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Southeastern Forest
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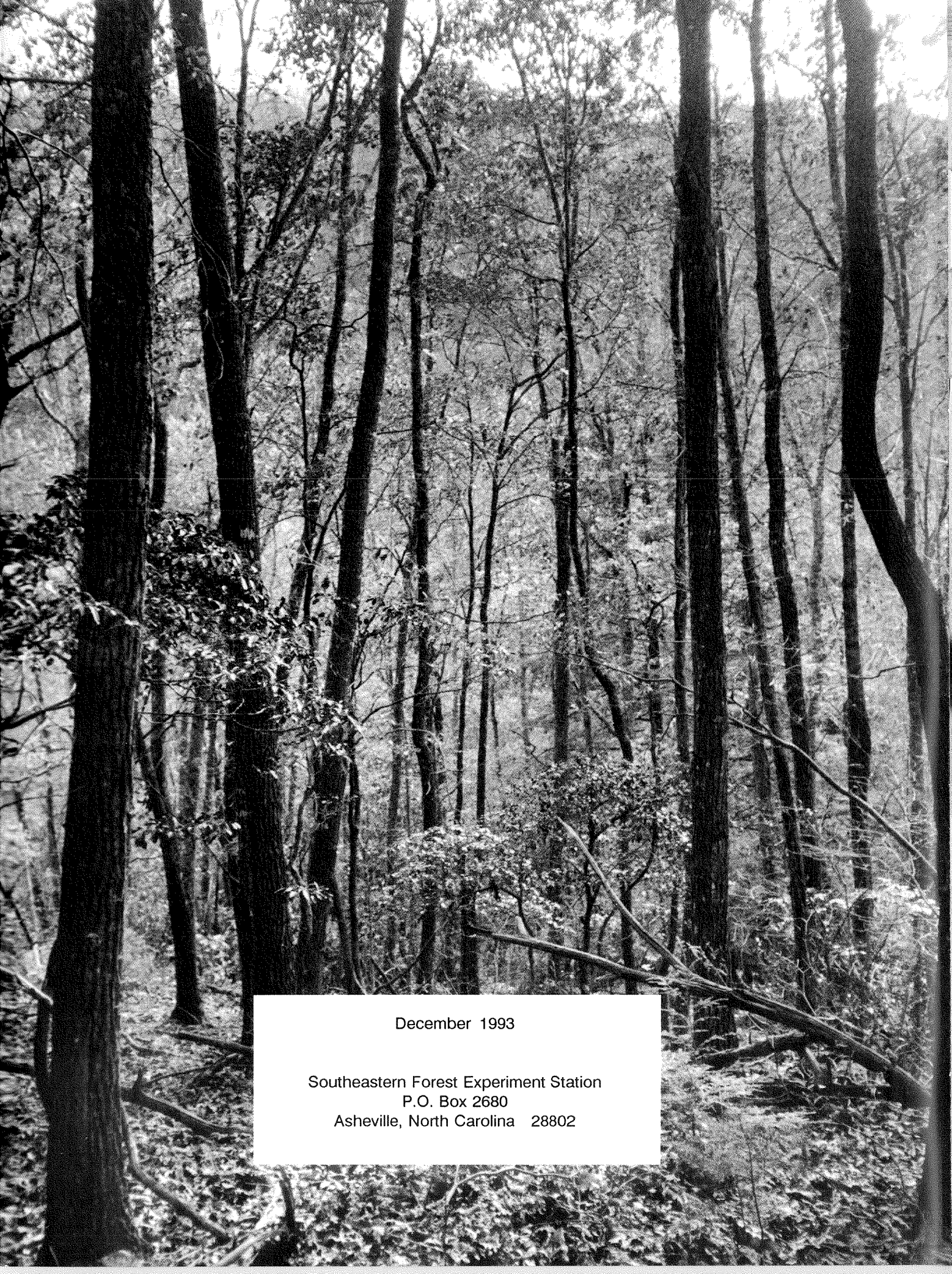
North Carolina's Forests, 1990

Mark J. Brown



December 1993

Southeastern Forest Experiment Station
P.O. Box 2680
Asheville, North Carolina 28802

North Carolina's Forests, 1990

Photo Courtesy of T. Tarnovski

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Forest Inventory and Analysis
Asheville, North Carolina

Foreword

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

The inventory of North Carolina's forests, authorized by the Forest and Rangeland Renewable Resources Research Act of 1978, is part of a continuing nationwide undertaking by the USDA Forest Service. In the five Southeastern States (Florida, Georgia, North Carolina, South Carolina, and Virginia), these surveys are conducted by the Forest Inventory and Analysis (FIA) Work Unit of the Southeastern Forest Experiment Station, one of six FIA research units in the United States. 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 (U.S. Department of Agriculture, Forest Service 1992).

Field work for the sixth survey of North Carolina began in April 1989 and was completed in November 1990. Five previous surveys, completed in 1938, 1956, 1964, 1974, and 1984, provide statistics for measuring changes and trends over a 52-year span. This analysis focuses mainly on changes and trends in recent years and their implications for the future. Previously reported figures have been adjusted in some cases to provide the best estimates of change. Normally, such adjustments are necessary to compensate for improvements in volume equations. However, trends in timberland area since 1984, as shown in this report, reflect a 1.8 percent upward adjustment in the acreage of timberland for 1984. The adjustments were confined to the Piedmont and Mountain Survey Units. Revisions were necessary due to the incomplete and poor quality aerial photography available for the 1984 survey and to the associated difficulties in photo interpretation of land use.

The combined efforts of many people have gone into this evaluation of North Carolina's forest resources. Appreciation is expressed to all Work Unit and Station personnel who participated in the field and office work. The Southeastern Station gratefully acknowledges the cooperation and assistance provided by the North Carolina Department of Environment, Health and Natural Resources, Division of Forest Resources, in collecting field data. Appreciation is also expressed for the excellent cooperation of other public agencies, forest industries, and private landowners in providing information and allowing access to the sample locations.

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. A Forest Information Retrieval service is available for custom compilation of forest resource data for any area within the Southeastern States. Data in a format common to the four FIA units in the Eastern United States (Eastwide Data Base) are also available (Hansen and others 1992). Custom compilations of tabular data and datasets require processing fees; costs may range from less than $100 for a relatively simple retrieval to several thousand dollars for a complex request that involves special programming. Although such requests are usually serviced promptly, attention to special requests is sometimes delayed by our regular duties.

Information concerning any aspect of this survey may be obtained from:

Forest Inventory and Analysis
Southeastern Forest Experiment Station
P.O. Box 2680
Asheville, NC 28802
Phone: 704-257-4350

Noel D. Cost
Project Leader

Photo Courtesy of T. Tarnovski

Contents

Highlights

Since the fifth inventory of North Carolina's forest resources was completed in 1984—

• *area of timberland dropped less than 1 percent to 18.7 million acres.* Some 301,000 acres were added to the timberland base, while nearly 379,000 acres of existing timberland were diverted to noncommercial forest and nonforest uses. The net loss of timberland was minimized by substantial increases in tree planting and natural reversion on previously nonforest land, predominantly idle cropland and pasture. Timberland now accounts for 60 percent of North Carolina's land area.

• *ownership of timberland by farmers continued to drop, with an 11-percent reduction to 5.0 million acres.* In contrast, timberland ownership by individuals other than farmers and corporations that do not manufacture forest products rose during the period. Other individuals control 7.5 million acres of North Carolina timberland, up by 6 percent, and other corporate ownership increased by 7 percent to 1.8 million acres. Forest industries control 2.4 million acres of the State's timberland (including long-term leases), down by 3 percent. Public agencies hold 2.0 million acres of timberland, more than one-half of which are in the National Forests.

- *area of pine plantation increased by 29 percent to 2.1 million acres as a result of increased tree planting on harvested forest land and on former agricultural land.* Area in natural pine stands continued a long-term reduction, dropping 13 percent to 4.2 million acres. Timberland classed as oak–pine increased 11 percent to nearly 2.6 million acres, whereas the remaining hardwood types cumulatively declined by 2 percent to under 9.9 million acres.

- *volume of softwood growing stock on timberland increased 4 percent to 12.5 billion cubic feet.* Most of the increase occurred on forest industry land, where softwood volume rose 20 percent to 2.1 billion cubic feet. Softwood volume also rose on public timberland by 21 percent to 1.3 billion cubic feet. In contrast, softwood volume was down by 1 percent on NIPF timberland. Softwood volumes rose somewhat in every region of the State, but the greatest increases were concentrated in the Coastal Plain units. Statewide, softwood volume increased in most diameter classes, dropping only in the 6- and 14-inch classes.

- *volume of hardwood growing stock on timberland increased over 4 percent to 20.2 billion cubic feet, but the rate of increase was lower than in previous decades.* The hardwood inventory increased by 10 percent on public land and by 4 percent on NIPF land but dropped by 4 percent on areas under forest industry control. Hardwood growing stock increased in the western half of the State, and actually decreased 2 percent in the Northern Coastal Plain. The inventory of hardwood growing stock includes 62.5 billion board feet of sawtimber, up by 9 percent. In North Carolina, 48 percent of the hardwood sawtimber volume is in tree grades 1 and 2 trees.

- *average net annual growth of softwoods increased 18 percent to 590 million cubic feet per year, reversing a previously recorded decline.* Softwood net growth increased on all ownerships, but it increased most—42 percent—on forest industry land and least—9 percent—on NIPF land. Softwood growth increases on forest industry land are attributed to vast acreages of intensively managed pine plantations. Across all ownerships, softwood net growth now exceeds removals by 15 percent. However, this growth surplus was supported by forest industry land, because a growth deficit exists for NIPF land.

- *average net annual growth of hardwoods decreased by 9 percent to 570 million cubic feet per year, a reversal of the increase measured previously.* Hardwood net growth declined for each major ownership group and in all regions of the State except the Southern Coastal Plain. Statewide, hardwood growth exceeds removals by 33 percent, which is down from 99 percent in 1984. Hardwood growth exceeds removals for each owner category and in all regions but the Northern Coastal Plain, where a deficit exists for the first time.

- *annual removals of softwood growing stock increased by 19 percent to 512 million cubic feet.* Softwood removals increased on all ownership categories. By ownership, 76 percent of the softwood removals came from NIPF land, 20 percent from forest industry land, and 4 percent from public land. Pine plantations supplied 15 percent of the total softwood removals. Hardwood removals increased 36 percent to 428 million cubic feet annually. Removals of hardwood growing stock increased in all ownership categories and in all regions of the State.

- *total annual output of timber products increased 24 percent, averaging 1.0 billion cubic feet annually.* About 84 percent of the output was from roundwood, and the remainder was from plant byproducts. Pulpwood accounted for 43 percent of total production. Saw logs accounted for 32 percent, veneer logs 7 percent, other miscellaneous products 8 percent, and domestic fuelwood the remaining 10 percent of total output.

- *average rates of artificial regeneration increased 39 percent to 103,000 acres annually.* Within this total, planting on nonforest land accounted for nearly 14,000 acres annually, up sevenfold. Planting on NIPF land doubled and accounted for more than half of the total artificial regeneration. Natural regeneration also increased, by 69 percent to an annual average of 253,000 acres. Discounting acres cleared to nontimber uses, all forms of regeneration together exceed acres receiving a final harvest. This positive relationship reverses the situation existing in the previous survey period.

- *the current age structure of North Carolina's softwood resource is sound, primarily because of large increases in pine regeneration over the last decade.* As in other regions of the Southeast, however, the decline in area of natural pine stands is likely to mean increasing proportions of juvenile wood in stems and reduced pine sawtimber supplies. Recent increases in commercial thinning of plantations along with changes in wood-processing techniques may alleviate these concerns. The hardwood age structure suggests tightening supplies in the future because of deficits in acreage of trees 11 to 50 years old. Eventually, however, the recent increases in regeneration will improve the hardwood situation.

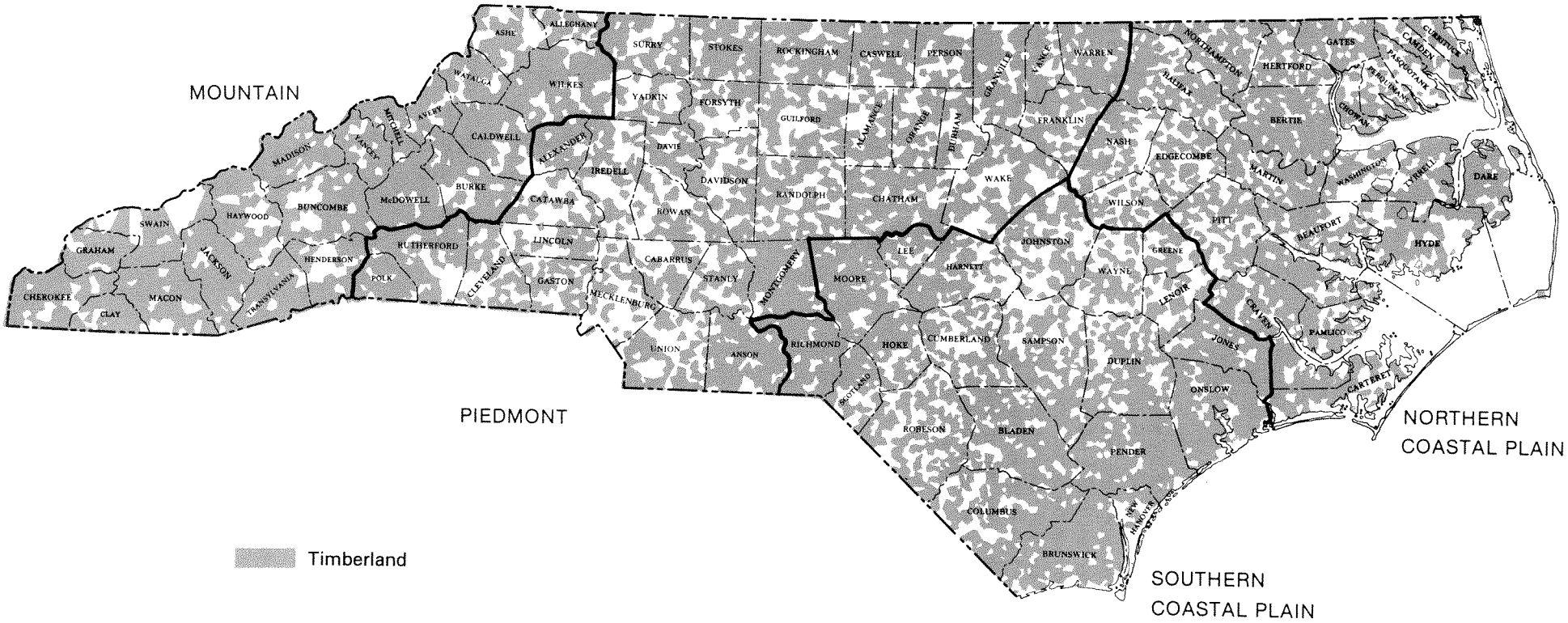


Figure 1—Forest survey units in North Carolina with a generalized distribution of timberland.

Forest Trends

North Carolina's boundaries encompass 31.2 million acres of land plus 2.5 million acres of inland water. Some 19.3 million acres (62 percent of the land) are forested. The majority of the forest land, 18.7 million acres, is classified as timberland. Another 0.5 million acres are classed as reserved timberland, and less than 43,000 acres are considered woodland. Reserved timberland consists of forested parks, wilderness areas, designated scenic areas, and historic sites where commercial timber harvesting is forbidden by legislation or administrative regulation. Woodland is unproductive timberland that is incapable, under natural conditions, of producing a minimum of 20 cubic feet of wood per acre annually. Of North Carolina's 11.8 million acres of nonforest land, 55 percent is cropland or idle farmland, 30 percent is in some type of urban use, 13 percent is in pasture or range, and the remainder is in marsh.

North Carolina has three distinct physiographic regions recognized as the Coastal Plain, Piedmont Plateau, and Appalachian Mountains. Because of the obvious regional differences, North Carolina has been divided into four survey units: the Mountains, Piedmont, and Northern and Southern Coastal Plains (fig. 1).

The two Coastal Plain units contain almost one-half of the State's total timberland and 62 percent of all the softwood timberland in the State. Forest industry has large holdings in both Coastal Plain units. In the Mountains, hardwood types occupy the vast majority of timberland. The Mountain unit is the most heavily forested due to the ruggedest terrain and highest proportion of publicly owned timberland. It also has the most reserved timberland. Conversely, the Piedmont unit is the least forested, with only 55 percent of the total land area in timberland. The Piedmont has numerous metropolitan areas and extensive agriculture. In addition, it has the least public timberland and a low proportion of forest industry holdings.

Land Use Trends

According to the first three surveys of North Carolina's forest resources, timberland increased steadily from 18.1 million acres in 1938 to nearly 20.0 million acres in 1964. A decline in farming, along with increased population migration to the cities for employment, contributed toward these timberland gains. In contrast, the latest three surveys have shown a steady decline in the area of timberland to 18.7 million acres in 1990. Since the timberland peak in 1964, urban acreage has almost doubled. Not only have metropolitan areas expanded but new roads, highways, and utility lines have been built through rural areas, causing further erosion of the timberland base. Fortunately, increased tree planting between 1985 and 1990, under various public and private incentive programs, along with increased natural reversion of idle farmland to forest, countered much of the recent timberland loss and prevented a larger decline.

In the most recent remeasurement period (1984–1990), land use changes involved nearly 0.7 million acres of timberland (table I). Statewide, nearly 0.4 million acres

Table I--Changes in area of North Carolina's timberland between 1984 and 1990, by Survey Unit

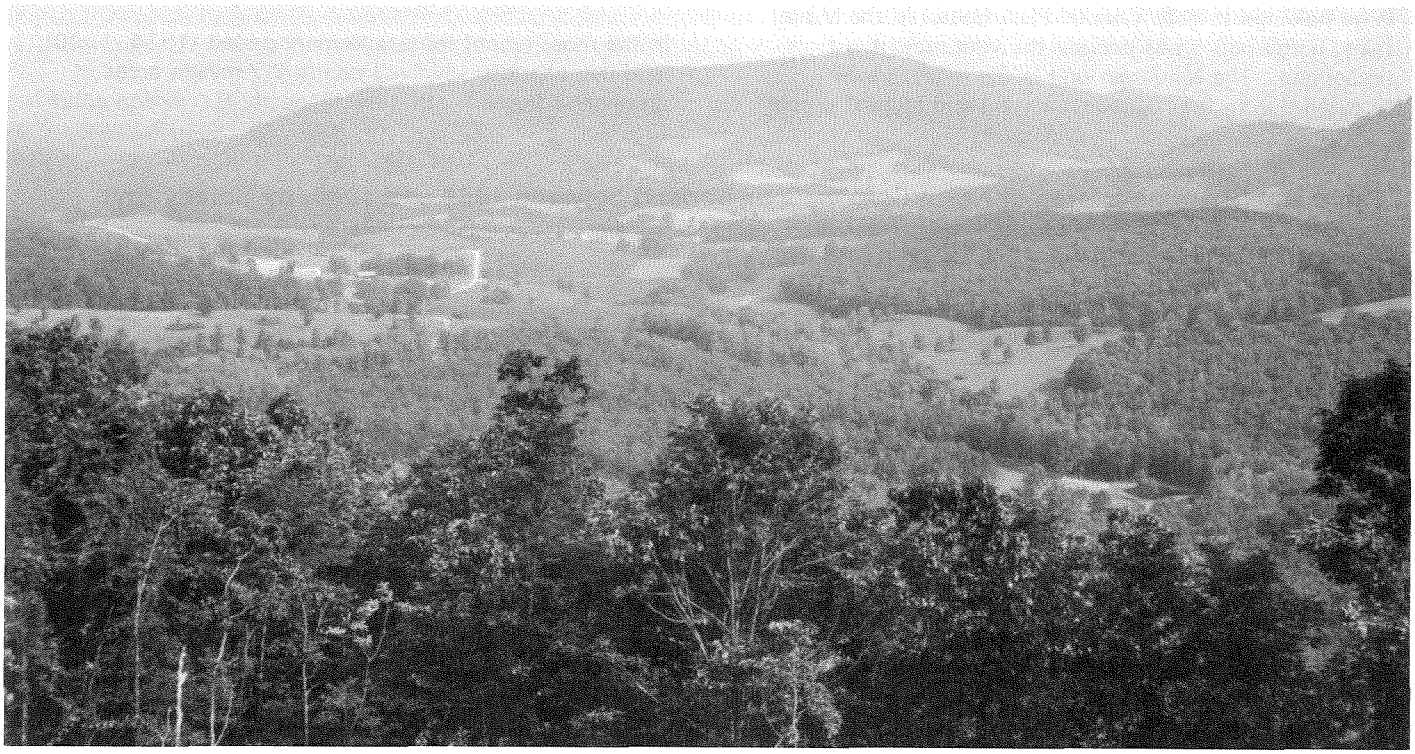
Survey Unit	Area of timberland in-- 1984	1990	Net change	Changes: Total gain	Additions from-- Nonforest	Other forest land	Total loss	Diversions to-- Other forest land	Agriculture	Urban and other	Water
					Thousand acres						
Southern Coastal Plain	5,265.7	5,236.4	−29.3	88.3	87.6	0.7	117.6	11.2	43.0	58.9	4.5
Northern Coastal Plain	3,761.3	3,767.9	+6.5	48.0	47.5	0.5	41.5	28.7	6.1	4.6	2.1
Piedmont	5,777.6	5,751.1	−26.5	155.6	155.4	0.2	182.0	1.7	48.7	119.0	12.6
Mountains	3,983.5	3,955.0	−28.5	9.3	9.3	--	37.8	24.3	4.5	9.0	--
State	18,788.1	18,710.4	−77.8	301.2	299.8	1.4	378.9	65.9	102.3	191.5	19.2

of timberland were diverted to other land uses, while 0.3 million acres were added to the timberland base from acreage that was previously nonforest or forest not classified as timberland. The net effect of all these land use changes was a drop in North Carolina's timberland base of fewer than 0.1 million acres, or less than 1 percent. Clearing of timberland for urban development accounted for 51 percent of the diversions. Sixty-two percent of the loss to urban development took place in the Piedmont unit. Since the Piedmont has a good year-round climate, adequate water supplies, suitable topography, numerous colleges and universities, and many associated cultural activities, it will continue to draw new industries, which will spawn more growth. Moreover, since 93 percent of the timberland in this region is controlled by nonindustrial private forest (NIPF) landowners, future urbanization is almost ensured because NIPF timberland can be more easily converted to nonforest than can public or even forest industry timberlands, which tend to limit urban growth.

The loss to urban development was lowest in the Northern Coastal Plain and Mountains. Clearing of timberland for agriculture accounted for 27 percent of the diversions. Forty-eight percent of the loss to agriculture took place in the Piedmont and 42 percent in the Southern Coastal Plain. The Mountains, as usual, lost little of their timberland to agriculture. Loss in the Northern Coastal Plain was low because of the large-scale presence of forest industry in the region and increases in publicly owned timberlands. Clearing timberland for new areas of water accounted for 5 percent of the diversions, predominantly in the Piedmont. Reclassification of timberland to reserved status caused 17 percent of the diversions. Thirty-seven percent of the loss to reserved timberland happened in the Mountains and 43 percent in the Northern Coastal Plain. Most of the remaining loss to reserved status occurred in the Southern Coastal Plain. Losses in the Piedmont portion were negligible.

