162.6 | 0.0 | 20.8 | 21.3 | 40.3 | 28.2 | 16.9 | 32.2 | 2.9 |
| Sweetgum | 2,695.7 | 0.0 | 565.1 | 750.7 | 444.3 | 316.9 | 251.0 | 295.7 | 71.9 |
| Blackgum | 596.4 | 0.0 | 87.0 | 133.1 | 109.5 | 96.1 | 58.5 | 103.6 | 8.6 |
| Other gums/tupelos | 114.9 | 0.0 | 14.9 | 17.5 | 40.8 | 17.7 | 11.9 | 12.1 | 0.0 |
| White ash | 146.5 | 0.0 | 32.4 | 37.2 | 30.0 | 23.6 | 13.7 | 9.5 | 0.0 |
| Other ashes | 322.1 | 0.0 | 48.6 | 105.9 | 64.1 | 42.9 | 26.6 | 26.8 | 7.3 |
| Sycamore | 66.6 | 0.0 | 3.0 | 12.2 | 6.6 | 7.7 | 1.9 | 23.6 | 11.7 |
| Cottonwood | 119.2 | 0.0 | 8.9 | 10.2 | 12.3 | 16.5 | 26.3 | 40.3 | 4.8 |
| Basswood | 4.8 | 0.0 | 3.4 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Magnolia | 67.9 | 0.0 | 8.7 | 14.6 | 10.9 | 20.3 | 2.8 | 8.7 | 2.0 |
| Sweetbay | 29.3 | 0.0 | 16.8 | 4.6 | 2.6 | 0.0 | 3.3 | 2.1 | 0.0 |
| Willow | 40.7 | 0.0 | 2.8 | 6.2 | 10.8 | 5.4 | 4.4 | 8.1 | 3.0 |
| Black walnut | 9.2 | 0.0 | 5.3 | 1.8 | 0.0 | 0.0 | 2.1 | 0.0 | 0.0 |
| Black cherry | 10.6 | 0.0 | 4.0 | 3.5 | 0.0 | 3.0 | 0.0 | 0.0 | 0.0 |
| American elm | 165.5 | 0.0 | 18.3 | 43.1 | 28.7 | 26.1 | 7.4 | 33.6 | 8.3 |
| Other elms | 386.9 | 0.0 | 109.2 | 135.1 | 60.8 | 42.9 | 16.4 | 15.6 | 6.8 |
| River birch | 66.5 | 0.0 | 11.3 | 15.9 | 13.3 | 13.1 | 6.6 | 5.3 | 1.1 |
| Hackberry | 149.8 | 0.0 | 23.1 | 29.5 | 35.4 | 32.7 | 14.4 | 14.6 | 0.0 |
| Black locust | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other locusts | 33.9 | 0.0 | 3.6 | 8.2 | 6.1 | 4.7 | 2.4 | 8.9 | 0.0 |
| Sassafras | 6.1 | 0.0 | 1.7 | 0.0 | 3.5 | 0.0 | 0.0 | 0.9 | 0.0 |
| Holly | 9.8 | 0.0 | 2.7 | 4.7 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other commercial | 3.1 | 0.0 | 3.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total hardwoods | 15,578.5 | 0.0 | 2,597.3 | 3,059.9 | 2,621.3 | 2,180.5 | 1,655.3 | 2,844.3 | 620.0 |
| All species | 50,711.6 | 4,411.4 | 8,537.8 | 9,398.4 | 8,700.3 | 6,772.9 | 4,670.1 | 7,050.9 | 1,169.7 |

\*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 and Shumard oaks.

Table 15.—*Volume of sawtimber on timberland by species and tree grade, east Texas, 1992*\*