Nearly all of the 0.3 million acres added to the timberland base came from former agricultural land. With the gradual decline in numbers of small farms (U.S. Department of Commerce 1989) and less-than-favorable economic conditions for agriculture, the area of idle farmland has risen from less than 0.5 million acres in 1984 to nearly 0.6 million acres in 1990. Idle agricultural land can become forest through tree planting or natural seeding of trees. Fifty-two percent of the additions to the timberland base came from the Piedmont unit. The Southern Coastal Plain provided another 29 percent of the additions and the Northern Coastal Plain another 16 percent. The Mountains accounted for just 3 percent.

Photo Courtesy of W. Abernathy



Timberland Acreage by Ownership

Recent trends in ownership of North Carolina's timberland are depicted in figure 2. The chart separates the State's total timberland into five ownership categories. Collectively, the individual, corporate, and farmer categories make up the NIPF or "other private" group. This group controls 14.3 million acres, or 76 percent of the timberland in North Carolina. Since 1984, the area of timberland held by this group has declined less than 1 percent. However, sizable shifts in timberland ownership occurred among the categories within the other private group. For instance, farmer holdings fell by 589,000 acres or by 10 percent. This loss continued a trend that began at least four decades ago. Over that timespan, farm ownership of timberland has fallen from 13.3 to 5.0 million acres. Recent losses in farm ownership were ameliorated by gains in the other individual and corporate categories of timberland ownership. Other individual ownership increased nearly 6 percent, or by 0.4 million acres, and corporate ownership increased nearly 7 percent, or by 0.1 million acres. Transfers of timberland from farmers to individuals and corporations are responsible for part of the shifts between these owner categories, but it is suspected that changes in owner occupation also played a significant role.

The forest industry category includes land owned by or under long-term lease to companies with primary wood-using mills. In North Carolina, forest industry controls more than 2.4 million acres, or 13 percent of the total timberland in the State. Its holdings decreased by 3 percent since 1984. Leased land makes up only 169,000 acres of the current forest industry total. Eighty-five percent of the forest industry timberland is in the Coastal Plain. Forest industry controls only 3 percent of the timberland in the Mountains and 4 percent in the Piedmont. It controls 22 percent in the Southern Coastal Plain and 24 percent in the Northern Coastal Plain.

The public category includes National Forests, wildlife refuges, and military, State, county, and municipal timberland. Altogether, the area of North Carolina's timberland in public ownership increased 4 percent to 2.0 million acres. Public ownership now accounts for 11 percent of the State's timberland. At nearly 1.1 million acres, National Forest holdings constitute 54 percent of all public timberland in the State. The area of National Forest timberland actually declined 3 percent due to transfer of some areas to a reserved status. All other categories of public timberland increased in area. By survey unit, public ownership accounts for only 3 percent of the timberland in the Piedmont, 9 percent in each of the Coastal Plain units, and 26 percent in the Mountains.

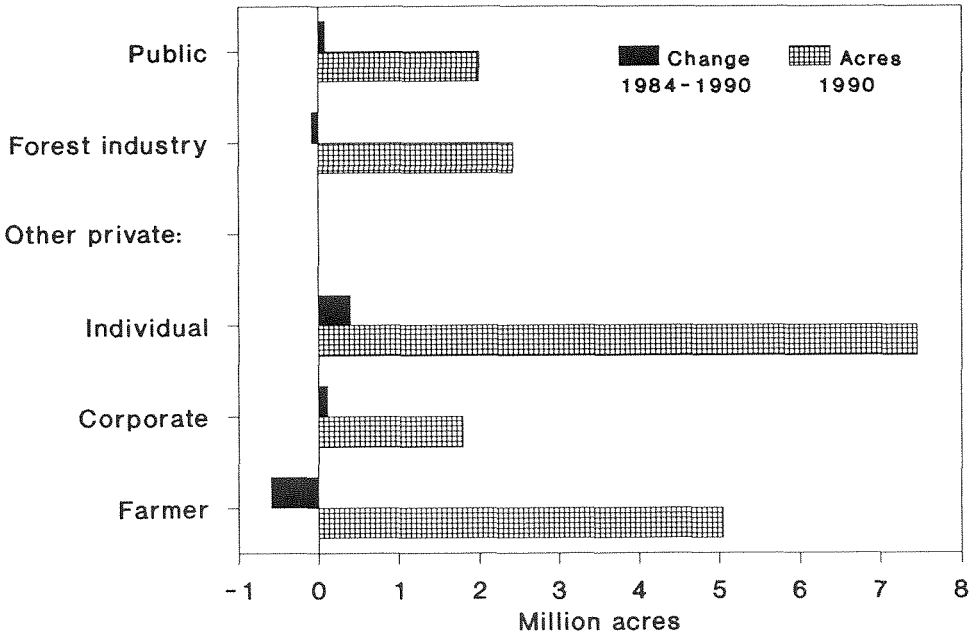


Figure 2—Timberland acreage in 1990, and change in timberland acreage between 1984 and 1990, by ownership class.

In addition to timberland, 524,000 acres of publicly owned forest land were classified as reserved timberland. Eighty percent of these forests are in the Mountains, 11 percent in the Northern Coastal Plain, 6 percent in the Piedmont, and 3 percent in the Southern Coastal Plain. North Carolina's reserved timberland is located primarily in wilderness areas on National Forests, the Great Smoky Mountains National Park, and State parks.

Timberland Acreage by Broad Management Class

Since 1984, the area in pine plantations increased by nearly one-half million acres (fig. 3). As a result, the 2.1 million acres of planted pine now account for more than one-third of all the pine stands in the State. Part of this increase came from farmland sources, and some came at the expense of natural pine and hardwood stands planted to pine after a harvest. Plantation establishment is one of the reasons for the 642,000-acre loss of natural pine stands since the last survey. Another reason is that after many natural pine stands are harvested, they become oak–pine or hardwood stands due to inadequate regeneration of pine. With these losses, there are now 4.2 million acres of natural pine in the State. Natural and planted pine types occupy 6.3 million acres or one-third of the State's timberland. The combined acreage decreased by 3 percent, continuing a trend originally encountered in the third survey in 1964. Three of the four survey units lost pine type acreage. Only the Northern Coastal Plain showed a 93,000-acre increase, which probably is attributable to the substantial forest industry interests in the region. The Southern Coastal Plain lost the most pine type acreage, 194,000 acres. The Piedmont dropped by 2 percent or 46,000 acres, and the Mountain loss was 20,000 acres or 4 percent.

All the pine forest types except loblolly decreased in acreage. Acreage in loblolly pine type increased some 283,000 acres, whereas longleaf, shortleaf, and pond pine types each lost more than 100,000 acres. At the time of the first survey, shortleaf accounted for more than 3.0 million acres and pond pine for nearly 2.0 million acres. They currently account for just 0.4 and 0.6 million acres, respectively. These type-specific declines are not just the result of agricultural land clearing, but evidently include forest management preference for the faster growing loblolly pine. Loblolly pine is by far the most dominant pine type in the State; it accounts for 3.7 million acres or 59 percent of all pine stand acreage, regardless of stand origin. Virginia pine is the second-largest pine type in the State with less than 0.8 million acres. Even though its area has declined recently,

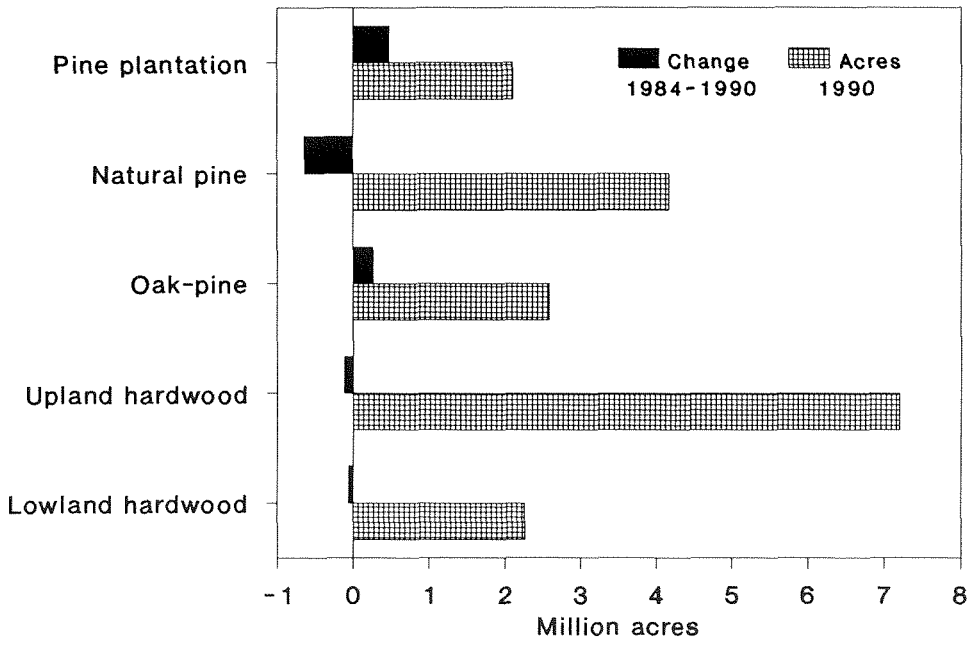


Figure 3—Timberland acreage in 1990, and change in timberland acreage between 1984 and 1990, by broad management class.

acreage in Virginia pine type is close to what it was three decades ago. Because of its typically small size and poor form, Virginia pine is less desirable for wood products than any other southern yellow pine species, but the species seeds readily into open areas in uplands. Virtually all of the Virginia pine forests occur in the Piedmont and Mountains.

Oak–pine stands, in which pines account for 25 to 50 percent of the stocking, cover about 14 percent of the State's timberland. Since 1984, area of oak–pine types rose by 261,000 acres, or by 11 percent, to nearly 2.6 million acres. Of all the forest types, oak–pine is most subject to fluctuation because of the narrow range of pine stocking proportion. Successional changes cause acres to move to and from this type. Many former pine stands, especially natural pine, are often reclassified as oak–pine after a partial harvest, which lowers the degree of pine stocking. Also, delays in regeneration after final harvest cause some acres to be temporarily classified as oak–pine.

Although the Piedmont contains the largest portion of the State's oak–pine acreage, substantial amounts exist in each of the survey units. Almost 478,000 acres of oak–pine occur in the Mountains, nearly 532,000 in the Northern Coastal Plain, more than 766,000 in the Southern Coastal Plain, and 804,000 in the Piedmont.

Hardwood types cover almost 53 percent of the State's timberland, but the area of hardwood declined by 2 percent to less than 9.9 million acres. Not quite three-fourths of this hardwood acreage is categorized as upland hardwood based upon physiography and species composition. The rest is categorized as lowland hardwood. As might be expected, the majority (87 percent) of the acreage in a lowland hardwood type is in the two Coastal Plain units. Upland hardwoods, on the other hand, are more heavily concentrated in the western half of the State. The Mountains contain 41 percent of the upland hardwood acreage, the Piedmont holds 39 percent, and the two Coastal Plain units combine for 20 percent.

Area in upland hardwoods has gradually declined by a total of almost 4 percent over the last two surveys. Meanwhile, the lowland hardwood acreage is nearly the same as it was two surveys ago. Upland stands bear most of the land use changes. Lowland stands are less subject to development because of drainage problems and restricting environmental concerns. Consider, for example, the oak–hickory type group, which constitutes the majority of the upland category. Area of the oak–hickory type group decreased by nearly 7 percent since 1984. Oak–gum–cypress is the predominant lowland hardwood type group. The area of oak–gum–cypress has increased by 8 percent since 1984.

In the latest survey of North Carolina, more detailed forest type classifications were used for oak–pine and hardwood stands. This new feature permits more specific analysis of the existing hardwood resource. Appendix table 10 outlines the present distribution of the hardwood resource by individual forest type and establishes a base for future analysis. Within the oak–pine group, mixtures of loblolly pine and hardwoods dominated nearly 1.3 million acres. Within the oak–hickory group, mixed hardwood was the most common individual type with more than 2.2 million acres. Within the oak–gum–cypress group, sweetbay–blackgum–red maple forest type was the most abundant with more than 1.2 million acres.

Forest Biomass

North Carolina's timberland resource includes 47.4 billion cubic feet of total aboveground wood fiber, commonly referred to as "biomass." This figure converts to 1.8 billion tons (green weight) of wood and bark (app. table 23). Analyzing the resource from a biomass perspective is an important alternative to the conventional approach, which is based on merchantability standards. Conventional merchantability standards include only the net volume in trees 5.0 inches d.b.h. and larger, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark. In addition, the growing-stock classification imposes minimum grade requirements. These guidelines are not as reflective of resource use as they once were. Since the inception of whole-tree chipping, the chip'n saw, and the manufacture of products from wood chips, wood fiber has increasingly been utilized beyond these guidelines. The volume in merchantable portions of all live trees in the State's timberland is 34.7 billion cubic feet. The additional 12.7 billion cubic feet in the biomass figure are in tree stumps, tops, limbs, and saplings. Nearly three-fourths of this additional biomass volume is hardwood.

The Softwood Inventory

Softwoods constituted 36 percent, or 12.6 billion cubic feet, of North Carolina's total timber resource. This figure includes all qualifying softwood trees regardless of their occurrence, whether located in softwood stands or scattered in hardwood stands. Over 99 percent of the softwood merchantable volume either met, or is expected to meet, minimum grade requirements to qualify as growing stock. The remaining fraction occurred in trees culled because of form, rot, or breakage. Hurricane Hugo damaged portions of the timber resource in 27 counties of North Carolina but caused very few softwoods to be reclassified as cull.

The 12.5 billion cubic feet of softwood growing stock represent an increase of 4 percent since the 1984 survey. Current survey results show that planted pine stands contain 17 percent of the softwood growing-stock volume. This percentage is less than the percentage of planted acres because many of the planted stands are very young. A high proportion of trees in planted stands, therefore, are less than 5.0 inches d.b.h., the minimum size for assignment of growing-stock volume.

About 73 percent of the State's softwood growing-stock inventory is on NIPF land, 17 percent is on forest industry land, and 10 percent is on public land. However, most of the recent increase in volume occurred on forest industry and public land. In fact, 60 percent of the increase took place on forest industry land, where softwood volume was up nearly 20 percent to 2.1 billion cubic feet. An increase of 21 percent to 1.3 billion cubic feet occurred on public land. In contrast, softwood volume on NIPF land decreased 1 percent to 9.1 billion cubic feet.

The Coastal Plain units hold more than half of the State's 12.5 billion cubic feet of softwood growing stock. The Piedmont holds nearly a third, and the Mountains contain the remainder. The Coastal Plain units had the greatest increase in softwood growing-stock volume at 6 percent, whereas the Piedmont had the lowest increase at 1 percent. More intensive forest management in the Coastal Plain contributed to the larger increase in softwood volume there.

Loblolly pine is the most abundant softwood species in North Carolina and accounts for just over half the State's softwood inventory. At 6.5 billion cubic feet, loblolly pine volume has increased 9 percent since 1984 (fig. 4). About three-fourth's of the loblolly pine volume occurs in the eastern half of the State. Here, the species accounts for 76 percent of the softwood volume in the Northern Coastal Plain and for 67 percent of the Southern Coastal Plain's softwood volume. Loblolly pine accounts for 40 percent of the Piedmont's softwood volume and only 2 percent of the Mountain's. Virginia pine is the second-most-prevalent species in the softwood inventory; its volume increased 7 percent to more than 1.5 billion cubic feet. Although second, Virginia pine accounts for only 12 percent of the State's softwood growing stock. Almost three-fourth's of the State's Virginia pine volume is in the Piedmont and virtually all of the remainder is in the Mountains.

The next-most-common softwood species is shortleaf pine, whose volume decreased by 13 percent to less than 1.3 billion cubic feet. Shortleaf accounts for 10 percent of North Carolina's softwood growing stock. Eighty-four percent of the State's shortleaf pine volume occurs in the Piedmont. Shortleaf experienced the largest decline in volume of any pine species. Since it occurs almost exclusively in natural stands, its decline correlates with the Southwide loss in area of natural pine stands (USDA Forest Service 1988). Other pines found primarily in natural stands include pond pine and longleaf pine, whose volumes fell 7 and 8 percent to 0.8 and 0.4 billion cubic feet, respectively. A 13-percent rise in the eastern white pine inventory to 0.7 billion cubic feet, following a sizable increase in the previous survey, is noteworthy. It suggests an increasingly important role for this species in the future, particularly in the Mountain unit. Almost 96 percent of the State's white pine volume occurs in the Mountain unit, where white pine already accounts for 41 percent of the softwood inventory.

Part of the softwood growing-stock inventory consists of the saw-log portion of sawtimber-size trees. This sawtimber portion was equivalent to 44.0 billion board feet, up by 7 percent since 1984. Distribution of the State's softwood sawtimber inventory by ownership shows 76 percent to be on NIPF land and 12 percent each on forest industry and public land. As with growing stock, the overall increase in sawtimber volume was not distributed in proportion to ownership. Only a fourth of the increase took place on NIPF land. Sawtimber volume rose just 2 percent on NIPF land to 33.4 billion board feet, but increased by 24 percent on forest industry to 5.5 billion board feet and by 27 percent on public land to 5.2 billion board feet.

Almost a third of the softwood sawtimber occurs in the Southern Coastal Plain unit, with more than a fourth each in the Northern Coastal Plain and Piedmont units, and 15 percent in the Mountains. Softwood sawtimber increased in all units. The largest increase took place in the Mountain unit where large amounts of public land exist. The lowest increase occurred in the Northern Coastal Plain where the demand from mills and the ratio of softwood in plantations are high.

The volume of softwood sawtimber declined from 1938 to 1955. Recent trends graphed in figure 5 reveal that softwood sawtimber has increased in each survey period since then. The volume of softwood growing stock has continued to increase between survey cycles since the first survey in 1938.

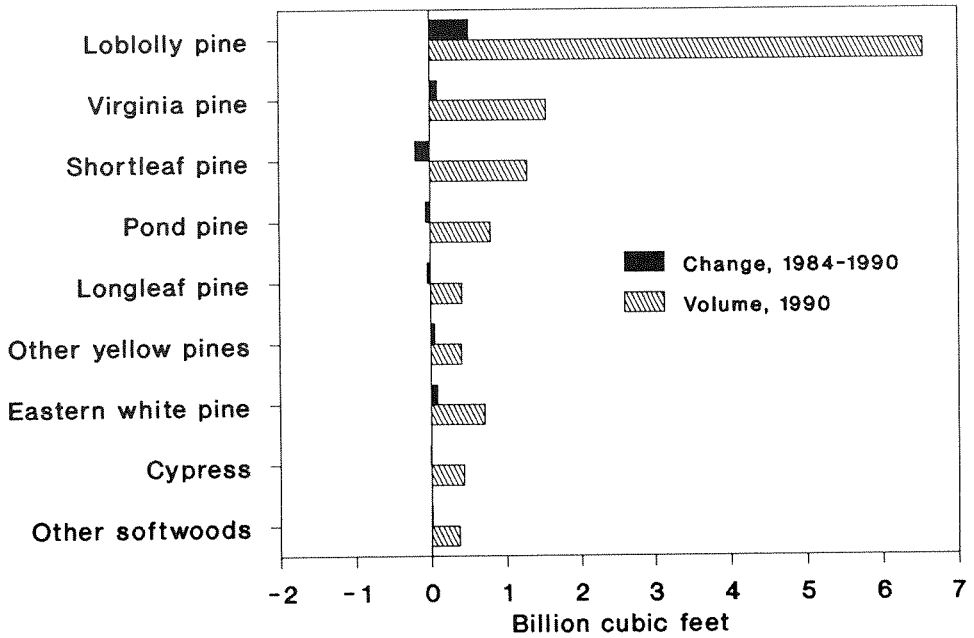


Figure 4—Volume of softwood growing stock by species, 1990, and change since 1984.

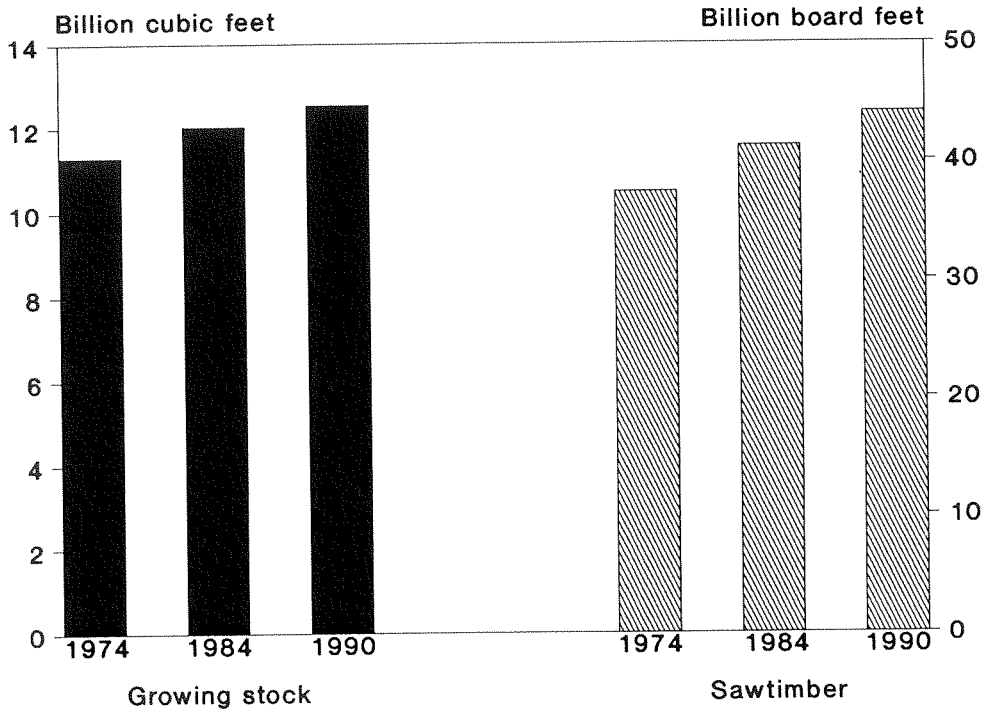


Figure 5—Volume of softwood growing stock and sawtimber, 1974, 1984, and 1990.

Traditionally, trees that seeded naturally onto abandoned agricultural fields have provided much of the increases in inventory volume. The recent increases are a result of vast acreages of planted pines reaching merchantable size. Most of these plantations are in the Coastal Plain units on forest industry land. However, the net loss of timberland, a nominal change in old-field abandonment, and harvesting of the Soil Bank stands do not bode well for sustained increases in softwood volume. In fact, the rate of volume accumulation appears to have declined somewhat and as demand escalates, the potential exists for a decline in softwood volume at some point in the future. Ameliorating this situation is the volume yet to come from acres planted under various recent incentive programs.