| Species | All grades | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5 |
|---|---|---|---|---|---|---|
| | - - - - - - - - - - - - - - - - - - - - - - - - - - *Million board feet†* - - - - - - - - - - - - - - - - - - - - - - - - - - - |
| Yellow pines | 34,489.1 | 8,935.9 | 8,003.9 | 17,270.3 | 0.0 | 278.9 |
| Cypress | 495.0 | 174.2 | 84.2 | 212.9 | 0.0 | 23.6 |
| Redcedar | 149.0 | 130.8 | 0.0 | 0.0 | 0.0 | 18.2 |
| Total softwoods | 35,133.1 | 9,240.9 | 8,088.2 | 17,483.3 | 0.0 | 320.8 |
| | | | | | | |
| Select white and red oaks‡ | 2,169.0 | 362.8 | 320.9 | 731.8 | 621.7 | 131.8 |
| Other white and red oaks | 7,506.6 | 603.4 | 949.1 | 2,889.8 | 2,438.1 | 626.2 |
| Hickories | 621.7 | 31.0 | 63.6 | 232.7 | 251.3 | 43.1 |
| Hard maples | 14.0 | 0.0 | 1.8 | 1.9 | 7.3 | 3.1 |
| Sweetgum | 2,695.7 | 346.3 | 442.1 | 1,035.7 | 682.0 | 189.6 |
| Tupelo and blackgum | 711.4 | 99.1 | 149.7 | 251.4 | 156.1 | 55.1 |
| Ash, walnut, and black cherry | 488.4 | 46.9 | 157.5 | 177.0 | 53.6 | 53.4 |
| Other hardwoods | 1,371.7 | 53.0 | 149.2 | 524.0 | 490.9 | 154.6 |
| Total hardwoods | 15,578.5 | 1,542.5 | 2,233.9 | 5,844.3 | 4,700.9 | 1,256.9 |
| All species | 50,711.6 | 10,783.4 | 10,322.1 | 23,327.6 | 4,700.9 | 1,577.7 |

\*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, and Shumard oaks.

Table 16.—*Average net annual growth and average annual removals of growing stock on timberland, by species, east Texas, 1986 to 1992*\*

| Species | Average net annual growth | Average annual removals |
|---|---|---|
| | - - - - - - - - - *Million cubic feet* - - - - - - - - - |
| Yellow pines | 497.9 | 511.7 |
| Other softwoods | 5.5 | 0.4 |
| Total softwoods | 503.3 | 512.1 |
| | | |
| Select white and red oaks† | 24.3 | 18.7 |
| Other white and red oaks | 89.4 | 73.5 |
| Hickories | 9.0 | 5.1 |
| Hard maples | 0.4 | 0.1 |
| Sweetgum | 45.5 | 39.3 |
| Tupelo and blackgum | 0.0 | 0.0 |
| Ash, walnut, and black cherry | 7.2 | 2.7 |
| Other hardwoods | 25.7 | 17.8 |
| Total hardwoods | 201.4 | 157.2 |
| All species | 704.7 | 669.3 |

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

†Includes white, swamp chestnut, swamp white, chinkapin, bur, cherrybark, 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, east Texas, 1986 to 1992\**

| Ownership class | Average net annual growth | | | Average annual removals | | |
|---|---|---|---|---|---|---|
| | All species | Softwood | Hardwood | All species | Softwood | Hardwood |
| | - - - - - - - - - - - - - - - - - - - - - - - *Million cubic feet* - - - - - - - - - - - - - - - - - - - - - - - - |
| National forest | 48.0 | 39.4 | 8.6 | 29.1 | 26.0 | 3.1 |
| Other public | 7.9 | 5.4 | 2.4 | 9.5 | 7.9 | 1.6 |
| Forest industry | 232.6 | 187.9 | 44.7 | 274.8 | 226.4 | 48.4 |
| Nonindustrial private | 416.3 | 270.6 | 145.7 | 355.9 | 251.9 | 104.1 |
| All ownerships | 704.7 | 503.3 | 201.4 | 669.3 | 512.1 | 157.2 |

\*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, east Texas, 1986 to 1992\**

| Species | Average net annual growth | Average annual removals |
|---|---|---|
| | - - - - - - - - *Million board feet†* - - - - - - - |
| Yellow pines | 2,198.2 | 2,445.4 |
| Other softwood | 23.9 | 0.8 |
| Total softwoods | 2,222.1 | 2,446.3 |
| | | |
| Select white and red oaks‡ | 91.9 | 77.0 |
| Other white and red oaks | 333.1 | 267.6 |
| Hickories | 18.3 | 17.7 |
| Hard maples | 1.4 | 0.7 |
| Sweetgum | 129.1 | 104.6 |
| Tupelo and blackgum | 0.0 | 0.0 |
| Ash, walnut, and black cherry | 24.1 | 9.7 |
| Other hardwoods | 23.4 | 53.9 |
| Total hardwoods | 621.3 | 531.2 |
| All species | 2,843.4 | 2,977.5 |