The trends in volume of softwood growing stock, by diameter class spanning three survey cycles, are displayed in figure 6. Since 1984, volume of softwood growing stock either increased or changed little in all but two diameter classes. Volume of 6- and 14-inch diameter softwoods dropped nearly 5 percent each. Volume increased 5 percent in the 8-inch and 11 percent in the 10-inch diameter softwoods. Together, these two diameter classes account for 67 percent of the total softwood volume gain. These gains result from rapid volume accumulation on vigorous plantation trees. In addition, volume in the 22-inch and larger classes rose by 27 percent. The current volume drop in the 6-inch diameter class is a result of a decline in the population of smaller softwood trees progressing towards harvestable size. The 1984 survey (Sheffield and Knight 1986) identified declines of 34 percent for 2-inch softwood trees and 20 percent for 4-inch softwood trees. These declines reflect periodic regeneration shortfalls. This could result from a decline in area of natural pine stands and an increase in area of plantations where typically fewer stems per acre are established than occur in natural stands. The volume drop in the 14-inch class probably reflects the impact of increased harvest rates on this size class.

Trends in numbers of softwood trees are displayed in table II, where noticeable differences can be seen between ownership categories. Although numbers of 6-inch softwood trees declined for all ownerships combined, the decline on public holdings and NIPF land were very small. The majority of the overall decline in numbers of 6-inch trees was borne by areas under forest industry control. This ownership-specific decline provides some evidence that the loss of natural stands to plantations is part of the reason for the decline in numbers of 6-inch trees. Forest industry favors planting as a means of regeneration after harvest. On all ownerships combined, the numbers of 14-inch softwood trees also declined slightly. However, in this class, tree numbers were up somewhat on public and forest industry and down on NIPF ownerships.

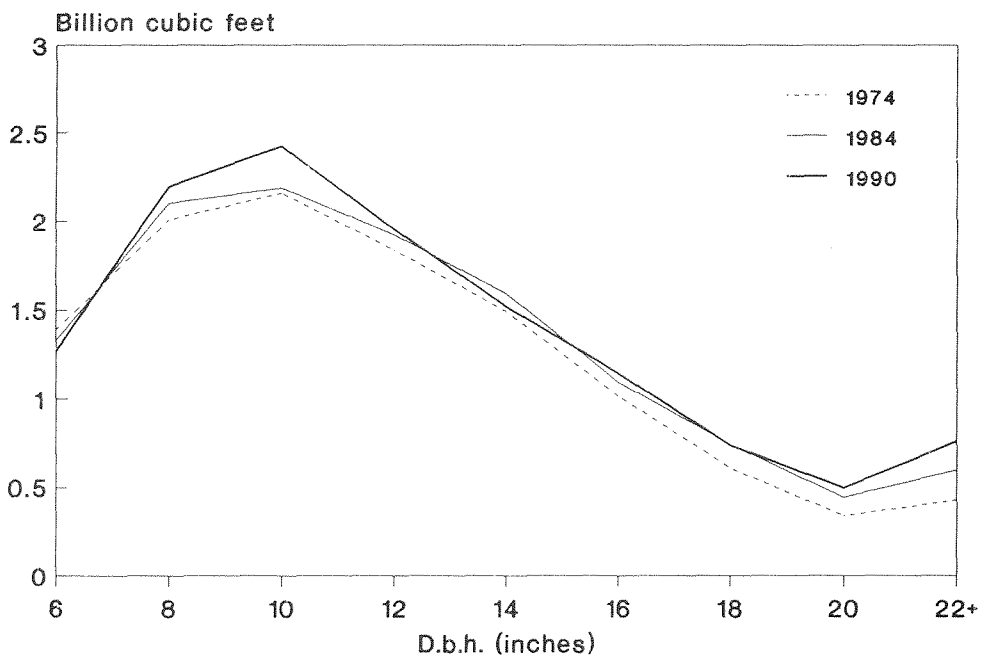


Figure 6—Volume of softwood growing stock by tree d.b.h. class, 1974, 1984, and 1990.

Table II--Number of live softwood and hardwood trees on North Carolina's timberland, by diameter and ownership classes, 1990, and change between 1984–1990

Diameter class	All ownerships		Public		Forest industry[a]		Other private	
	Inventory 1990	Change 1984–1990	Inventory 1990	Change 1984–1990	Inventory 1990	Change 1984–1990	Inventory 1990	Change 1984–1990
				SOFTWOODS (million trees)				
2	1,117.6	−23.8	90.1	−21.9	143.6	−65.0	883.9	+63.1
4	648.0	−77.2	58.5	+5.7	128.1	−65.8	461.4	−17.1
6	466.1	−22.0	36.4	−0.7	125.9	−20.0	303.8	−1.3
8	332.8	+12.5	27.6	+2.3	90.9	+14.4	214.3	−4.2
10	197.7	+19.7	19.6	+4.5	42.2	+15.5	135.9	−0.3
12	100.0	+3.1	11.4	+1.7	15.2	+3.5	73.4	−2.1
14	52.9	−0.8	6.8	+1.7	5.6	+0.2	40.5	−2.7
16+	56.5	+3.2	7.2	+1.4	5.1	--	44.2	+1.8
				HARDWOODS (million trees)				
2	7,373.8	−376.9	698.6	+13.6	1,020.5	−174.5	5,654.7	−216.0
4	1,854.6	−93.8	220.8	+25.2	204.7	−8.1	1,429.1	−110.9
6	726.8	−44.3	87.2	−1.6	67.2	−2.6	572.4	−40.1
8	401.4	−7.9	50.9	+6.0	34.8	+1.9	315.7	−15.8
10	244.6	+1.7	32.0	+3.5	17.2	−0.7	195.4	−1.1
12	159.7	−6.1	17.9	−0.7	11.6	−1.4	130.2	−4.0
14	107.7	+4.5	13.1	+0.5	6.3	−0.5	88.3	+4.5
16+	159.0	+11.8	23.3	+1.5	11.3	−0.9	124.4	+11.2

[a] Including inventory on lands under long–term lease.

The remaining diameter classes for which volume is measured (8-, 10-, 12-, 16-inch & larger), all experienced increases in tree numbers. Once again, by ownership, the only declines in these classes occurred on NIPF land, where the numbers of 8-, 10-, and 12-inch trees decreased. The numbers of 2- and 4-inch trees are important measures of future volume. Although the current numbers of 2- and 4-inch trees have declined, they changed less severely than in the previous survey. Numbers of 2-inch trees dropped by only 2 percent, compared with 34 percent in 1984. The numbers of 4-inch trees dropped 11 percent, compared with 20 percent in 1984. The number of small trees was supported by increased regeneration efforts early in the remeasurement period. The recent stability in number of 2-inch softwood trees can be viewed as a positive sign for future softwood timber supplies, at least under present removal rates. Another positive sign is the 8-percent increase in number of 2-inch softwood trees on NIPF land. Such an increase is important because more than three-fourths of North Carolina's timberland is held by NIPF owners. The increase resulted from a substantial rise in planting on this ownership. The number of 2-inch softwood trees declined on public and forest industry lands. The numbers of 8- and 10-inch trees rose by 4 and 11 percent, respectively, but all of these increases occurred on forest industry and public lands. The forest industry increase was driven by developing plantations, whereas the public increase was aided by land acquisition.

The Hardwood Inventory

Volume in the merchantable portion of live hardwood trees 5.0 inches d.b.h. and larger totaled almost 22.1 billion cubic feet, or 64 percent, of the State's live timber resource. Some 20.2 billion cubic feet met minimum requirements to qualify as growing stock. The rest was in trees culled because of form, rot, or breakage. This cull portion is typically higher for hardwoods than softwoods due to inherent differences in form. Hardwood growing-stock volume increased by 4 percent since 1984.

Almost 80 percent of the State's hardwood growing-stock inventory is in NIPF hands, 13 percent is in public ownership, and only 7 percent is under forest industry control. The increase in the State's hardwood growing-stock volume from 19.3 to 20.2 billion cubic feet was not proportionately distributed across the major ownership categories. The volume of hardwood growing stock rose 10 percent to 2.7 billion cubic feet on public land and by 4 percent to nearly 16.1 billion cubic feet on NIPF land. It dropped by 4 percent on areas under forest industry control.

The Mountain and Piedmont units have nearly two-thirds of the State's hardwood inventory. Individually, the Mountains contain 33 percent, the Piedmont 31 percent, and the two Coastal Plain units 18 percent each. Hardwood volume increased 6 and 7 percent in the Mountains and Piedmont, respectively. It also increased, but to a lesser extent, in the Southern Coastal Plain and decreased by 2 percent in the Northern Coastal Plain. The difference between changes in the eastern and western halves of the State probably are related to growing demands for hardwood timber on the Coastal Plain.

The hardwood resource in North Carolina consists of numerous and diverse species. With 16 percent of the State's hardwood inventory, yellow-poplar is the most abundant individual hardwood species (fig. 7). Volume of yellow-poplar increased 8 percent since 1984 to 3.3 billion cubic feet. More than four-fifths of the State's yellow-poplar volume occurs in the western half of the State.

Red maple, which makes up 99 percent of the soft maple group, is the second-most-prevalent species in the hardwood inventory. Its volume increased 10 percent to almost 2.2 billion cubic feet. Soft maple, which is distributed fairly equally across all units of the State, accounts for 11 percent of the State's hardwood inventory.

Sweetgum volume increased almost 4 percent to 2.1 billion cubic feet. Sweetgum accounts for 10 percent of the State's hardwood growing stock. Roughly a third of the State's sweetgum volume occurs in the Piedmont and each of the two Coastal Plain units. Very little of the State's sweetgum volume exists in the Mountains.

The select white oak group consists of white oak, swamp chestnut oak, and swamp white oak. Select white oak volume increased by 7 percent to nearly 2.1 billion cubic feet. Select white oaks account for 10 percent of the State's hardwood growing stock. About half of the State's select white oak volume is in the Piedmont, and 22 percent is in the Mountains.

Chestnut oak volume rose 7 percent to 1.2 billion cubic feet. It now accounts for 6 percent of the State's hardwood inventory. Seventy-nine percent of the State's chestnut oak volume is in the Mountains. The other white oak group contains post oak and overcup oak volume; it decreased by 14 percent to 0.3 billion cubic feet. More than half of this volume is found in the Piedmont. This group is one of the few hardwoods to lose volume.

Select red oaks include northern red oak, cherrybark oak, and shumard oak. The group's volume rose 4 percent to 1.0 billion cubic feet and accounts for 5 percent of the State's hardwood growing-stock inventory. Not quite two-thirds of the select red oak volume is in the Mountains, and more than a fourth is in the Piedmont. The other red oak group is the largest of the species groups; its volume changed little at 2.5 billion cubic feet. This group is made up of scarlet, southern red, black, water, laurel, pin, and shingle oaks.

Volume of tupelo and blackgum rose almost 3 percent to 1.9 billion cubic feet and makes up less than 10 percent of the State's hardwood inventory. As might be expected, 90 percent of the tupelo and blackgum volume occurs in the eastern half of the State.

Hickory volume remains at less than 1.0 billion cubic feet and accounts for under 5 percent of the State's hardwood inventory. The western half of the State holds 86 percent of the hickory volume.

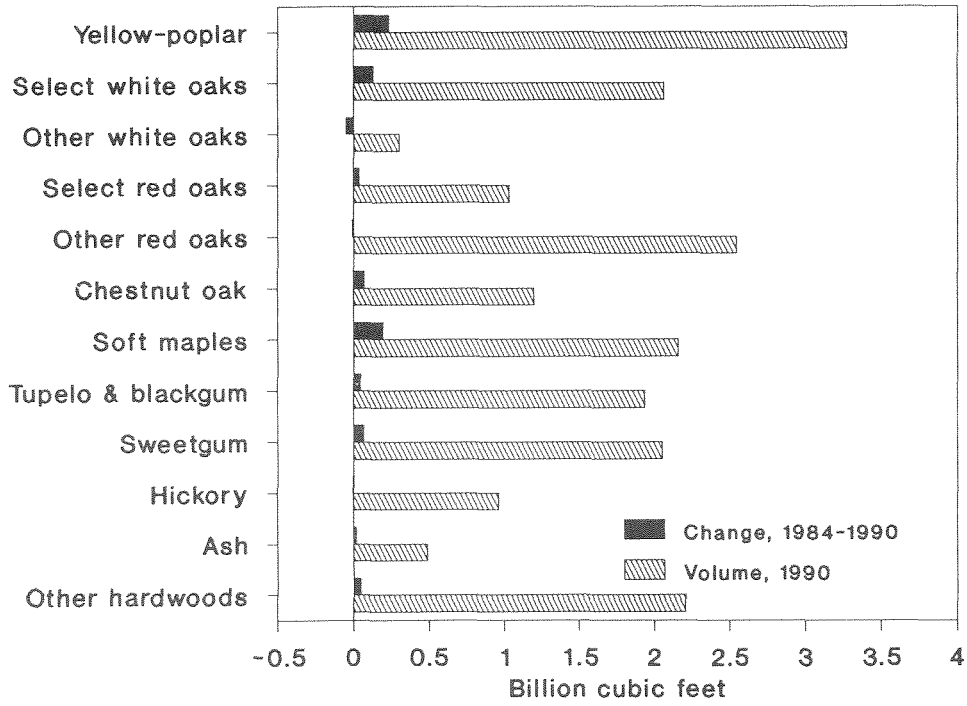


Figure 7—Volume of hardwood growing stock in 1990, and change in volume of hardwood growing stock between 1984 and 1990, by species.

The most valuable part of the hardwood growing-stock inventory is in the saw-log portions of sawtimber-size trees. These portions hold 62.5 billion board feet, up by 9 percent since the previous survey. The ownership distribution of hardwood sawtimber is similar to that for growing stock: 80 percent is on NIPF land, 14 percent on public land, and 6 percent on forest industry land. Hardwood sawtimber volume rose by nearly 11 percent on both public and NIPF land to nearly 8.6 and 49.9 billion board feet, respectively. It decreased by almost 8 percent on forest industry land to less than 4.1 billion board feet.

Almost two-thirds of the hardwood sawtimber occurs in the western half of the State. The Mountains have the most with 21.5 billion board feet, followed closely by the Piedmont with 19.4 billion board feet. The remaining 21.7 billion board feet are divided fairly equally between the Coastal Plain units. Hardwood sawtimber rose from 9 to 12 percent in all but the Northern Coastal Plain, where it increased by only 1 percent.

The quality of hardwood sawtimber is paramount to the hardwood lumber industry. To estimate the quality of sawtimber trees, tree grades were assigned to each of them (procedures used are described in appendix table 22). The entire board-foot volume of each tree was assigned to a single grade—usually the grade of the butt log. Since the butt log usually is the highest quality log in the tree, the tree grade tends to exaggerate log quality. In previous inventories, log grade distributions were estimated for the State from subsamples of the total number of plots.

In North Carolina, 48 percent of the hardwood volume is in grade 1 and grade 2 trees, 42 percent is in grade 3 trees, and 10 percent is in grade 4 trees (where butt log qualifies for tie and timber grade only). Among trees 15 inches and larger d.b.h., 63 percent are in grades 1 and 2. Appendix table 22 shows the distribution of sawtimber volume by grade for various species groups.

Hardwood volume increased over several decades since the first survey in 1938. Recent trends, graphed in figure 8, show that the volume of hardwood growing stock has continued to increase. Fostering these increases were low rates of hardwood removals due to comparatively low prices, long rotations for hardwoods, and lack of hardwood management. Recent increases in demand for hardwood fiber suggest that hardwood volumes will soon peak.

Volume of hardwood sawtimber has also crept upward since 1938. The State's hardwood resource obviously is maturing. The implications are particularly strong in the Mountain unit, which contains not only the most hardwood sawtimber volume in the State but also the most volume in trees 29.0 inches d.b.h. and larger. Changes in hardwood growing-stock volume by diameter class since 1974 are displayed in figure 9. Volume increased in all diameter classes 14 inches and larger. Cumulatively, the volume in trees 15.0 inches d.b.h. and larger increased by 12 percent. Such trees now account for nearly 41 percent of the State's 20.2 billion cubic feet of hardwood growing stock. The buildup in large diameter trees is much smaller than that recorded between the prior two surveys. Hardwood volume decreased in the 6- and 12-inch diameter classes by 3 and 5 percent, respectively. The decline in volume of 6-inch trees is related to a decline in numbers of small hardwoods reported in the 1984 survey (Sheffield and Knight 1986). The decline in volume of 12-inch trees reflects increases in harvest of hardwoods that occurred in many diameter classes. The high proportion of volume in large trees, the significant increases in volume of large trees, and the decline in volume of 6-inch trees provide further evidence of a maturing hardwood resource.

Trends in tree numbers for all ownerships combined correspond well to the volume trends seen in figure 9. However, table II shows that differences do exist between the major ownership categories. The all-owner decline in numbers of 6-inch trees follows the volume decrease in this diameter class very well. But, even though numbers of 6-inch trees dropped in each owner category, 91 percent of the decline in 6-inch trees occurred on NIPF land. In fact, numbers of trees on NIPF land dropped in all diameter classes below 14.0 inches d.b.h. in addition to dropping the most.

Conversely, NIPF land supported the greatest increases in numbers of trees 14.0 inches d.b.h. and larger. Since NIPF land accounts for a majority of North Carolina's timberland, these trends are indicative of a maturing hardwood resource. On forest industry land, except for a slight increase in numbers of 8-inch trees, numbers of hardwood trees were down in all diameter classes. This trend generally reflects forest industry's emphasis on softwood management.

On public land, only the 6- and 12-inch diameter classes experienced very slight declines in numbers of hardwood trees. All other diameters on public lands had increases in numbers of hardwood trees. Particularly noteworthy were increases in numbers of 2- and 4-inch hardwood trees, a change that was confined to this owner category. The all-owner reduction in numbers of 2- and 4-inch hardwood trees is far less dramatic than that occurring between the prior two surveys (Sheffield and Knight 1986).

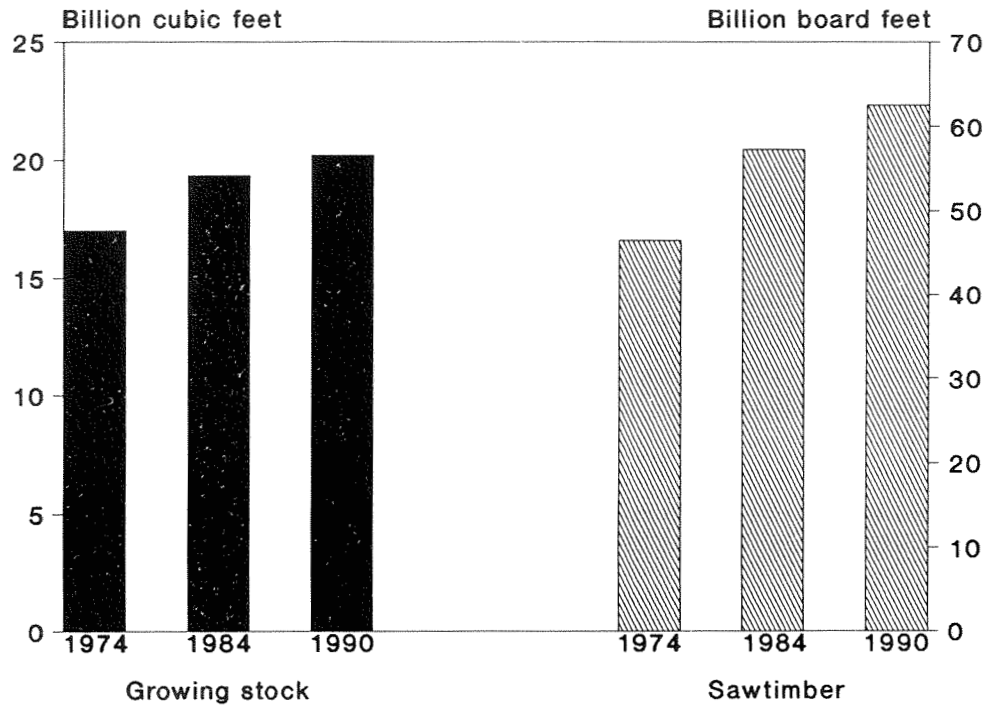


Figure 8—Volume of hardwood growing stock and sawtimber, 1974, 1984, and 1990.

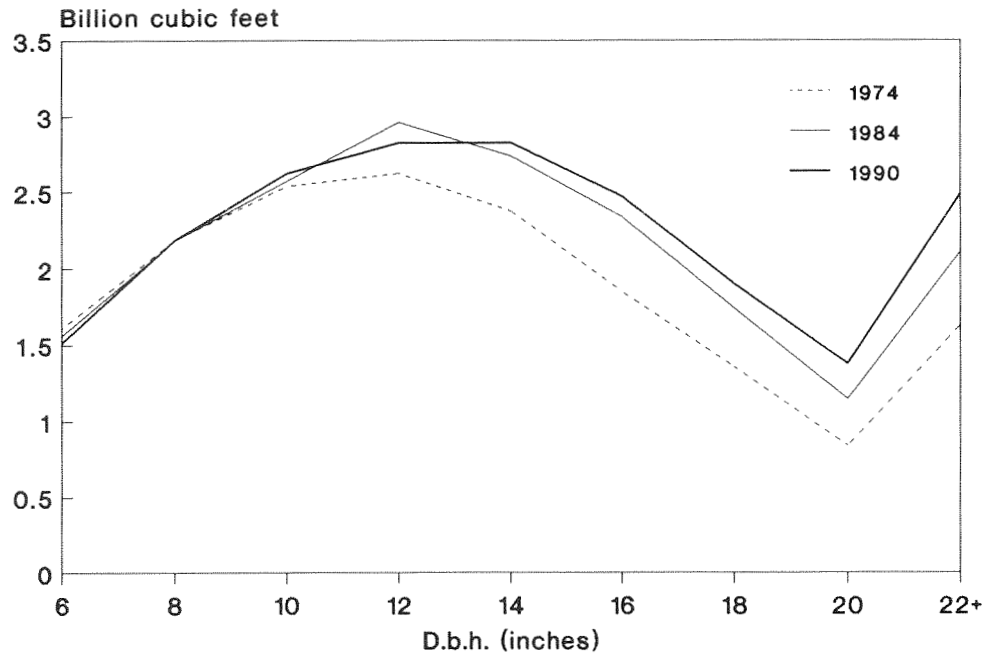


Figure 9—Volume of hardwood growing stock by tree d.b.h. class, 1974, 1984, and 1990.

Softwood Growth, Removals, and Mortality

The change in inventory volume between two surveys reflects all aspects of tree growth, tree removals, and tree mortality. Mortality volume is subtracted from gross growth to arrive at net growth. Then removal volume is subtracted from net growth to achieve net change. The various components of growth are summarized in table III.

Gross growth has five components: survivor growth, ingrowth, growth on ingrowth, growth on removals, and growth on mortality. In the period 1984–1989, softwood gross growth in North Carolina totaled more than 706 million cubic feet.

Survivor growth, the average annual volume increment of surviving growing-stock trees at least 5.0 inches d.b.h. at the time of initial inventory, accounted for 85 percent of the total softwood gross growth. Ingrowth is the volume of growing-stock trees that grew to 5.0 inches d.b.h. each year during the remeasurement period, and growth on ingrowth is the average annual volume increment on these trees after they attained 5.0 inches. Together, ingrowth plus growth on ingrowth accounted for 13 percent of gross growth. Growth on removals and growth on mortality equal the average annual volume increment on trees prior to harvest or death, respectively. Combined, growth on removals and mortality account for the remaining 2 percent of softwood gross growth. Net growth is the remainder after

Table III——Annual components of change in the volume of growing stock on North Carolina's timberland, by Survey Unit and species group, 1984–1989

Survey Unit and species group	Gross growth	Components of growth: Survivor growth	Ingrowth	Growth on ingrowth	Growth on removals	Growth on mortality	Mortality	Net growth	Removals	Net change
				Million cubic feet						
Southern Coastal Plain										
Softwood	245.7	207.5	27.5	4.7	5.1	0.9	25.2	220.5	185.3	+35.2
Hardwood	148.7	130.0	15.1	1.2	1.8	0.6	32.1	116.6	93.6	+23.0
Total	394.4	337.5	42.6	5.9	6.9	1.5	57.3	337.1	278.9	+58.2
Northern Coastal Plain										
Softwood	197.0	164.5	23.6	4.0	4.3	0.6	18.8	178.2	151.6	+26.6
Hardwood	143.6	126.8	13.3	1.0	2.1	0.4	22.7	120.9	132.8	−11.9
Total	340.6	291.3	36.9	5.0	6.4	1.0	41.5	299.1	284.4	+14.7
Piedmont										
Softwood	197.8	166.9	23.8	2.6	3.2	1.3	50.4	147.4	140.4	+7.0
Hardwood	243.4	215.5	22.9	1.8	2.2	1.0	42.9	200.5	129.1	+71.4
Total	441.2	382.4	46.7	4.4	5.4	2.3	93.3	347.9	269.5	+78.4
Mountains										
Softwood	65.8	59.9	4.3	0.5	0.6	0.5	22.1	43.7	34.5	+9.2
Hardwood	183.8	171.0	10.2	0.7	1.1	0.8	52.0	131.8	72.3	+59.5
Total	249.6	230.9	14.5	1.2	1.7	1.3	74.1	175.5	106.8	+68.7
State										
Softwood	706.3	598.8	79.2	11.8	13.2	3.3	116.5	589.8	511.8	+78.0
Hardwood	719.5	643.3	61.5	4.7	7.2	2.8	149.7	569.8	427.8	+142.0
Total	1,425.8	1,242.1	140.7	16.5	20.4	6.1	266.2	1,159.6	939.6	+220.0

mortality volume is subtracted from gross growth. Softwood mortality totaled more than 116 million cubic feet, reducing the average annual gross growth of softwoods by 16 percent, leaving less than 590 million cubic feet in net growth.

At 116 million cubic feet, the average annual mortality of softwood growing stock remained at about the same level as in the previous survey. Statewide, the leading identifiable causes of death to softwoods were weather and insects, which accounted for 31 and 23 percent of the mortality, respectively (app. table 35). Hurricane Hugo, which primarily traversed the western Piedmont, was responsible for a large portion of the weather-related mortality. As a result, softwood mortality rose 20 percent in the Piedmont as opposed to only a 2-percent increase in the Southern Coastal Plain and declines in the remaining two regions. Within the Piedmont, weather accounted for 40 percent of the softwood mortality.

Softwood net annual growth increased by 18 percent, reversing a decline recorded in the previous survey period (fig. 10). This increase in softwood net growth was matched by an increase in softwood annual removals on the order of 19 percent to 512 million cubic feet. This also reversed a slight decline recorded in the prior survey period. Although softwood growth was up on all ownerships, the increase was highest (41 percent) on forest industry land and lowest (9 percent) on NIPF land.

The same was true for removals, which rose 46 percent on forest industry and just 12 percent on NIPF land. The larger increase in growth on forest industry land can be attributed to vast areas of intensively managed plantations that developed to merchantable sizes during the period.

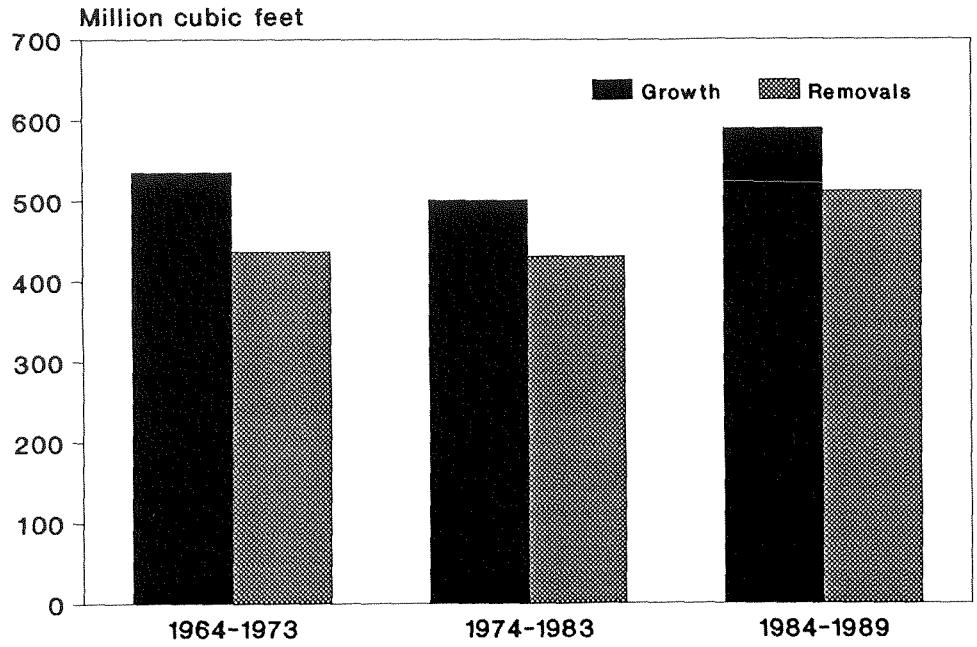


Figure 10—Average net annual growth and annual timber removals of softwood growing stock, by remeasurement period.

Across all ownerships, the ratio of softwood growth to removals has been gradually decreasing over the last three survey cycles from 1.226 in 1974 to 1.153 in 1990. Currently, softwood net growth exceeds removals by 78 million cubic feet, or by 15 percent. However, softwood growth did not exceed removals in all of the major ownership categories (fig. 11). On NIPF land, the softwood net annual growth of nearly 376 million cubic feet was 13 million cubic feet below the amount removed annually (fig. 11). On public land, softwood growth (44 million cubic feet) was more than double removals. Forest industry land accounted for the majority of the overall surplus in softwood net growth. On forest industry lands, the 170 million cubic feet of softwood growth exceeded removals by 69 million cubic feet, or by 68 percent.

Softwood net annual growth was up in all survey units. It increased only 3 percent in the Mountains, 10 percent in the Piedmont, 13 percent in the Southern Coastal Plain, but jumped 38 percent in the Northern Coastal Plain. The huge increase here was primarily due to developing plantations on forest industry land, which accounted for three-fourths of the unit's softwood growth increase. Annual removals of softwood were up in all survey units as well but were up the most in the Coastal Plain, where increases of 30 and 18 percent were recorded in the Southern Coastal Plain and Northern Coastal Plain, respectively. Growth continues to exceed removals in all regions, although the relationship is tightest in the Piedmont. In the Piedmont, the 147 million cubic feet of softwood growth exceeds removals by just 5 percent. In the Mountains, the 44 million cubic feet of softwood growth exceeded removals by 27 percent. In the Northern and Southern Coastal Plain units, the 178 and 220 million cubic feet of softwood growth exceeded removals by 18 and 19 percent, respectively.

Hardwood Growth, Removals, and Mortality

The various components of hardwood growth are summarized in table III. The gross growth of North Carolina's hardwood growing-stock inventory totaled less than 720 million cubic feet. Survivor growth accounted for 90 percent of the total hardwood gross growth, and ingrowth and growth on ingrowth together accounted for 9 percent of gross growth. Growth on removals and growth on mortality, in combination, accounted for the remaining 1 percent of hardwood gross growth. Hardwood mortality totaled 150 million cubic feet and reduced the average annual growth of hardwoods by 21 percent, leaving nearly 570 million cubic feet in net growth.

Statewide, average annual mortality of hardwood growing stock nearly doubled from 75 to 150 million cubic feet. Hardwood mortality increased substantially in each of the survey units, with increases ranging from 72 to 139 percent. The leading identifiable causes of death to hardwoods were weather and disease, accounting for 26 and 18 percent of the mortality, respectively (app. table 35). Hurricane Hugo caused a significant amount of damage to the hardwood resource. Although weather was the most recognized cause of death to hardwoods and 63 percent of the total hardwood mortality occurred in the western half of the State, the impact of Hugo upon hardwood mortality was less discernible than for softwoods. Most of the hardwood mortality caused by Hugo will be measured in future surveys because severely damaged hardwoods often linger for years before dying, while softwoods die quickly.

At 570 million cubic feet, hardwood net annual growth was down 9 percent, reversing an increase measured in the previous survey (fig. 12). The decrease in net annual growth of hardwoods was accompanied by a significant increase in annual removals. Hardwood removals jumped by 36 percent to 428 million cubic feet annually. The decrease in growth and the increase in removals were recorded across all ownership categories. Percentagewise, public lands had the greatest decrease in hardwood growth and the greatest increase in hardwood removals. However, this can be misleading because NIPF lands actually accounted for the vast majority of the changes in hardwood growth and removal volumes. Approximately 80 percent of the State's reduction in hardwood growth and 79 percent of the increase in hardwood removals took place on NIPF land.

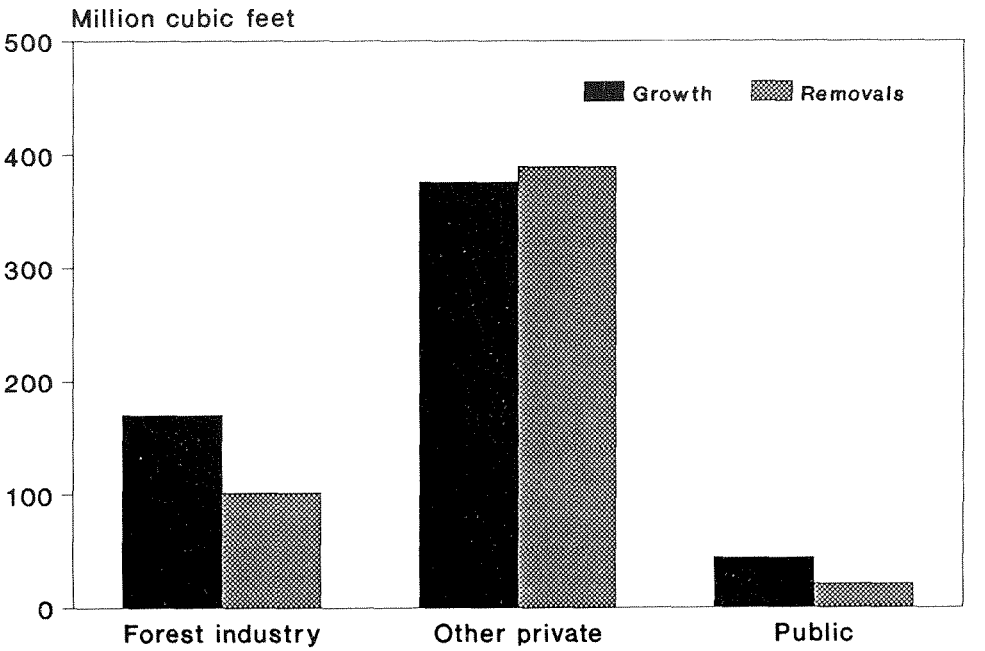


Figure 11—Average net annual growth and annual timber removals of softwood growing stock, by ownership class, 1984–1989.

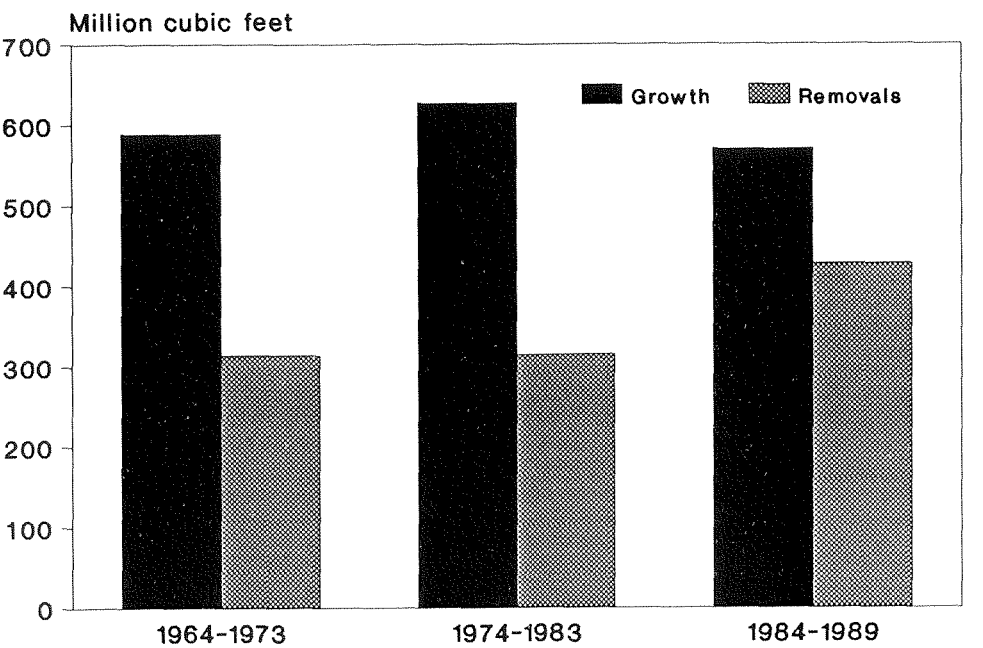


Figure 12—Average net annual growth and annual timber removals of hardwood growing stock, by remeasurment period.

Even with the increase in hardwood removals, hardwood growth across all ownerships combined still exceeds removals by 33 percent, or 142 million cubic feet. In the previous survey, hardwood growth was almost double the rate of removals. Current hardwood growth-to-removals ratio dropped to 1.332 after rising to 1.990 in the previous survey. Hardwood growth exceeded removals in each major ownership category. Percent-agewise, the relationship was narrowest on forest industry and widest on public lands (fig. 13). Still, NIPF land accounted for nearly three-fourths of the overall surplus in hardwood net growth.

Hardwood net growth declined in three of the four survey units. The only increase occurred in the Southern Coastal Plain, where hardwood growth rose by 3 percent. The greatest decline in hardwood growth took place in the Mountains, where it dropped by 21 percent. Yet, growth still exceeds removals there by a wide margin.

Annual removals of hardwood increased in each survey unit. Substantial increases of 39, 57, and 60 percent occurred in the Mountains, Northern Coastal Plain, and Southern Coastal Plain, respectively. In the Piedmont, hardwood removals rose by only 8 percent. Hardwood growth exceeded removals in three of the four survey units. For the first time in the Northern Coastal Plain, hardwood removals exceeded growth. Hardwood growth exceeded removals by 82 percent in the Mountains, by 55 percent in the Piedmont, and by 25 percent in the Southern Coastal Plain.

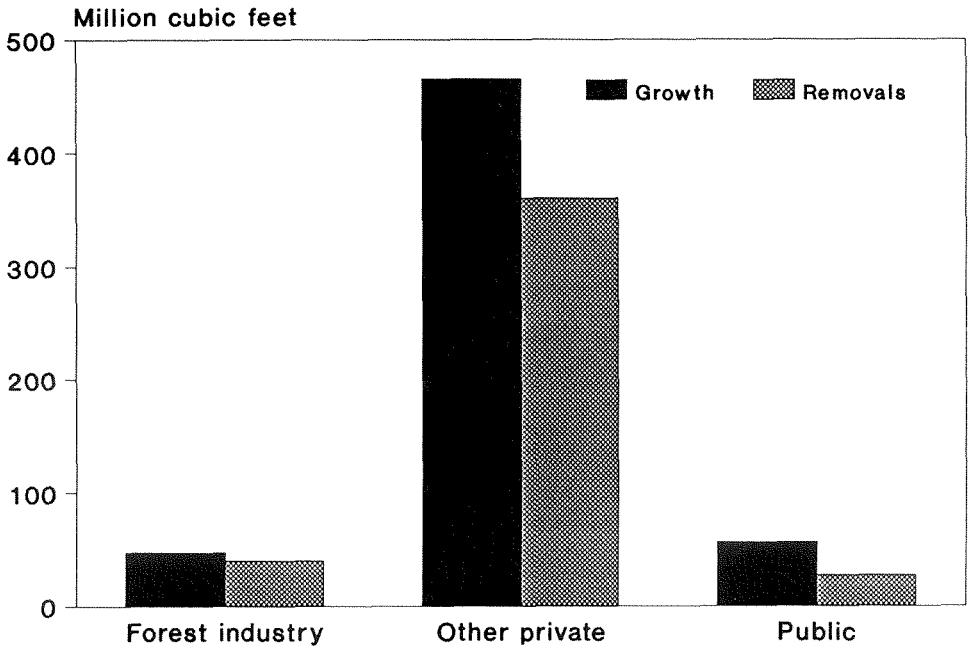


Figure 13—Average net annual growth and annual timber removals of hardwood growing stock by ownership class, 1984–1989.

Per-Acre Growth

Growth trends may be easiest to understand when they are presented on a per-acre basis. Net growth of all growing stock combined increased from 60 to 62 cubic feet per acre, statewide. The softwood segment accounted for 51 percent of current per-acre growth, compared with 44 percent in the previous inventory. Softwoods accounted for all the increase in growth per acre. Growth per acre rose from 58 to 64 cubic feet in the Southern Coastal Plain and from 72 to 79 cubic feet in the Northern Coastal Plain. In the Piedmont, it increased slightly from 59 to 60 cubic feet, and in the Mountains growth per acre decreased substantially from 52 to 44 cubic feet. Increases in per-acre growth in the eastern half of the State, where softwoods account for 66 and 60 percent of the total growth per acre, were driven by the high incidence of managed pine plantations there. Changes in per-acre growth in the western half of the State were driven by a drop in overall hardwood growth.

Hardwood growth per acre was down in all but the Southern Coastal Plain, where it increased very little. In contrast, softwood growth per acre rose in every unit. The slowdown in hardwood growth could be the result of several factors, including a maturing resource, increasing stand density, and droughts suffered in the 1980's.

Softwood growth per acre was up for all ownerships, and hardwood growth per acre was down on all ownerships except forest industry, where it was virtually unchanged (fig. 14). Total growth per acre decreased from 49 to 47 cubic feet on public land and from 60 to 59 cubic feet on NIPF land. It rose from 68 to 90 cubic feet on forest industry land. The huge increase on forest industry was influenced by the high proportion of plantations in this ownership. Softwoods make up 78 percent of the total per-acre growth on forest industry land.

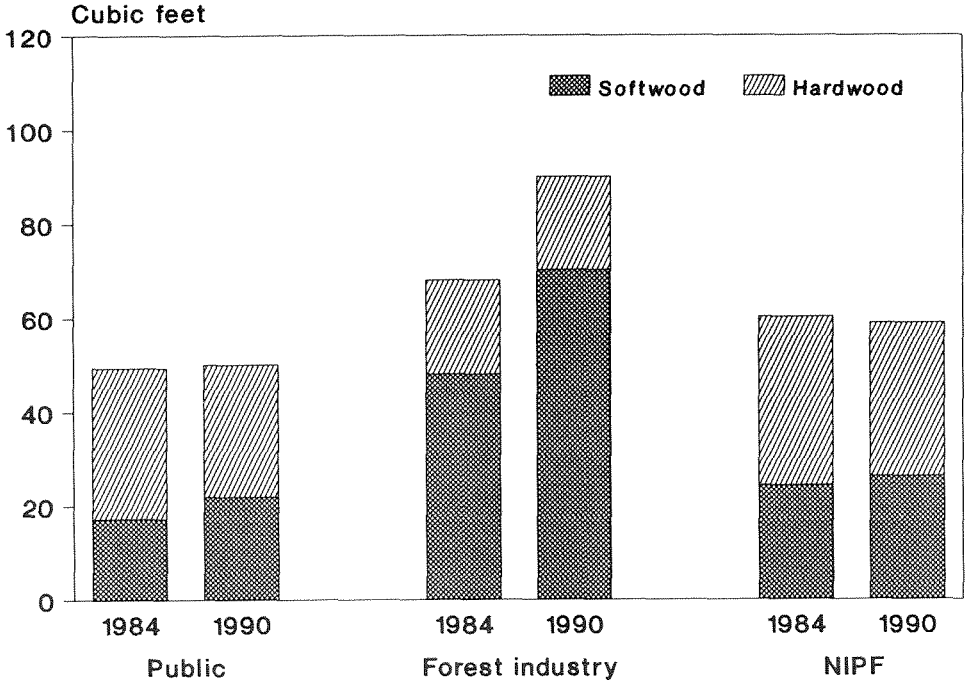


Figure 14—Net annual growth per acre of timberland, by ownership class and species group, 1984 and 1990.

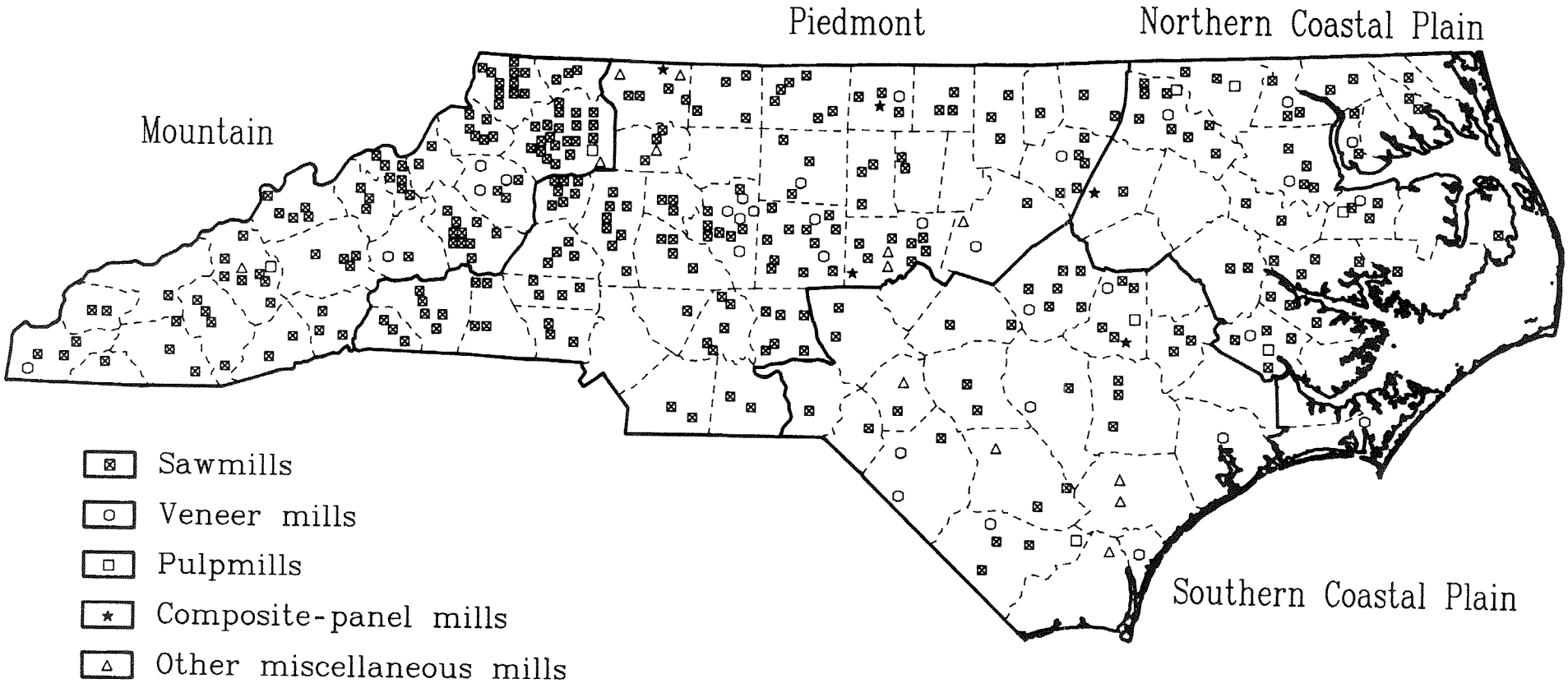


Figure 15—Location of primary wood-using plants in North Carolina, 1990.