\*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, 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, east Texas, 1986 to 1992\**

| Ownership class | Average net annual growth | | | Average annual removals | | |
|---|---|---|---|---|---|---|
| | All species | Softwood | Hardwood | All species | Softwood | Hardwood |
| | - - - - - - - - - - - - - - - - - - - - - - - *Million board feet* † - - - - - - - - - - - - - - - - - - - - - - - | | | | | |
| National forest | 244.6 | 220.2 | 24.4 | 160.4 | 151.9 | 8.5 |
| Other public | 29.6 | 25.3 | 4.4 | 47.7 | 42.7 | 5.0 |
| Forest industry | 762.4 | 610..9 | 151.5 | 1,215.7 | 1,055.2 | 160.6 |
| Nonindustrial private | 1,806.7 | 1,365.8 | 441.1 | 1,553.8 | 1,196.6 | 357.1 |
| All ownerships | 2,843.4 | 2,222.1 | 621.3 | 2,977.5 | 2,446.3 | 531.2 |

*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, east Texas, 1986 to 1992\**

| Species | Average annual mortality | |
|---|---|---|
| | Growing stock | Sawtimber |
| | *Million cubic feet* | *Million board feet* † |
| Yellow pines | 53.6 | 227.0 |
| Cypress | 0.0 | 0.0 |
| Redcedar | 0.0 | 0.0 |
| Other softwoods | 0.2 | 0.6 |
| Total softwoods | 53.8 | 227.5 |
| | | |
| Select white and red oaks‡ | 3.7 | 16.5 |
| Other white and red oaks | 17.0 | 59.9 |
| Hickories | 1.3 | 5.4 |
| Hard maples | 0.0 | 0.0 |
| Sweetgum | 7.6 | 19.4 |
| Tupelo and blackgum | 0.0 | 0.0 |
| Ash, walnut, and black cherry | 1.3 | 2.6 |
| Other hardwoods | 8.8 | 26.3 |
| Total hardwoods | 39.7 | 130.2 |
| All species | 93.5 | 357.7 |

*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, and Shumard oaks.

Table 21.—*Average annual mortality of growing stock and sawtimber on timberland by ownership class and by softwoods and hardwoods, east Texas, 1986 to 1992\**

| | Average annual mortality | | | | | |
| | Growing stock | | | Sawtimber | | |
| Ownership class | All species | Softwood | Hardwood | All species | Softwood | Hardwood |
|---|---|---|---|---|---|---|
| | - - - - - - - - - - - *Million cubic feet* - - - - - - - - | | | - - - - - - - - - - - *Million board feet* † - - - - - - - - - - | | |
| National forest | 9.1 | 6.6 | 2.6 | 39.4 | 31.9 | 7.6 |
| Other public | 2.7 | 1.5 | 1.2 | 12.6 | 8.6 | 3.9 |
| Forest industry | 26.9 | 15.3 | 11.5 | 103.7 | 57.0 | 46.8 |
| Nonindustrial private | 54.9 | 30.4 | 24.5 | 202 | 130.0 | 71.9 |
| All ownerships | 93.5 | 53.8 | 39.7 | 357.7 | 227.5 | 130.2 |

*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, east Texas, 1986 to 1992\**

| | Average annual mortality | | | | | |
| | Growing stock | | | Sawtimber | | |
| Cause of death | All species | Softwood | Hardwood | All species | Softwood | Hardwood |
|---|---|---|---|---|---|---|
| | - - - - - - - - - - - *Million cubic feet* - - - - - - - - | | | - - - - - - - - - - - *Million board feet* † - - - - - - - - - - | | |
| Bark beetles | 10.5 | 10.5 | 0.0 | 50.6 | 50.6 | 0.0 |
| Other insects | 0.3 | 0.2 | 0.0 | 1.8 | 1.6 | 0.3 |
| Disease | 68.6 | 35.5 | 33.2 | 252.6 | 148.7 | 103.9 |
| Fire | 2.4 | 2.2 | 0.2 | 4.8 | 4.2 | 0.6 |
| Beaver | 0.6 | 0.1 | 0.5 | 1.7 | 0.5 | 1.2 |
| Other animals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Weather | 8.9 | 3.5 | 5.4 | 43.2 | 19.3 | 23.8 |
| Suppression | 1.2 | 1.1 | 0.1 | 2.5 | 2.2 | 0.4 |
| Other | 1.1 | 0.8 | 0.3 | 0.6 | 0.6 | 0.0 |
| All causes | 93.5 | 53.8 | 39.7 | 357.7 | 227.5 | 130.2 |

*Numbers in rows and columns may not sum to totals due to rounding.
 †International 1/4-inch rule.

The principal findings of the sixth forest survey of east Texas (1992) and changes
that have occurred since the previous survey are presented. Topics examined
include forest area, ownership, forest-type groups, stand structure, basal area,
timber volume, growth, removals, mortality, harvesting, and management activity.