Timber Removals and Products Output

Economic Status

North Carolina's forests provide many nontimber benefits. They purify air and water, provide wildlife habitat and outdoor recreation, and are esthetically pleasing. The renewable timber resource also contributes a great deal to the State's economy. In 1989, almost 2,300 firms were involved in some form of timber products manufacturing (U.S. Department of Commerce 1991). These companies employed nearly 107,000 workers and generated an annual payroll of $2.1 billion. The timber production and wood products industry ranks third in the State behind textiles and equipment manufacturing in economic importance. This chapter describes the utilization of timber harvested from North Carolina's timberland.

Sources of Timber Removals and Products Output Data

Appendix tables 37–41 present estimates of average annual timber removals and products output for the period 1984 through 1989. A combination of sources was used to develop these data. The product and residue volumes of trees removed from timberland along with the volume of trees on timberland diverted to nonforest uses were calculated from remeasurement of permanent FIA plots. Over-and-under utilization of these removals by FIA merchantability standards were determined by applying utilization factors obtained from a sample of 108 active logging operations scattered throughout the State.

Estimates of wood receipts, industrial products output, and the generation and use of plant residues were obtained from canvasses of all primary wood-using mills in the State. These canvasses were conducted jointly by the North Carolina Division of Forest Resources and the Southeastern Forest Experiment Station. Primary mills are those that process roundwood in log or bolt form or as chipped roundwood. Some 366 primary wood-using plants operated in North Carolina in 1990 (fig. 15). Pulpmill surveys were conducted each year during the remeasurement period; other primary wood-using mills were canvassed in 1986, 1987, and 1990. The removal values in this report are annual averages for the period 1984–1989.

Estimates of fuelwood consumption were derived from data reported by Skog and Watterson (1986). Estimates of fuelwood removals from timberland came from FIA permanent plot remeasurement.

Annual Removals

Between 1984 and 1989, annual removals of growing stock from North Carolina's timberland totaled 940 million cubic feet, up 26 percent from the previous survey period. Softwood removals rose 19 percent to 512 million cubic feet. Although softwood removals increased, their share of the total removals is down from 58 percent in 1984 to 54 percent in 1989. The rate of increase in softwood removals varied considerably by major ownership category. They rose 12 percent on NIPF lands while increasing 46 and 40 percent on forest industry and public lands, respectively. These differences led to slight changes in the distribution of softwood removals by ownership as well. NIPF land supplied 76 percent, or 389 million cubic feet, of the softwood removals as opposed to 80 percent in the prior survey. Forest industry land supplied 20 percent, compared with 16 percent previously, and public land supplied 4 percent in each period.

Between 1973 and 1983, only 4 percent of North Carolina's annual softwood growing-stock removals came from pine plantations. The majority, 86 percent, of these removals came from plantations 11 to 20 years old. In the period 1984 to 1989, annual removals of softwood growing stock from plantations have increased to 15 percent. Ninety-eight percent of these removals came from plantations 11–20 and 21–30 years old. Recent increases in planting, frequently after harvest of natural pine stands, have enabled the acreage in the 0- to 10-year age class to represent the State's largest block of plantations to date. Because of planting, softwood supplies are projected to increase gradually (USDA Forest Service 1988); this suggests that plantations will continue to increase their proportion of future softwood removals.

Since the last survey, hardwood removals increased 36 percent to 428 million cubic feet. In fact, hardwoods accounted for 58 percent of the overall increase in the State's timber removals. Hardwood removals increased substantially on all major ownership categories: 33 percent on NIPF land, 38 percent on forest industry, and 80 percent on public land. Distribution of hardwood removals by ownership has changed very little since the previous survey. NIPF land supplied 84 percent, forest industry land accounted for nearly 10 percent, and public land supplied more than 6 percent of the State total. The increase in the State's hardwood removals is projected to continue (USDA Forest Service 1988). In the previous survey, hardwoods accounted for 39 percent of total

product volume. By the latest survey, the percentage had increased to 43 percent. Forces driving the increased hardwood removals include greater use of hardwoods in products, and increased demand both locally and abroad. Any major increase in removals of hardwoods must be supplied by NIPF owners, since they control most of the hardwood acreage. Although public land has significant hardwood acreage, increased demands for recreation use and watershed management may actually reduce the amount of hardwood removed from public timberland.

Timber Utilization

Of the 940 million cubic feet of growing stock removed annually from timberland in North Carolina between 1984 and 1989, 84 percent was used for timber products (app. table 39). Simultaneously, 8 percent was left in the woods as logging residues, which consist of unused merchantable portions of growing-stock trees. The remaining 8 percent of the growing-stock removals are classified as "other removals." This category includes trees felled in cultural operations and land use changes but not utilized for a product. Some of the material classed as "other removals" is in standing trees on land reclassified as nonforest in an urban or agricultural setting. This category of removals also includes timber on land converted to a reserved timberland status.

The 786 million cubic feet of growing stock used for timber products represent a 29-percent increase since the prior survey. In conjunction, average output of roundwood products rose as well by 24 percent to 871 million cubic feet (app. table 38). The roundwood output estimate is higher than the removals estimate because non-growing-stock sources of volume are excluded from the latter (app. table 38). However, the volume of non-growing-stock material accounted for a smaller proportion of the product output in this survey (10 percent) than in the last survey (13 percent). Excluding other removals (app. table 39), the proportion of growing-stock removals used for roundwood products (including fuelwood) has leveled off at around 91 percent.

For all classes of timber combined, utilization of the merchantable portions of trees averaged 94 percent for softwoods and 88 percent for hardwoods. Along with the merchantable volume, total volume utilized in harvesting operations includes some volume not considered merchantable by FIA standards. This material includes tops above 4.0 inches in diameter, stumps below 1.0 foot, and large limbs of merchantable trees. For hardwoods, 3 percent of the total volume utilized came from material beyond FIA standards, and 2 percent of the total softwood volume utilized came from these sources.

The proportion of product output from cull trees dropped a fraction to less than 2 percent and remains mostly hardwood. The proportion of product output from "other sources," which include stumps, tops, limbs, and trees from nonforest situations, decreased from 10 to 8 percent between surveys. Almost 61 percent of the volume from "other sources" is hardwood.

Pulpwood Production

North Carolina ranks second in the Southeast and sixth in the Nation for pulpwood production. Pulpwood has surpassed saw logs as the leading timber product harvested from North Carolina's timberland. Pulpwood accounts for 43 percent of total product output and 40 percent of the total roundwood output (app. table 37). The average annual production of pulpwood was up 34 percent from 259 to 347 million cubic feet. Softwood output increased 25 percent to 197 million cubic feet. Despite this increase, the softwood share of the total declined from 61 to 57 percent of roundwood pulpwood production. Hardwood output for pulp increased 47 percent to 149 million cubic feet.

Plant byproducts were the source of another 99 million cubic feet of pulp between 1984 and 1989 (app. table 37). Including these additional sources, total annual output of pulpwood averaged 446 million cubic feet (6.0 million cords), up 22 percent since the last survey period. The growing-stock portion of pulpwood production increased from 231 to 311 million cubic feet, or from 63 to 70 percent, since the last survey. The portion derived from non-growing-stock roundwood remained at 8 percent during both survey periods, whereas plant byproducts declined from 29 to 22 percent of the total pulpwood produced.

Pulpwood production has been increasing fairly steadily for 30 years (fig. 16). Since 1960, total annual pulpwood production has more than doubled, peaking at 5.8 million cords in 1987 and reaching 5.6 million cords in 1990. Pulping of both softwoods and hardwoods has increased. Softwood pulpwood practically doubled since 1960 and currently accounts for 62 percent of the total output. In the same timespan, however, hardwood pulpwood production increased almost fivefold to more than 2.1 million cords. Hardwood pulpwood now accounts for 38 percent of the total output, compared with only 20 percent in 1960.

In 1990, North Carolina was a net exporter of roundwood pulpwood (Davenport 1992). Hardwood export volume was 2½ times the volume of imports, while softwood exports barely exceeded imports. Exports of all species combined, exclusive of chips shipped overseas, totaled nearly 72 million cubic feet, with softwoods making up 55 percent of this total. The primary recipients of North Carolina's exported pulpwood were South Carolina, Tennessee, and Virginia. Imports totaled 52 million cubic feet, with softwoods accounting for 75 percent of this total. The major sources were South Carolina and Virginia. Just 78 percent of the roundwood cut in 1990 for pulpwood was retained for processing in North Carolina.

In 1990, eight pulpmills were operating in North Carolina. Since 1983, the pulping capacity increased by 3 percent to more than 8,100 tons per day.

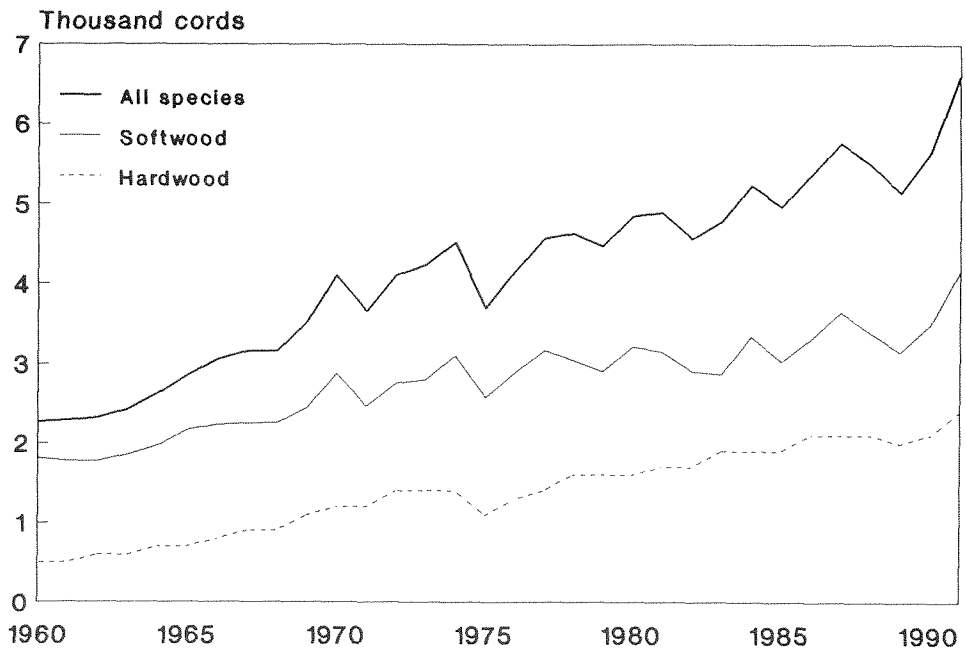
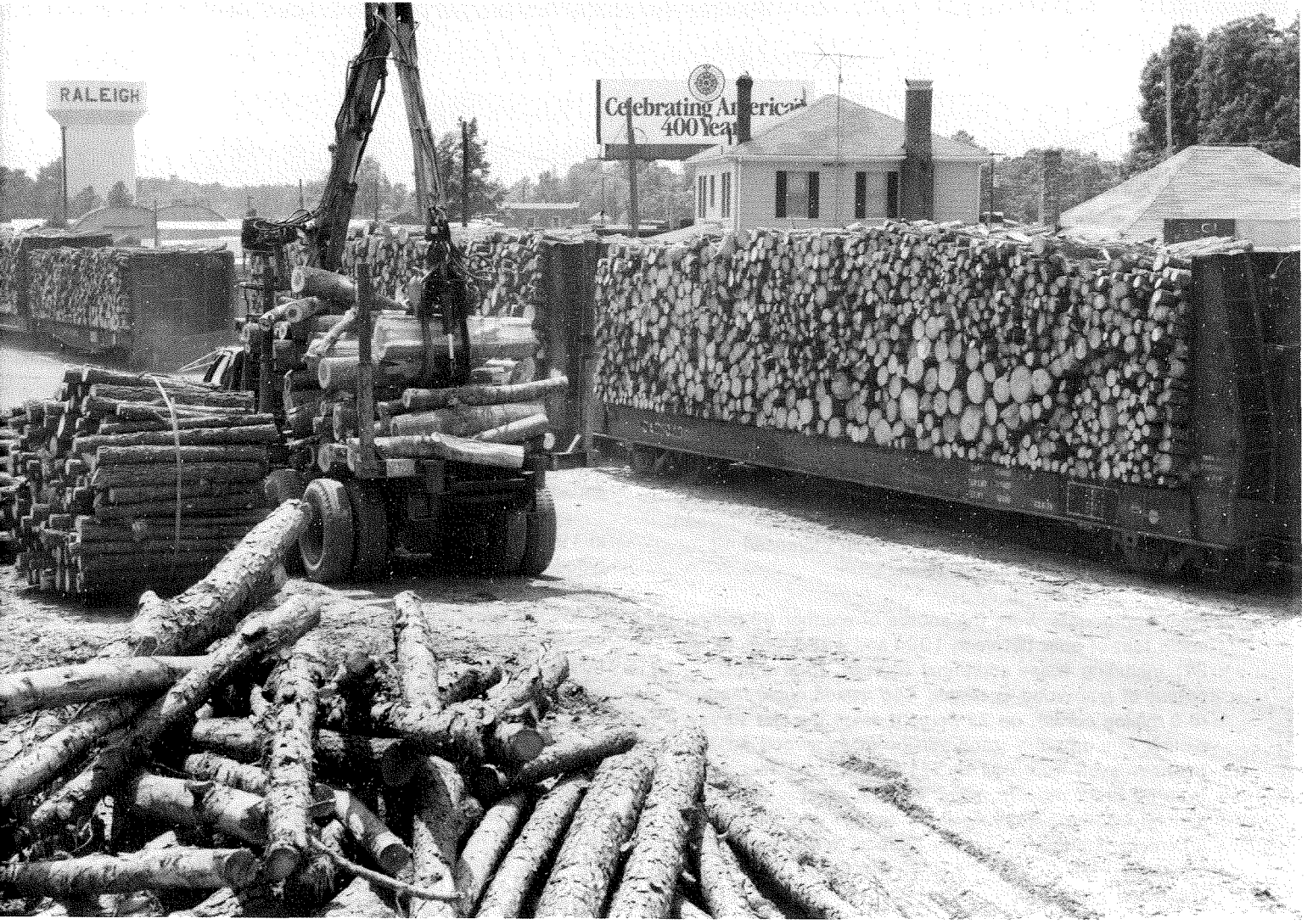


Figure 16—Pulpwood production in North Carolina, 1960–1990.



Saw-Log Production

Saw logs are the second-leading timber product from North Carolina's timberland. Saw logs account for 32 percent of total product output and 37 percent of the total roundwood output (app. table 37). The average annual production of saw logs increased from 261 to 320 million cubic feet since the previous survey period. Production of softwood saw logs increased 10 percent to 204 million cubic feet, but its share of total saw-log output dropped from 71 to 64 percent. This shift was caused by a large increase in hardwood saw-log consumption, which jumped 55 percent to 116 million cubic feet. Hardwoods now account for 36 percent of the total saw-log output, compared with 29 percent previously.

In addition to saw-log output from roundwood, an average of 11 million cubic feet was gleaned from plant byproducts, such as veneer cores, between 1984 and 1989 (app. table 37). Together, total annual output of saw logs from all sources averaged 331 million cubic feet, up 24 percent since the previous survey period. Growing use of hardwoods and somewhat greater use of non-growing-stock trees contributed to the increase.

In 1990, North Carolina's imports and exports of saw logs were nearly in balance. Softwood saw-log exports exceeded imports, but the opposite was true for hardwood saw logs. For all species combined, almost 20 million cubic feet of saw logs were exported to mills in South Carolina and Virginia. In return, North Carolina mills imported 20 million cubic feet from Georgia, South Carolina, Tennessee, and Virginia. Almost 94 percent of the saw logs cut in 1990 were retained for processing in the State.

After increasing to 429 sawmills between 1973 and 1983, the number of sawmills operating in North Carolina fell to 308 in 1990. Only sawmills with receipts of less than 5 million board feet were lost. Numbers of small mills dropped from 344 in 1983 to 210 in 1990. Number of sawmills receiving from 5.0–9.9 million board feet increased from 45 to 49, and those with receipts of 10 million board feet or more increased from 40 to 49. The majority of the mills receiving greater than 10 million board feet are in the eastern half of North Carolina. In contrast, only 15 percent of the State's sawmills with receipts less than 5 million board feet are in this region. Three-fourths of the State's sawmills are in the western half of North Carolina, but 77 percent of these mills have receipts totaling less than 5 million board feet.

Veneer-Log Production

Veneer logs ranked third behind pulpwood and saw logs as logging products. Between 1984 and 1989, annual production of veneer logs averaged 71 million cubic feet. This represents an increase of 57 percent since the prior survey period. Veneer logs accounted for 7 percent of total product output and for 8 percent of roundwood production (app. table 37). At least 96 percent of the State's veneer-log production came from sawtimber-size growing-stock trees. The remainder was divided almost equally between poletimber and other sources (app. table 38).

Although the increase in veneer-log production was almost equally divided between softwoods and hardwoods, changes in the hardwood segment were more significant. Softwood veneer-log production increased by one-third to nearly 49 million cubic feet. Meanwhile hardwood veneer output increased 2½ times to almost 22 million cubic feet. The hardwood portion of total veneer-log output has risen to 31 percent from only 19 percent in 1983.

In 1990, North Carolina was a net importer of veneer logs. More than 95 percent of the veneer logs produced in North Carolina were retained for processing within the State. Most imports originated in Georgia, South Carolina, and Virginia, while most exports went to South Carolina and Virginia.

Since 1983, the number of veneer mills in North Carolina has risen from 29 to 32. Currently, five pine plywood plants are operating in the State, as in the prior survey. These 5 mills produced 74 percent of the total veneer output for 1990 (Davenport 1992). The remaining 27 plants produced either hardwood veneer, hardwood plywood, or containers.

Output of Other Industrial Timber Products

The remaining industrial timber products categories are poles and pilings, posts, and other miscellaneous products. Included under other products are such items as particleboard, logs for log homes, and miscellaneous materials. Between 1983 and 1989, the combined output of these products averaged 81 million cubic feet, almost 8 percent of the total timber products output and 3 percent of roundwood production. The average annual output in this category increased by 57 million cubic feet, almost tripling since the prior survey. In the past, gains in output of other industrial timber products have been supported by increased use of plant byproducts. The recent gains, however, have come from use of roundwood. Currently, 37 percent of the products in this category were derived from roundwood and 63 percent from plant byproducts. In the previous survey, only 20 percent came from roundwood and 80 percent came from plant byproducts. Softwoods account for 60 percent of the category total output, compared with 57 percent in 1983.

Pole and piling production rose from a little over 0.2 million cubic feet to nearly 1.9 million cubic feet. About 98 percent of the poles were derived from growing-stock roundwood, but only 25 percent of the posts came from trees qualifying as growing stock. All of the poles and pilings, but only 30 percent of the posts, were softwood.

Since 1983, the number of mills producing other industrial timber products has increased from 13 to 18. There are now six post and four pole and piling operations in the State, down one each from the number in 1983. However, new operations include three oriented strandboard mills, one medium-density fiberboard plant, one particleboard plant, and two log home manufacturers. The State continues to have one plant producing other miscellaneous products.

Domestic Fuelwood Production

Current annual production of domestic fuelwood is estimated at more than 107 million cubic feet, or 10 percent of the total product output and 12 percent of roundwood production. Trends in firewood production are difficult to track due to the large numbers of small producers and users. It is known that fuelwood use soared between 1973 and 1983 as a result of large price increases for conventional heating fuels and electricity. Since that time, conventional fuel and power prices have stabilized and even dropped in some cases. Under these circumstances, one would expect demand for fuelwood and fuelwood production to decline.

About 64 percent of the current fuelwood production came from growing-stock roundwood, 32 percent from non-growing-stock roundwood, and 4 percent from plant byproducts. Hardwoods make up 88 percent of the current total output of domestic fuelwood. Hardwood fuelwood made up 21 percent of total hardwood product output. In contrast, softwood fuelwood accounted for only 2 percent of total softwood product output.

Utilization of Plant Byproducts

Between 1984 and 1989, primary wood-using plants in North Carolina annually generated an estimated 300 million cubic feet of mill residues (app. table 41). Included in this volume are 134 million cubic feet of coarse residues (chip, veneer cores, slabs, and edgings), 95 million cubic feet of fine residues (sawdust and shavings), and 71 million cubic feet of bark. The processing of saw logs generated 72 percent of the mill residues.

Of the mill residue volume generated annually, 43 percent was used for industrial fuel, 33 percent for fiber products manufacture, 6 percent for composition-board products, 4 percent for sawn items, 1 percent for domestic fuel, and 11 percent for miscellaneous products (litter, mulch, and charcoal). Only 2 percent was not used.

The volume of unused plant residues is down from nearly 16 million cubic feet in 1983 to only 5.4 million cubic feet in 1989. The use of plant residues for industrial fuel almost doubled between the two survey periods, accounting for the drop in volume of unused residues. Hardwoods and softwoods shared equally in the volume of residues unused. Meanwhile, the output from plant byproducts increased by 21 percent. Plant byproducts were the source for 16 percent of total industrial products output each year, and accounted for 14 percent of the increase in product output between 1984 and 1989.

Photos Courtesy of North Carolina Division of Forest Resources

Timber Supply Outlook

Any large expanse of forest is an expression of the recent human and natural history of the area. The extent and character of a State's forests are determined by past management decisions and practices, fluctuations in land use for agriculture, demographic changes, the natural productivity of the land, and natural phenomena like ice storms, insect outbreaks, and disease epidemics. It is difficult to predict future forests conditions precisely because people and natural forces often do surprising things. Nevertheless, an analysis of recent history is needed to predict timber availability in the future.

The timber supply outlook is strongly influenced by the amount of timberland, the present rates of harvest and regeneration, and the character of existing forests. In this chapter, we analyze these factors separately for pine and hardwood timber. We maintain this traditional separation because of major differences in silvicultural practices and uses associated with the two types of timber.

At the outset, however, it is useful to look at acreages of all types of stands combined. Between 1984 and 1990, some 295,000 acres of timberland in North Carolina experienced a final harvest each year (table IV), excluding acres cleared for nontimber uses. Over the same period, an average of 357,000 acres were regenerated with a manageable stand of timber each year (table V). Manageable stands are generally 60 percent stocked with growing-stock trees of similar size. By current estimates, for every acre harvested about 1.2 acres were regenerated. This harvest/regeneration relationship bodes well for the future of the resource. In contrast, in the former survey period (1974 to 1984), harvest rates averaging 260,000 acres annually exceeded regeneration rates averaging 224,000 acres annually.

Pine Harvest/Regeneration

During the latest survey period, an average of 131,000 acres per year of pine stands underwent a final harvest. At the same time, pine regeneration was established on 136,000 acres annually. This tight but positive relationship represents a turnaround from the former survey period when the annual harvest of 126,000 acres exceeded the annual pine regeneration of 98,000 acres. Nearly 90 percent of the final harvest of pine came from natural stands, while 63 percent of the regenerated acres were planted.

The average number of acres planted to pine increased by 31 percent since the previous survey. Planting on harvested and poorly stocked timberland accounted for 74,000 acres annually, up 15 percent. Planting on nonforest land averaged 13,000 acres annually, up sevenfold.

Natural regeneration accounted for 37 percent of the new pine stands. The annual average of natural pine stands successfully established increased by 63 percent. Natural regeneration of harvested and poorly stocked timberland accounted for 37,000 acres annually, up 82 percent. Natural reversion of nonforest land accounted for 13,000 acres annually, up 25 percent.

Pine harvest/regeneration relationships improved for each of the three ownership groups. Most significantly, the relationship on NIPF lands now approaches a balance. The current harvested acreage exceeds the regenerated acreage by only 3 percent, compared with 70 percent in the previous period. Artificial and natural regeneration together nearly doubled on NIPF land. On public land, pine harvest now exceeds regeneration by just 6 percent compared with 36 percent previously. Here, however, the primary change was a more than 50-percent reduction in harvest rate. On forest industry land, the acreage of pine regeneration continues to exceed harvested acreage by a margin of 25 percent, suggesting that pine timber supplies in this ownership class will be increasing.

Situations and events in other regions of the country (e.g., endangered species, catastrophic weather) that either reduce the supply of available timber or create excessive demand for these products could increase demand for wood in the South. Sustained or increased harvest rates to meet these demands and clearing of southern timberland to accommodate population growth and urban development, make continued improvement in the pine harvest/regeneration relationship unlikely. The acres cleared to nontimber uses were excluded from the harvest portion of the relationship. Including these acres would further exacerbate the situation. In addition, 26,000 acres of previously nonforested agricultural lands were regenerated to pine stands. Although idle agricultural land has been a traditional source of new timberland, a continual flow of acres from this source cannot be expected. These lands can succumb to urban development pressures or reenter active agricultural status. If this source were diminished, the total pine harvest/regeneration relationship would be negative indeed. All these factors simply reiterate the need for continued vigorous regeneration efforts and programs, particularly on private lands. NIPF owners control the idle agricultural lands that are the source of new timberland. NIPF lands, both idle and forest, historically are the most vulnerable to conversion to nontimber uses.

Table IV--Area of North Carolina's timberland treated or disturbed annually, by broad management and ownership classes, 1984 to 1990

Broad management[a] and ownership classes[b]	Major stand treatments				
	Final harvest	Partial harvest[c]	Commercial thinning	Other cutting	Natural disturbance
			Acres		
Pine plantation					
Public	--	--	2,064	389	232
Forest industry	10,857	--	30,169	1,468	8,674
Other private	2,707	--	6,260	1,722	5,486
Total	13,564	--	38,493	3,579	14,392
Natural pine					
Public	2,763	925	817	2,981	4,995
Forest industry	22,026	1,155	1,674	2,673	7,585
Other private	92,428	13,202	7,894	16,378	93,993
Total	117,217	15,282	10,385	22,032	106,573
Oak–pine					
Public	1,600	584	--	1,806	1,835
Forest industry	8,322	1,123	328	429	444
Other private	25,351	13,453	1,910	13,494	44,636
Total	35,273	15,160	2,238	15,729	46,915
Upland hardwood					
Public	7,649	937	--	1,543	11,499
Forest industry	5,471	538	--	1,118	3,580
Other private	71,724	13,700	--	38,804	133,064
Total	84,844	15,175	--	41,465	148,143
Lowland hardwood					
Public	440	--	--	--	1,845
Forest industry	7,330	191	--	1,205	3,562
Other private	36,318	7,104	--	6,706	28,525
Total	44,088	7,295	--	7,911	33,932
All classes					
Public	12,452	2,446	2,881	6,719	20,406
Forest industry	54,006	3,007	32,171	6,893	23,845
Other private	228,528	47,459	16,064	77,104	305,704
Total	294,986	52,912	51,116	90,716	349,955

[a] Broad management class before treatment or disturbance.

[b] Ownership class in 1990. Forest industry includes lands under long–term lease.

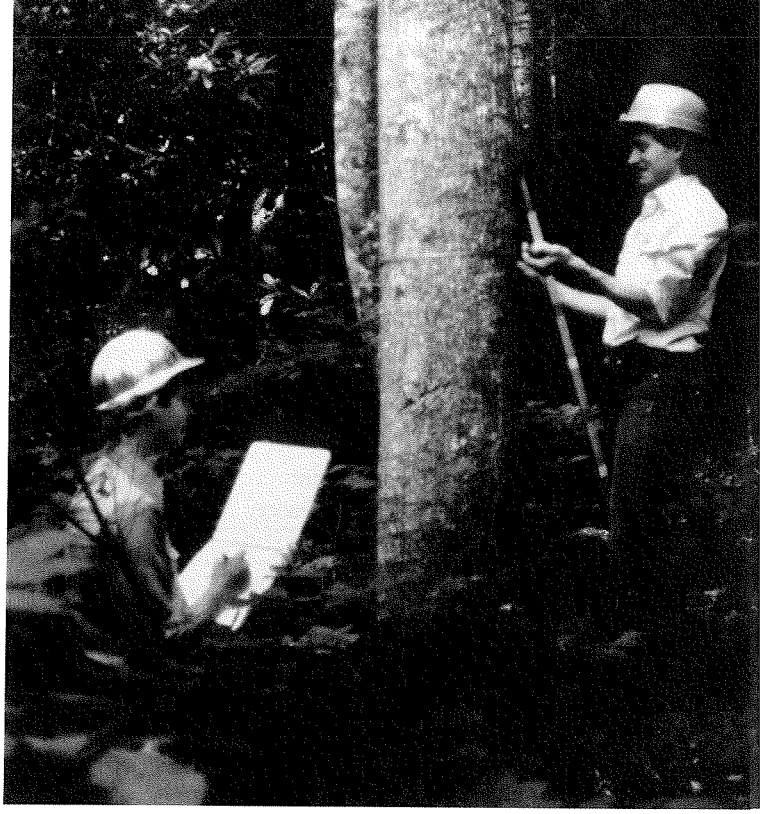
[c] Includes high-grading and some selective cutting.

Table V--Area of timberland regenerated annually, by broad management and ownership classes, North Carolina, 1984 to 1990

Broad management[a] and ownership classes[b]	Total regeneration	Type of regeneration					
		Artificial regeneration after a harvest	Natural regeneration after a harvest	Other artificial regeneration on forest land	Other natural regeneration on forest land	Artificial regeneration on nonforest land	Natural reversion on nonforest land
		Acres					
Pine plantation							
Public	742	575	--	167	--	--	--
Forest industry	39,185	22,174	--	17,011	--	--	--
Other private	46,551	26,448	--	7,380	--	12,723	--
Total	86,478	49,197	--	24,558	--	12,723	--
Natural pine							
Public	1,860	--	94	--	1,252	--	514
Forest industry	1,968	--	1,017	--	951	--	--
Other private	46,059	--	13,434	--	19,905	--	12,720
Total	49,887	--	14,545	--	22,108	--	13,234
Oak-pine							
Public	2,066	--	1,077	--	989	--	--
Forest industry	10,186	4,322	2,738	899	2,227	--	--
Other private	65,750	8,134	34,519	1,549	14,478	433	6,637
Total	78,002	12,456	38,334	2,448	17,694	433	6,637
Upland hardwood							
Public	8,186	--	6,189	655	1,342	--	--
Forest industry	6,187	--	4,932	--	882	--	373
Other private	87,605	--	57,104	--	25,218	--	5,283
Total	101,978	--	68,225	655	27,442	--	5,656
Lowland hardwood							
Public	821	--	--	--	821	--	--
Forest industry	6,698	--	4,045	--	2,653	--	--
Other private	32,643	343	22,846	--	7,932	405	1,117
Total	40,162	343	26,891	--	11,406	405	1,117
All classes							
Public	13,675	575	7,360	822	4,404	--	514
Forest industry	64,224	26,496	12,732	17,910	6,713	--	373
Other private	278,608	34,925	127,903	8,929	67,533	13,561	25,757
Total	356,507	61,996	147,995	27,661	78,650	13,561	26,644

[a] Broad management class after regeneration.

[b] Ownership class in 1990. Forest industry includes lands under long-term lease.



Hardwood Harvest/Regeneration

Overall, hardwoods were regenerated on more than 220,000 acres annually, while they were harvested on 164,000 acres annually. However, within the hardwood category certain segments fared better than others. The harvest/regeneration relationship for the oak–pine types boosted the positive relationship for the category as a whole. Regeneration to oak–pine types more than doubled harvests of that type with 78,000 acres versus 35,000 acres, respectively. Virtually all of the surplus oak–pine regeneration occurred on NIPF land. The 66,000 acres of NIPF land regenerated exceeded the 25,000 acres of harvest by more than 2½ times. Thus, NIPF ownerships contributed 84 percent of the acres regenerated to oak–pine and provided 72 percent of the oak–pine acres harvested. Oak–pine regeneration exceeded harvest by 29 percent on public and 22 percent on forest industry land.

Artificial regeneration following a harvest accounted for 19 percent of the new oak–pine stands, and almost two-thirds of these acres were NIPF. An unknown but significant proportion of oak–pine stands result from aggressive encroachment of hardwoods in young plantations. Unless measures are taken to control the hardwood component, the stand may remain a mixed type or move towards a hardwood stand. Some 36 percent of the oak–pine regeneration occurred after the harvest of a pine type.

Regeneration to an upland hardwood forest type occurred on 102,000 acres annually, while 85,000 acres of this type were harvested each year. Most of the surplus regeneration occurred on NIPF land where regeneration exceeded harvest by 22 percent. NIPF ownerships accounted for 86 percent of the acres regenerated to upland hardwoods and for 85 percent of the upland hardwood acres harvested. Upland hardwood regeneration exceeded harvest on public and forest industry land by just 7 and 13 percent, respectively. Practically all of the new upland hardwood stands regenerated naturally. Failure to plan for renewal of harvested pine stands at the time of harvest also contributed to the upland hardwood regeneration; 24 percent of the new upland hardwood stands became established after harvesting in a pine stand.

While there may be an excess of upland hardwood regeneration, there is a deficit for lowland hardwoods. The 44,000 acres of lowland hardwood harvested annually exceeded area regenerated by 10 percent. By ownership, the only surplus in lowland hardwood regeneration was on public land, where regenerated acres nearly doubled those harvested. However, public land made up only a small portion of the lowland hardwoods regenerated or harvested. Harvest of lowland hardwood exceeded regeneration on forest industry and NIPF lands by 9 and 11 percent, respectively. However, NIPF lands accounted for 82 percent of the total lowland hardwood acres harvested and for 81 percent of the total regenerated.

As with other hardwood stands, some in lowlands arose after pine harvests. More than one-fifth of the new lowland hardwood stands followed the harvest of a pine stand. Although this is a lower percentage than other segments of the hardwood resource, it is still significantly high considering differences in physiographic site preference between the two type groups. Almost all of the new lowland hardwood stands developed through natural regeneration.

For all hardwood types combined, the harvest/regeneration relationship looks promising. However, as with much of the hardwood regeneration in the past, part of the recent gain in hardwood regeneration resulted from inadequate pine regeneration on harvested pine sites. Many land managers are working hard to increase their pine acreage. This fact will likely make the gains in hardwood regeneration difficult to perpetuate, and hardwood harvest/regeneration relationships could become tighter. Increased interest in hardwood fiber will sustain or raise harvest rates and further tighten this relationship unless successful regeneration follows. The regeneration deficit in lowland hardwood stands reflects the general lack of hardwood management and the need for establishment of high-quality hardwood stands. The fact that many of the newly regenerated hardwood stands are occurring on harvested pine sites suggests they will not be growing under optimum conditions and often are occupied with less desirable hardwoods. Some of these management opportunities are discussed in the next chapter.

Other Cutting/Disturbance

Additional volumes of timber were removed from another 195,000 acres each year through partial harvests, commercial thinning, and other miscellaneous cuttings. Partial harvests occurred on 53,000 acres annually. Partial harvests are defined as the removal of selected trees from a stand, leaving enough stocking in residual trees to form a manageable stand. Hardwood stands, including oak–pine, account for 71 percent of the area receiving a partial harvest. In these stands, practices often approach high-grading, in which the quality of the remaining stand is not considered. All the remaining area receiving a partial harvest occurred in natural pine stands, where selection is usually based on diameter limits. About 90 percent of the partial harvests took place on NIPF land. In terms of volume, partial harvests made up only 6 percent of the State's total annual removals volume, compared with 75 percent from areas receiving a final harvest.

Commercial thinning occurred on an average of 51,000 acres annually, up from 30,000 acres during the previous survey period. Three-fourths of the commercially thinned area was pine plantation, 20 percent was natural pine, and the remaining 5 percent was oak–pine. Land under forest industry control accounted for 63 percent of the commercially thinned area, NIPF land made up 31 percent, and public land accounted for the last 6 percent. Commercial thinning supplied 5 percent of the State's total removals volume. Stand improvement and other miscellaneous cuttings occurred on 91,000 acres each year.

Pine Age-Profile Implications

The age structure of timber stands in a region provides insight into prospective changes in the timber resource. FIA field crews determine a stand age at each sample location based upon the average age of trees that could collectively be managed as an even-aged stand. If a manageable stand is not present, an average age is computed for all trees not overtopped. This section examines the current age structure of the pine resource, and evaluates changes since 1984 in an effort to predict probable changes in the region's pine timber over the next two decades. However, such predictions must be qualified by uncertainties involving physical phenomenon (weather extremes) and economic cycles (demand).

The age-class distributions of North Carolina's 2.1 million acres of pine plantations and 4.2 million acres of natural pine are shown in figure 17.

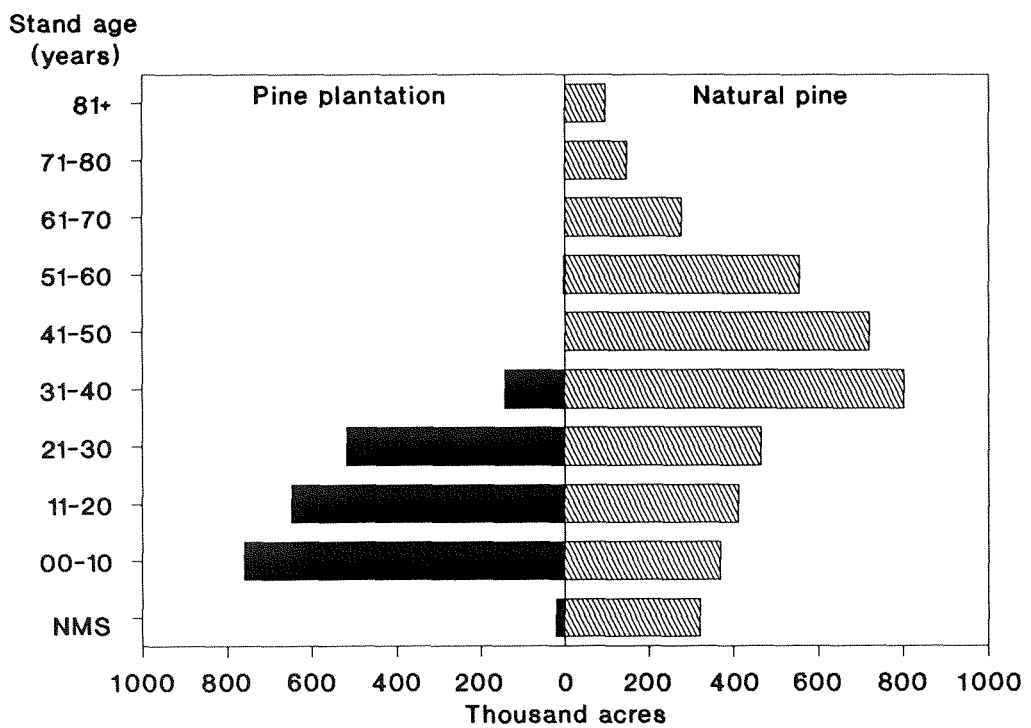


Figure 17—Profile of timberland classified as pine forest types, by stand-age class and stand origin, 1990. "NMS" are those areas with no manageable stand.

Despite reductions in acreage of stands between 11 and 50 years old, compared with acreages in the previous survey, the age-class distribution shows a sound pine resource. Acreage in stands over 50 years old increased somewhat since the previous survey.

Promising changes between the last two surveys include the large increase in stands 10 years and younger, a rise in net annual growth, increased commercial thinning, and reductions in poorly stocked acres. Net annual growth of pine increased 19 percent from that recorded in the previous period. Most of the increase occurred in the Coastal Plain, which contains some of the most intensively managed pine plantations in the South. Increases in pine growth were highest on forest industry holdings and least on NIPF land. Statewide, there are now 1.3 million acres of pine plantations over 10 years old.

The 761,000 acres of pine stands in the youngest age class reflect a considerable increase in pine regeneration on NIPF land in North Carolina over the past decade due to various incentive programs. Between 1984 and 1990, an average of nearly 13,000 acres of nonforest land was planted each year, compared with an average of less than 1,600 acres between 1974 and 1983.

About 92 percent of the State's pine plantations are less than 30 years old. Through a stand age of 30 years, plantation acreage exceeds natural pine acreage. Plantation trees are typically harvested around this age. Between 1984 and 1990, pine plantations supplied only 15 percent of the annual harvest of softwood. Based upon the current distribution of acres by age class, pine plantations can be expected to supply more than half of the annual softwood harvest within 20 years. Close to half of the manageable natural stands are greater than 40 years old and currently are the main source of sawn products. Natural pine stands from 11 to 50 years old have declined in acreage since the previous survey. There are also fewer acres of natural pine in each younger age class below 40 years old than are needed to replenish the acres in age classes immediately above (fig.17). In recent years, 57 percent of the softwood harvest has come out of pine stands from 21 to 60 years old. Over the next 20 years, as older natural stands are depleted, harvests will necessarily come from younger stands. The overall decline in natural pine stands, in conjunction with increased acreage in plantations, will change the proportion of juvenile wood in the future softwood harvests and alter products, processing, and suitability of the resource for dimension lumber.

Currently, some 344,000 acres of pine are so poorly stocked that there is no manageable stand. This area of poor stocking decreased from 481,000 acres in the previous survey. Most of these acres are classified as natural pine stands. One-fifth of the pine acreage with no manageable stand has been recently harvested and is awaiting some form of artificial or natural regeneration.

There were definite differences in the age structure and origin of pine stands between the major ownership categories. Although forest industry controls just one-fourth of the State's pine acreage, it holds 55 percent of the planted pine acreage. Despite some reduction in planting on forest industry land in recent years, 76 percent of its pineland is planted (fig. 18). Almost four-fifths of forest industry's pine acreage is less than 30 years old. Most of the increase in commercial thinning is occurring in pine plantations on industry land. This trend is particularly encouraging from the standpoint of pine sawtimber supplies because numbers of 6- to 10-inch pines are down on NIPF land. These reductions will progress into the larger diameter classes, reducing sawtimber supplies from NIPF land, which has been the major source for pine sawtimber in the State. Two-thirds of the State's pine acreage is under NIPF ownership, and 79 percent of those stands are natural pine. However, NIPF planting is up and 53 percent of new pine stands (0-10 years old) were artificially regenerated (fig. 18). NIPF land now supports 47 percent more 0-10-year-old pine stands than in the prior survey. As a result, NIPF owners now have more plantation acreage less than 10 years old than does forest industry. If recent rates of artificial regeneration for each ownership were to continue for the next decade, NIPF lands would control as much of the plantation poletimber as industry currently does. However, the large upturn in pine regeneration on NIPF land will not contribute significantly to pine growth and timber supplies until beyond the year 2000. This is because the 11- to 30-year-old pine stands on NIPF land contain fewer acres than each of the two age classes preceding them. Less than one-tenth of North Carolina's pine acreage occurs on public land, where 85 percent of the pinelands are natural stands. Just about half of the public pine stands are greater than 40 years old.

The South's Fourth Forest (SFF) study projected the inventory of softwood timber on NIPF land in North Carolina to decline by about 21 percent between 1990 and 2010. The latest survey indicates that the actual decline could be much smaller. Both the SFF study and this latest survey indicate further buildups in softwood inventory on industry and public timberland.

In summary, pine growth has more than kept pace with a 19-percent increase in removals in North Carolina over the past 6 years. Looking ahead, the main softwood

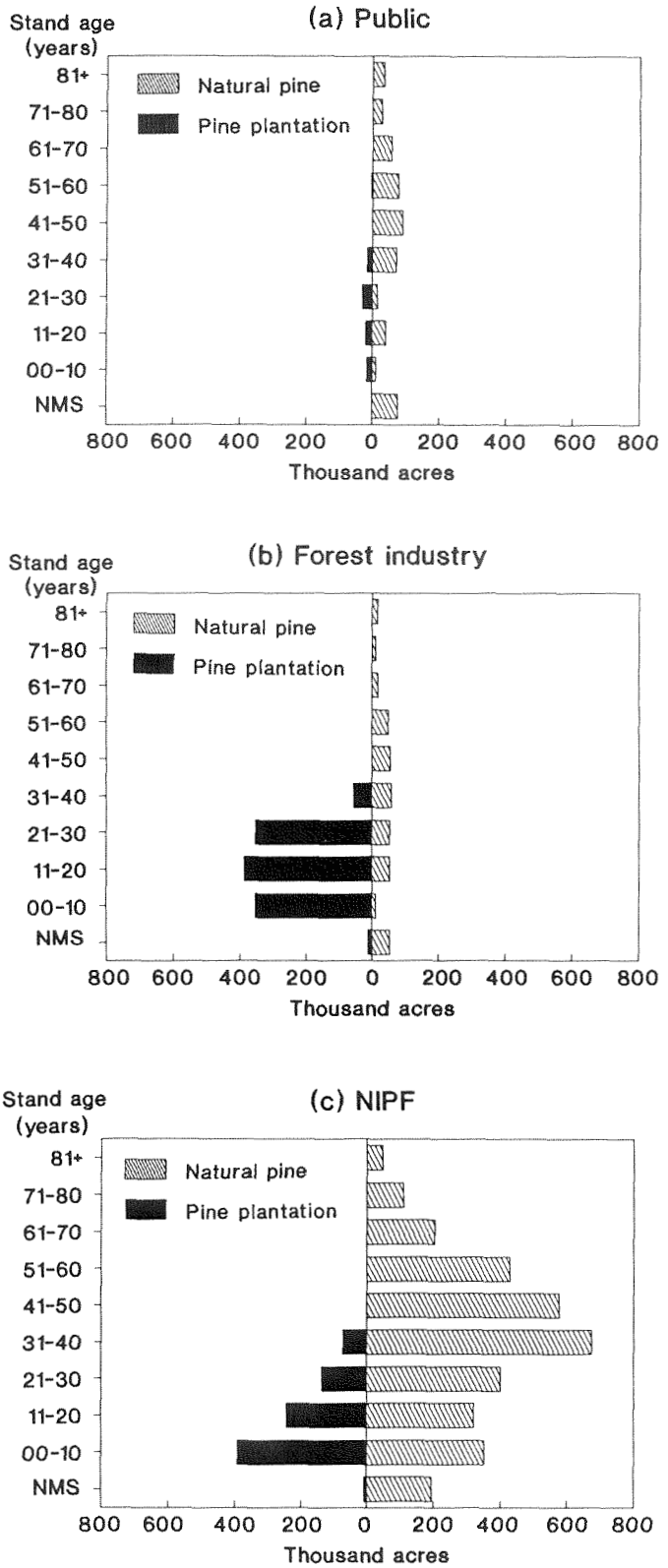


Figure 18—Profile of timberland classified as pine forest types, by stand-age class and stand origin, by ownership class, 1990. "NMS" are those areas with no manageable stand.

concern is the prospective supply from NIPF land. Until the newly established pine stands reach desirable harvest size, sometime beyond 2000, it will be very difficult for the NIPF land to accommodate a further increase in the pine harvest without a significant, albeit temporary, decrease in inventory. During this period, increased amounts of pine removals will probably need to come from forest industry land.

Hardwood Age-Profile Implications

Figure 19 shows the age-class distributions of the 2.6 million acres of oak–pine stands, 7.2 million acres of upland hardwood stands, and 2.7 million acres of lowland hardwood in the State. Unlike that for pine, the stand age distributions for the combined hardwood resource reflect an aging resource. More than half of the manageable stands are over 50 years old. The age distribution also depicts deficits in stands between 11 and 50 years old. With minor exception, each of these age classes contain fewer acres than the 51-year-and-older age classes they will eventually replace. In addition to fewer acres in these age classes, compared with those over 50 years, reductions between 1984 and 1990 in acreage of hardwood stands spanned the 21- to 60-year age classes. Substantial increases in acreage of hardwood stands 10 years and younger are evident as well, resulting from recent increases in the removals of

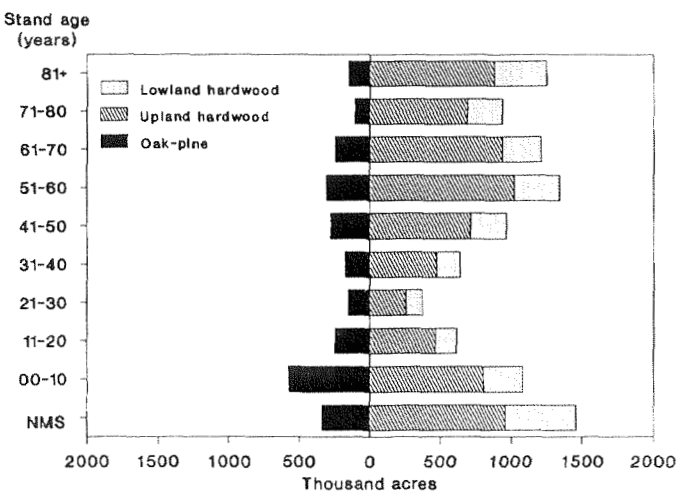


Figure 19—Stand-age profile of timberland classified as a hardwood or oak–pine forest type, by upland and lowland type groups, 1990. "NMS" are those areas with no manageable stand.

hardwood. The increase in acreage of young hardwood stands is encouraging for hardwood timber supplies in the future, but will not alleviate any shortages anticipated from deficits identified by the current age distribution. Since 59 percent of recent hardwood removals have come from hardwood stands over 50 years old, these older age classes will probably experience significant declines over the next 20 years because of the current deficits in the younger 11- to 50-year age classes needed to replace them. These profile characteristics are generally common to each of the oak–pine, upland and lowland hardwood categories.

Another noticeable feature of the hardwood age profile is the combined 1.8 million acres of hardwood stands so poorly stocked that a manageable stand does not exist. This situation has improved little since the previous survey. More than half of these stands are classed as upland hardwoods. Between 1984 and 1990, timber harvests contributed to the poor stocking on 24 percent of the hardwood stands with no manageable stand present. About 25 percent of these were pine harvests.

Because NIPF owners control a majority of the State's hardwood acreage, the age-class distribution depicted in figure 19 is most influenced by those owners. Significant differences are noted when the age profile is separated for the major ownership groups (fig. 20), as are differences in the distribution of the major hardwood type categories among ownership groups. NIPF owners have 82 percent of the State's hardwood acreage, forest industry 7 percent, and public land 11 percent. Public land has the highest proportion, 65 percent, of its hardwood land in upland hardwoods and the lowest proportion, 15 percent, in lowland hardwood of all the ownership groups. This is because a higher ratio of public land occurs in the mountainous portions of the State than do the other ownerships. More than three-fourths of the manageable hardwood stands on public land are greater than 50 years old. Many acres of public land may be increasingly restricted from contributing to the timber supply in the future becauseof recreational and other nontimber demands. NIPF land also has a high proportion of its hardwood acres, 59 percent, in upland hardwood, with the remainder split equally between oak–pine and lowland hardwood. About 49 percent of the manageable hardwood stands on NIPF land are over 50 years old. Forest industry land has the highest proportion of its hardwood acres in lowland hardwood, 50 percent. This is because mostof their upland sites are converted to pine. Over 47 percent of the manageable hardwood stands on forest industry land are over 50 years old.

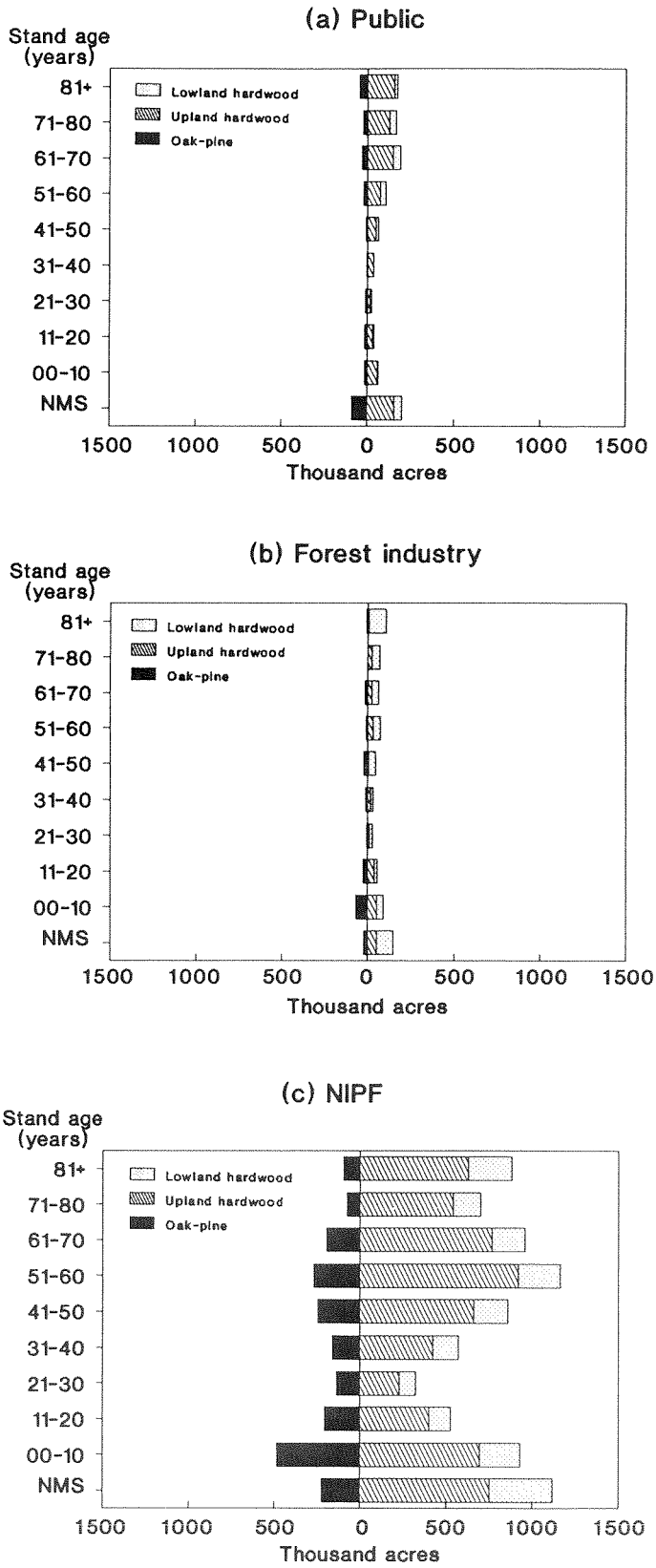


Figure 20—Stand-age profile of timberland classified as a hardwood or oak–pine forest type, by upland and lowland type groups, by ownership class, 1990. "NMS" are those areas with no manageable stand.

Based upon the current structure of North Carolina's hardwood resource, any increased demand for timber will have to be met from NIPF land, where little evidence of management for sustained yield or higher quality stands exists.

By region, the long-term trend for hardwood inventory in the Coastal Plain seems to have reached a turning point. After steadily increasing for the last 50 years, hardwood inventory buildup has plateaued, increasing by just 1 percent overall. Hardwood inventory in this region will likely decline over the next few decades due to anticipated increased demand for hardwood fiber. In the Northern Coastal Plain, hardwood removals exceeded hardwood growth by 10 percent. Hardwood inventory continues to accumulate in the Piedmont and Mountain regions, but at a decreasing rate due to reduced net annual growth and increased removals.

Statewide deficits in younger well-stocked vigorous hardwood stands, and buildups in mature and overmature stands with high mortality and low growth, are not the only concerns. There seem to be growing uncertainties over the availability of much of the hardwood timber. Many of the older hardwood stands are in swamps, on steep mountain slopes, or are on public holdings. Almost one-third of hardwood stands over 50 years old are in areas with steep slopes or year-round water problems. In addition, 15 percent of these older hardwood stands are on public land. Many other stands also are not readily available for harvest due to small tract size, owner preference not to harvest, or a broad mixture of species present.

In the previous survey, hardwood growth was about double the annual harvest. In the latest survey, average annual mortality of hardwood growing stock doubled and net annual growth decreased by 9 percent. Simultaneously, average annual removals of hardwood jumped by 36 percent. When combined, these changes reduced the margin of hardwood growth over removals to 33 percent. This rise in demand for hardwood in North Carolina follows decades of low demand and may now make active management of this resource more economically feasible to landowners and foresters alike.

Photo Courtesy of North Carolina Division of Forest Resources

Management Opportunities

This chapter describes opportunities to improve North Carolina's timberland. The acres in idle cropland are included as regeneration opportunities. Increasing demands for wood (USDA Forest Service 1988) in conjunction with a shrinking timberland base make it advantageous to investigate all opportunities to improve the quantity and quality of the timber resource. Efforts to efficiently manage forests at optimum levels are further constrained by environmental concerns and regulations, diverse landowner intentions, and the high costs of stand management. These constraints simply clarify the need for action on as many acres as possible. Treatment opportunities presented here are based on stand conditions encountered by field crews at each sample location. The assigned treatment opportunities describe the single-most-important action that could be taken to improve growth and quality of the stand. The treatment opportunities used are general categories because the spectrum of stand conditions and treatment opportunities can differ substantially between ownerships and broad management classes (table VI).

Adverse Sites

Difficult operating conditions inhibit timber management opportunities on nearly 2.9 million acres, or 15 percent, of North Carolina's timberland. These sites have extremely steep slopes or year-round water problems that limit management practices and severely hinder operation of machinery. For these reasons, they are listed and discussed separately from the treatment opportunities. Nevertheless, the development of specialized harvesting equipment and techniques may make some management of these areas more feasible and worthy of consideration.

Slopes of 40 percent and more account for 85 percent of the acreage classified as adverse. Virtually all of these stands are in the western portion of the State. Areas with year-round water problems account for the remaining 15 percent of the adverse sites. They are located almost exclusively in the eastern portion of the State.

Less than 7 percent of the area in adverse sites supports pine forest types. Upland hardwood stands cover 72 percent of the adverse sites, lowland hardwoods 13 percent, and oak–pine stands just 8 percent. Two-thirds of the adverse sites are on NIPF land, another 28 percent are on public ownership, and less than 7 percent are in forest industry control. Thirteen percent of NIPF timberland, 8 percent of forest industry land, and 40 percent of public land are on adverse sites. A very high proportion of public land is classed adverse because there are so many steep slopes on National Forests in the Appalachian Mountains.

Table VI--Area of North Carolina's idle cropland and timberland, by broad management, ownership and treatment opportunity classes, 1990

Broad management and ownership classes[a]	Total area	Broad treatment opportunity class							
		Salvage	Harvest	Commercial thinning	Other stand improvement	Stand conversion[b]	Regeneration[c]	Stands in relatively good condition	Adverse sites or conditions[d]
	Thousand acres								
Idle cropland									
Public	--	--	--	--	--	--	--	--	--
Forest industry	--	--	--	--	--	--	--	--	--
Other private	569.1	--	--	--	--	--	569.1	--	--
Total	569.1	--	--	--	--	--	569.1	--	--
Pine plantation									
Public	87.6	--	--	18.2	1.7	--	--	63.7	4.0
Forest industry	1,159.9	4.1	--	217.8	12.6	2.4	13.1	906.8	3.1
Other private	851.0	--	--	125.2	42.1	--	8.9	668.7	6.1
Total	2,098.5	4.1	--	361.2	56.4	2.4	22.0	1,639.2	13.2
Natural pine stands									
Public	497.6	0.2	44.2	13.1	16.0	--	72.4	297.4	54.3
Forest industry	368.3	4.0	25.6	20.4	10.6	7.6	51.3	237.3	11.5
Other private	3,297.3	36.5	213.6	443.2	230.0	6.7	185.9	2,068.6	113.0
Total	4,163.4	40.7	283.4	476.7	256.6	14.3	309.6	2,603.3	178.8
Oak-pine stands									
Public	279.7	--	39.6	--	16.0	--	80.4	64.6	79.1
Forest industry	194.2	--	15.2	2.3	14.4	--	21.7	130.5	10.1
Other private	2,106.3	18.8	130.3	16.0	208.5	18.9	213.5	1,351.7	148.6
Total	2,580.2	18.8	185.1	18.3	238.9	18.9	315.6	1,546.8	237.8
Upland hardwood stands									
Public	927.7	3.8	57.6	--	14.4	--	34.0	200.9	617.0
Forest industry	253.0	--	15.6	5.8	23.3	6.3	47.5	107.0	47.5
Other private	6,021.7	59.0	503.7	21.5	416.4	64.7	595.5	2,957.3	1,403.6
Total	7,202.4	62.8	576.9	27.3	454.1	71.0	677.0	3,265.2	2,068.1
Lowland hardwood stands									
Public	210.1	1.6	18.5	--	6.6	2.3	41.8	100.0	39.3
Forest industry	445.0	--	86.7	2.0	17.6	3.7	73.3	139.7	122.0
Other private	2,010.8	--	230.5	30.5	132.4	10.2	332.8	1,052.5	221.9
Total	2,665.9	1.6	335.7	32.5	156.6	16.2	447.9	1,292.2	383.2
All classes									
Public	2,002.7	5.6	159.9	31.3	54.7	2.3	228.6	726.6	793.7
Forest industry	2,420.4	8.1	143.1	248.3	78.5	20.0	206.9	1,521.3	194.2
Other private	14,856.4	114.3	1,078.1	636.4	1,029.4	100.5	1,905.7	8,098.8	1,893.2
Total	19,279.5	128.0	1,381.1	916.0	1,162.6	122.8	2,341.2	10,346.7	2,881.1

[a] Forest industry includes lands under long-term lease.

[b] Areas occupied with species unsuitable for the site from the standpoint of timber production.

[c] Includes 153,700 acres where high-quality hardwood regeneration could be accomplished by felling residual trees to release advance understory hardwood reproduction and promote stump sprouting.

[d] Areas where management opportunities are severely limited because of steep slopes or poor drainage.

Timber was cut from less than 1 percent of the acres classed as adverse each year during the latest survey period. The comparable rate on sites not classed as adverse was almost four times higher. Net annual growth of all species on adverse sites was more than 2½ times the volume of removals. On operable sites, growth exceeded removals by just 15 percent. Due to the lower rate of removals on adverse sites, the volume of growing stock averages 2,288 cubic feet per acre, or 39 percent greater than the comparable volume on operable sites.

Stands in Good Condition

Of the 15.8 million timberland acres deemed operable, 65 percent, or 10.3 million acres, support stands in relatively good condition. These stands are moderately to fully stocked with young or vigorous trees of acceptable quality and free to grow. Volume of growing stock on these areas averages 1,638 cubic feet per acre. These stands contain much of the State's current and future timber supplies. Although they are in good condition now, these stands need continued protection, timely treatments, and adequate regeneration after harvest to remain in this productive category.

Discounting the acres classed as adverse, 68 percent of forest industry's operable timberland is classified as having stands in good condition, compared with 65 percent on NIPF land and 60 percent on publicly held tracts.

By broad forest type, 70 percent of the operable pine acreage is in good condition (fig. 21) as is 62 percent of the operable hardwood acreage (fig. 22). The main apparent differences between these broad-forest-type categories revolve around regeneration, thinning, and harvest. A higher proportion of hardwood types need regeneration and harvesting than do pine types. Conversely, a higher proportion of pine types need thinning than do hardwood types. The proportions of pine plantations and natural pine stands in good shape are 79 and 65 percent, respectively. For oak–pine, upland hardwood, and lowland hardwood, the proportions are 66, 64, and 57 percent, respectively.

Treatment Opportunities

More than one-third of North Carolina's operable timberland offers significant opportunities to improve the quality and quantity of the State's timber supply. These 5.5 million acres presenting opportunities encompass a variety of ownerships, stand sizes, and management objectives, which influence the practicality of implementing corrective treatments. However, from an ideal forest management perspective, the six opportunities recognized below would enhance quality and quantity of timber on these acres. Conditions on these acres range from low stocking to overmaturity.

1. *Salvage and regenerate seriously damaged stands on 128,000 acres.* These are stands that have been heavily damaged by disease, insects, weather, or fire. Without treatment they will suffer excessive mortality. Stands in need of salvage averaged 58 years of age and contained 2,245 cubic feet of growing stock per acre. Upland hardwood stands account for 49 percent of the acres in this category, and natural pine stands contribute another 32 percent. Although stands requiring and worthy of salvage constitute less than 1 percent of North Carolina's timberland, the actual acreage damaged by destructive agents is somewhat higher. Many damaged acres temporarily reside in this opportunity category until mortality reduces stocking below manageable levels. These acres then are reported under the regeneration-opportunity category. Eighty-nine percent of the salvageable stands are under NIPF control.

2. *Harvest and regenerate mature stands on almost 1.4 million acres.* More than 7 percent of North Carolina's timberland falls into this category. Such stands typically exhibit slow growth, high mortality, and advanced age. About 42 percent of this area is in upland hardwoods and 24 percent is in lowland hardwoods. Another 21 percent is in natural pine types and the rest is in oak–pine. On average, these stands are 82 years old and contain 3,148 cubic feet of growing stock per acre. Net annual growth per acre averages 67 cubic feet. Seventy-eight percent of this harvest opportunity is on NIPF land.

3. *Thin young, overstocked stands on 0.9 million acres.* Trees in these stands are so heavily stocked that they are receiving intense competition from each other. Commercial thinning would prevent stagnation and enhance growth on the remaining trees. These stands average 30 years old and support 2,957 cubic feet of growing stock per acre. Net annual growth per acre averages 163 cubic feet. Fifty-two percent of the thinning opportunity occurs in natural pine stands and 39 percent in planted pine stands. Sixty-nine percent of the acreage in need of thinning is on NIPF land and the balance largely on forest industry land.

4. *Remove undesirable trees and competing vegetation from immature stands on nearly 1.2 million acres.* This category includes stands containing numerous rough trees and other inhibiting vegetation competing with potential crop trees, as well as stands heavily stocked with growing-stock trees below merchantable size and in need of precommercial thinning. In these stands, a cleaning or release would enhance the growth

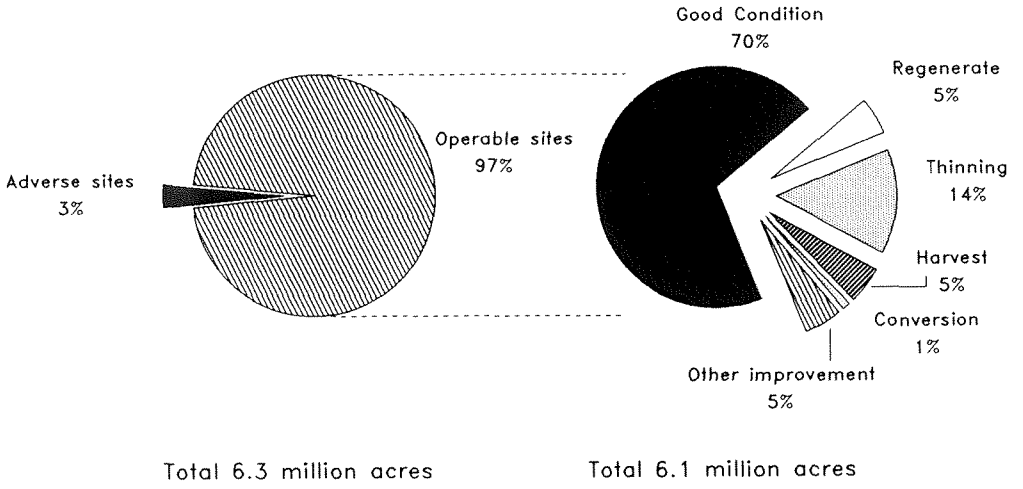


Figure 21—Pine timberland acreage by treatment opportunity, 1990.

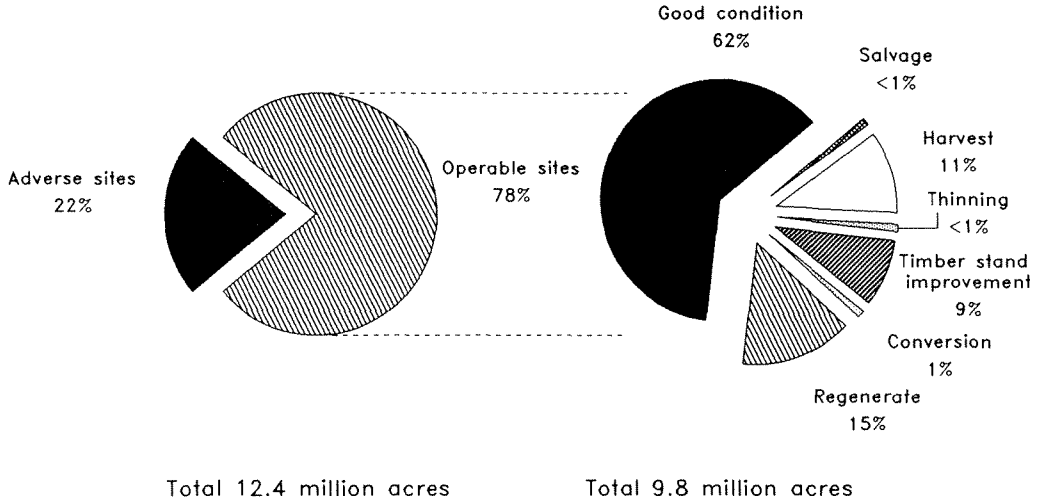


Figure 22—Hardwood timberland acreage by treatment opportunity, 1990.

and quality of the residual trees. Stands that would benefit from some form of timber stand improvement (TSI) average 16 years old with 708 cubic feet of volume per acre. Net annual growth of growing stock averages 40 cubic feet per acre. Upland hardwood stands accounted for 39 percent of the acres in this opportunity. About 89 percent of the acres in need of TSI are on NIPF land.

5. Convert stands on 123,000 acres to species more suitable for the site. These acres are producing below the site potential because they support species considered offsite from a timber production standpoint. Replacement with native or more productive species would promote maximum stand development for the site. These stands averaged 29 years old and contained 818 cubic feet of volume per acre. Net annual growth of growing stock averages 31 cubic feet per acre. Upland hardwood stands account for 58 percent of the area in need of stand conversion. More than four-fifths of the acreage in need of conversion is on NIPF land.

6. *Regenerate nearly 1.8 million acres of timberland poorly stocked and devoid of a manageable stand.* Remnant trees, inferior seedlings, and inhibiting vegetation dominate most of these stands. Although these stands may eventually restock naturally, the process can be lengthy and the species that appear may be less than desirable. Currently, the growing-stock volume on these stands averages only 512 cubic feet per acre, and net annual growth of growing stock averages only 19 cubic feet per acre. Despite the low stand volumes and usual

poor quality of trees, which inhibit commercial sale, the best silvicultural action is to remove the stand and regenerate it. Stands on these acres are often the result of past harvesting practices. During the most recent remeasurement period, 26 percent of the area in need of regeneration experienced a final harvest. Much of the remaining acreage was harvested during the previous survey period. Average age of the stands in need of regeneration was 32 years. Of the timberland needing regeneration, 38 percent is classified as upland hardwood, 25 percent as lowland hardwood, 18 percent as oak–pine, 18 percent as natural pine, and only 1 percent as pine plantations.

These distributions include unknown acreage supporting species that are not best suited to their sites. The usual cause of that problem is inadequate preparation for regeneration at the time of harvest. Corrective action at a later date is unduly costly. Therefore, efforts to remedy the problem should concentrate on immediate regeneration of stands after harvest. These efforts should be directed towards NIPF land, which includes three-fourths of the poorly stocked stands in need of regeneration.

In addition to poorly stocked timberland, North Carolina has 569,000 acres of idle cropland. These acres were added to the regeneration opportunity in table VI. Historically, natural seeding of old fields has been the major source of new stands added to the timberland base. Planting these acres to trees represents an important opportunity to offset the loss of timberland to urban buildup. Site preparation and planting costs on these acres are well below those for cutover forest because there is relatively little competing vegetation.

Financial and professional assistance in timber management are available to North Carolina timberland owners. The Stewardship Incentives Program, the Forestry Incentives Program, the Agricultural Conservation Program, and the Conservation Reserve Program are all Federal cost-share programs designed to aid forest landowners. Another important source of cost-share assistance is the State of North Carolina's Forest Development Program. Professional advice and services are available from private forestry consultants, North Carolina Agricultural Research Service of North Carolina State University, and the Division of Forest Resources of the North Carolina Department of Environment, Health, and Natural Resources. Seedlings are available at nominal cost from the Division of Forest Resources. Many wood products companies also offer technical assistance as well as cooperative agreements to private landowners.

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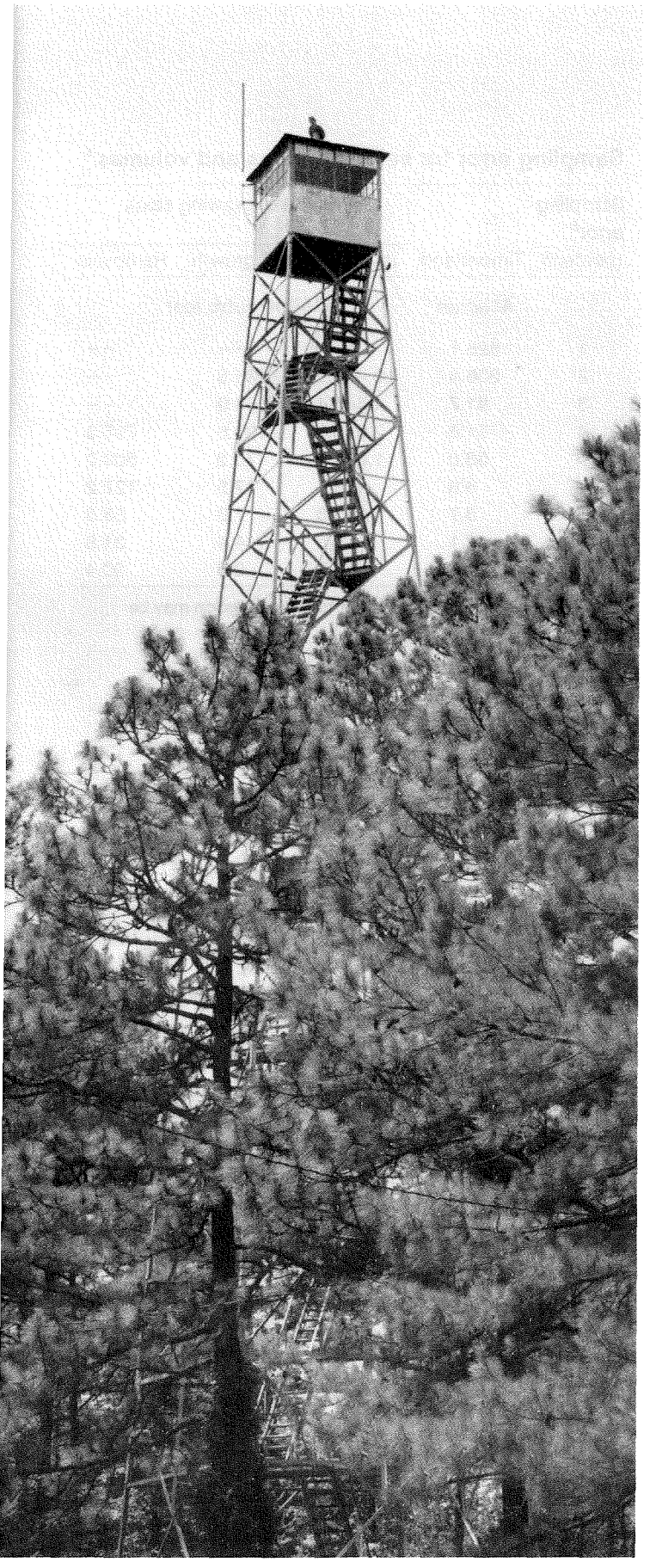

Appendix

Procedure

The procedures used in the sixth statewide inventory and evaluation of North Carolina's forest resources included several basic steps.

1. Initial estimates of forest and nonforest areas were based on the classification of 128,322 sample clusters systematically spaced on the latest available aerial photographs. A subsample of 9,612 of the 16-point clusters was ground checked, and a linear regression was fitted to the data to develop the relationship between the photo and ground classification of the subsample. This procedure provides a means for adjusting the initial estimates of area for changes in land use since date of photography and for photo misclassification.

2. Estimates of timber volume and forest classification were based on measurements recorded at 5,692 ground sample locations systematically distributed on timberland. The plot design at each location was based on a cluster of 10 points. In most cases, variable plots, established by using a basal-area factor of 37.5 square feet per acre, were systematically spaced within a single forest condition at 5 of the 10 cluster points. Trees less than 5 inches d.b.h. were tallied on a fixed-radius plot around each point center.

3. Seedlings, shrubs, vines, grasses, forbs, and other lesser vegetation occurring within a 35-foot radius of selected point centers were identified and recorded at each forest sample location. Each distinctive zone of lesser vegetation was classified based on its height, density, and species composition. When merged with the tree tally, this information provided a vegetative profile of each condition sampled. Additional nontimber attributes measured or classified included land use, terrain features, soils, erosion, litter, water, snags, tree cavities, livestock grazing, and recreational use.

4. Equations prepared from detailed measurements collected on standing trees in North Carolina, and similar measurements taken throughout the Southeast, were used to compute the volume of individual tally trees. A mirror caliper and sectional aluminum poles were used to obtain the additional measurements required to construct volume equations (Cost 1978). Forest biomass estimates were made with equations developed by the Utilization of Southern Timber Research Work Unit of the Southeastern Forest Experiment Station in Athens, GA. In

addition, felled trees were measured at 108 active cutting operations to provide utilization factors for the different timber products and species groups and to supplement the standing-tree volume study.

5. Growth, removals, and mortality were estimated from the remeasurement of 5,429 permanent sample plots established at the time of the 1984 inventory. Periodic surveys of timber products output, conducted in cooperation with the North Carolina Department of Environment, Health, and Natural Resources, Division of Forest Resources, along with the annual pulpwood production study for the South, provided additional information for breakdowns of removals by product.

6. Ownership information was collected from correspondence, public records, and local contacts. In counties where the sample missed a particular ownership class, temporary samples were added and measured to describe forest conditions within the ownership class.

7. All field data were sent to Asheville for editing and were entered into disk and magnetic-tape storage for processing. Final estimates were based on statistical summaries of the data.

Reliability of the Data

Statistical analysis of these data indicates a sampling error of ± 0.21 percent for the estimate of timberland, 1.13 percent for total growing-stock volume, 1.23 percent for growing-stock growth, and 3.68 percent for growing-stock removals. As the totals are broken down by forest type, species, tree diameter, or other subdivisions, the sampling error increases. If homogeneity of variances is assumed, the order of this increase may be approximated by using the following tabulation showing the sampling errors in terms of one standard error, or two chances out of three. For example, a subset of the State totals with an estimate of 10.452 billion cubic feet would have an estimated sampling error of 2 percent, or 0.209 billion cubic feet. This means that, two times out of three, the true growing-stock volume for this subset would be within the range defined by 10.452 ± 0.209, or from 10.243 to 10.661 billion cubic feet.

Sampling error for selected areas and volumes[a]

Sampling error[b] (percent)	Timberland	Volume of growing stock		
		Inventory	Net growth	Removals
	M acres	*Million cubic feet*		
1	825.1	--	--	--
2	206.3	10,452.2	438.6	--
3	91.7	4,645.4	194.9	--
4	51.6	2,613.0	109.6	795.3
5	33.0	1,672.3	70.2	509.0
10	8.3	418.1	17.5	127.2
15	3.7	185.8	7.8	56.6
20	2.1	104.5	4.4	31.8
25	1.3	66.9	2.8	20.4

[a] Sampling error of volume or area totals in question may be computed with the following formula:

$$SE_s = SE_t \frac{\sqrt{X_t}}{\sqrt{X_s}},$$

where

SE_s = sampling error for subdivision of Survey Unit or State total,

SE_t = sampling error for Survey Unit or State total,

X_s = sum of values for the variable of interest (area or volume) for subdivision of Survey Unit or State,

X_t = total area or volume for Survey Unit or State.

[b] By random-sampling formula.

Definitions

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.

Biomass. The aboveground green weight of solid wood and bark in live trees 1.0 inch d.b.h. and larger from the ground to the tip of the tree. All foliage is excluded. The weight of wood and bark in lateral limbs, secondary limbs, and twigs under 0.5 inch in diameter at the point of occurrence on sapling-size trees is included but is excluded on poletimber and sawtimber-size trees.

Bole. That portion of a tree between a 1-foot stump and a 4-inch top diameter outside bark (d.o.b.) in trees 5.0 inches d.b.h. and larger.

Broad management class. A classification of timberland based on forest type and stand origin.

Pine plantation. Stands that have been artificially regenerated by planting or direct seeding and with a southern yellow pine, white pine-hemlock, or other softwood forest type.

Natural pine. Stands that have not been artificially regenerated and with a southern yellow pine, white pine-hemlock, or other softwood forest type.

Oak-pine. Stands with a forest type of oak-pine.

Upland hardwood. Stands with a forest type of oak-hickory, chestnut oak, southern scrub oak, or maple-beech-birch.

Lowland hardwood. Stands with a forest type of oak-gum-cypress, elm-ash-cottonwood, palm, or other tropical.

Census water. Streams, sloughs, estuaries, canals, and other moving bodies of water one-eighth of a statute mile in width and greater, and lakes, reservoirs, ponds, and other permanent bodies of water 40 acres in area and greater.

Commercial forest land. (see: Timberland).

Commercial species. Tree species currently or potentially suitable for industrial wood products. Noncommercial species are excluded.

Cropland. Land under cultivation within the past 24 months, including orchards and land in soil-improving crops but excluding land cultivated in developing improved pasture. Also includes idle farmland.

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

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 through 6.9 inches d.b.h.

Farm. Land on which agricultural operations are being conducted and sale of agricultural products totaled $1,000 or more during the year.

Farm operator. A person who operates a farm, either doing the work or directly supervising the work.

Farmer-owned land. (see: Other private land).

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

Forest industry-leased land. Land leased or under management contracts to forest industry from other owners for periods of one forest rotation or longer. Land under cutting contracts is not included.

Forest land. Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use.

Forest type. A classification of forest land based on the species forming a plurality of live-tree stocking.

White pine-hemlock. Forests in which eastern white pine, red pine, or jack pine, singly or in combination, constitute a plurality of the stocking. (Common associates include hemlock, birch, and maple.)

Spruce-fir. Forests in which spruce or true firs, singly or in combination,constitute a plurality of the stocking. (Common associates include maple, birch, and hemlock.)

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

Loblolly-shortleaf pine. Forests in which loblolly pine, shortleaf pine, or other southern yellow pines, except longleaf or slash pine, singly or in combination, constitute a plurality of the stocking. (Common associates include oak, hickory, and gum.)

Oak-pine. Forests in which hardwoods (usually upland oaks) constitute a plurality of the stocking but in which pines account for 25 to 50 percent of the stocking. (Common associates include gum, hickory, and yellow-poplar.)

Oak-hickory. Forests in which upland oaks or hickory, singly or in combination, constitute a plurality of the stocking, except where pines account for 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, maple, and black walnut.)

Oak-gum-cypress. Bottom-land forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, constitute a plurality of the stocking, except where pines account for 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Elm-ash-cottonwood. Forests in which elm, ash, or cottonwood, singly or in combination, constitute a plurality of the stocking. (Common associates include willow, sycamore, beech, and maple.)

Maple-beech-birch. Forests in which maple, beech, or yellow birch, singly or in combination, constitute a plurality of the stocking. (Common associates include hemlock, elm, basswood, and white pine.)

Palm, other tropicals. Forests in which palms and other tropicals constitute a plurality of the stocking.

Gross growth. Annual increase in merchantable volume of trees in the absence of cutting and mortality. (Gross growth includes survivor growth, ingrowth, growth on ingrowth, growth on removals prior to removal, and growth on mortality prior to death.)

Growing-stock trees. Live sawtimber-size trees of commercial species containing at least a 12-foot log, or two noncontiguous saw logs each 8 feet or longer, meeting minimum grade requirements (hardwoods must qualify as a log grade of either 3 or 4; softwoods must qualify as a log grade 3) with at least one-third of the gross board-foot volume (International 1/4-inch rule) between a 1-foot stump and the minimum saw-log top being sound, or a live tree below sawtimber size that will prospectively qualify under the above standards.

Growing-stock volume. Volume (cubic feet) of solid wood in growing-stock trees 5.0 inches d.b.h. and larger, from a 1-foot stump to a minimum 4.0-inch top diameter, outside bark, on the central stem. Volume of solid wood in primary forks from the point of occurrence to a minimum 4.0-inch top diameter outside bark is included.

Hardwoods. Angiosperms; dicotyledonous trees (including all palm species which are monocotyledonous), usually broadleaf and deciduous.

Soft hardwoods. Soft-textured hardwoods such as boxelder, red and silver maples, hackberry, loblolly-bay, sweetgum, yellow-poplar, magnolia, sweetbay, water tupelo, blackgum, sycamore, cottonwood, black cherry, willow, basswood, and elm.

Hard hardwoods. Hard-textured hardwoods such as sugar maple, birch, hickory, dogwood, persimmon (forest grown), black locust, beech, ash, honeylocust, holly, black walnut, mulberry, and all commercial oaks.

Idle farmland. Cropland, orchard, improved pasture, and farm sites not tended within the past 2 years, and currently less than 16.7 percent stocked with live trees.

Improved pasture. Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush.

Indian land. All lands held in trust by the United States for individual Indians or tribes, or all lands, titles to which are held by individual Indians or tribes, subject to Federal restrictions against alienation.

Industrial wood. All roundwood products except fuelwood.

Ingrowth. The number or net volume of trees that grow large enough during a specified year to qualify as saplings, poletimber, or sawtimber.

Land area. The area of dry land and land temporarily or partly covered by water such as marshes, swamps, and river floodplains (omitting tidal flats below mean high tide), streams, sloughs, estuaries, and canals less than one-eighth of a statute mile in width and greater, lakes, reservoirs, and ponds less than 40 acres in area.

Live trees. All trees 1.0 inch d.b.h. and larger which are not dead at the time of inventory.

Live-tree volume. Volume (cubic feet) of wood above the ground line in live trees 1.0 inch d.b.h. and larger. The volume in twigs and lateral limbs smaller than 0.5 inch in diameter at the point of occurrence on sapling-size trees is included but is excluded on poletimber and sawtimber-size trees.

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

Logging residues. The unused merchantable portion of growing-stock trees cut or destroyed during logging operations.

Manageable stand. Timberland at least 60 percent stocked with growing-stock trees that can be featured together under a management scheme.

Merchantable portion. That portion of live trees 5.0 inches d.b.h. and larger between a 1-foot stump and a minimum 4.0-inch top diameter outside bark on the central stem. That portion of primary forks from the point of occurrence to a minimum 4.0-inch top diameter outside bark is included.

Merchantable volume. Solid-wood volume in merchantable portion of live trees.

Miscellaneous Federal land. Federal land other than National forests, land administered by the Bureau of Land Management, and land administered by the Bureau of Indian Affairs.

Miscellaneous private land. (see: Other private land).

Mortality. The merchantable volume in trees that have died from natural causes during a specified period.

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

Net annual growth. The net change in merchantable volume for a specific year in the absence of cutting (gross growth minus mortality for that specified year).

Net volume. Gross volume of wood less deductions for rot, sweep, or other defect affecting use for timber products.

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

Nonforest land. Land that has never supported forests and land formerly forested where timber production is precluded by development for other uses.

Nonindustrial private forest (NIPF) land. (see: Other private land).

Nonstocked forest land. Timberland less than 16.7 percent stocked with growing-stock trees.

Other private land. Privately owned land excluding forest industry land or forest industry-leased land. Also referred to as nonindustrial private forest (NIPF) land.

Farmer-owned land. Owned by farm operators, excluding incorporated farm ownerships.

Other individual land. Owned by individuals other than farm operators.

Other corporate land. Owned by corporations, including incorporated farm ownerships.

Other removals. The growing-stock volume of trees removed from the inventory by cultural operations such as timber stand improvement, land clearing, and other changes in land use that result in the removal of the trees from timberland.

Plant residues. Wood material generated in the production of timber products at primary manufacturing plants.

Coarse residues. Material, such as slabs, edgings, trim, veneer cores and ends, which is suitable for chipping.

Fine residues. Material, such as sawdust, shavings, and veneer chippings, which is not suitable for chipping.

Plant byproducts. Residues (coarse or fine) utilized in the further manufacture of industrial products or for consumer use, or utilized as fuel.

Unused plant residues. Residues (coarse or fine) that are not used for any product, including fuel.

Poletimber-size trees. Live trees at least 5.0 inches d.b.h. but smaller than sawtimber size.

Primary wood-using plants. Industries that receive roundwood or chips from roundwood for the manufacture of products such as veneer, pulp, and lumber.

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

Rangeland. Land on which the natural vegetation is predominantly native grasses, grasslike plants, forbs, or shrubs valuable for forage, not qualifying as timberland and not developed for another land use. Rangeland includes natural grassland and savannah.

Reserved timberland. Forest land sufficiently productive to qualify as timberland, but 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 of rot or missing sections, and with less than one-third of the gross board-foot tree volume in sound material.

Rough 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 of roughness, poor form, splits, and cracks, and with less than one-third of the gross board-foot tree volume in sound material; and live trees of noncommercial species.

Roundwood (roundwood logs). Logs, bolts, or other round sections cut from trees for industrial or consumer uses.

Roundwood chipped. Any timber cut primarily for pulpwood, delivered to non-pulpmills, chipped, and then sold to pulpmills as residues, including chipped tops, jump sections, whole trees, and pulpwood sticks.

Roundwood products. Any primary product such as lumber, poles, pilings, pulp, or fuelwood which is produced from roundwood.

Salvable dead trees. Standing or down dead trees considered utilizable by Forest Inventory and Analysis standards.

Saplings. Live trees 1.0 to 5.0 inches d.b.h.

Saw log. A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark for softwoods of 6 inches (8 inches for hardwoods).

Saw-log portion. That part of the bole of sawtimber trees between a 1-foot stump and the saw-log top, including the portion of forks large enough to contain a saw log.

Saw-log top. The point on the bole of sawtimber trees above which a conventional saw log cannot be produced. The minimum saw-log top is 7.0 inches in diameter outside bark (d.o.b.) for softwoods and 9.0 inches (d.o.b.) for hardwoods.

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

Sawtimber volume. Growing-stock volume in the saw-log portion of sawtimber-size trees in board feet (International 1/4-inch rule).

Seedlings. Trees less than 1.0 inch in d.b.h. Only seedlings of a commercial species that are not overtopped and are more than 6 inches tall for softwoods and 1 foot tall for hardwoods are counted.

Site class. A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands, by annual production capacity.

Softwoods. Gymnosperms; in the order Coniferales, usually evergreen (includes the genus *Taxodium* which is deciduous), having needles or scalelike leaves.

Pines. Yellow pine species which include loblolly, longleaf, slash, pond, shortleaf, pitch, Virginia, sand, spruce, and Table Mountain pines.

Other softwoods. Cypress, eastern red-cedar, white cedar, eastern white pine, eastern hemlock, spruce, and fir.

Stand-size class. A classification of forest land based on the diameter class distribution of live trees in the stand.

Sawtimber stands. Stands at least 16.7 percent stocked with live trees, with half or more of total stocking in sawtimber and poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands. Stands at least 16.7 percent stocked with live trees, of which half or more of total stocking is in poletimber and sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands. Stands at least 16.7 percent stocked with live trees of which more than half of total stocking is saplings and seedlings.

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. The degree of occupancy of land by trees, measured by basal area or the number of trees in a stand and spacing in the stand, compared with a minimum standard, depending on tree size, required to fully utilize the growth potential of the land.

Fully stocked. 100 percent or more stocking.

Medium stocked. 60 to 99 percent stocking.

Poorly stocked. Less than 60 percent stocking.

Survivor growth. The merchantable volume increment on trees 5.0 inches d.b.h. and larger in the inventory at the beginning of the year and surviving to its end.

Timberland. Timberland that is capable of producing 20 cubic feet of industrial wood per acre per year and not withdrawn from timber utilization.

Timber products. Roundwood products and byproducts.

Timber removals. The merchantable volume of trees removed from the inventory by harvesting, cultural operations such as stand improvement, land clearing, or changes in land use.

Top. The portion of the main stem and forks from a 4.0-inch diameter outside bark to the tips of the main stem and forks, plus all other limbs above the 4.0-inch top at least 0.5 inch in diameter at their point of occurrence.

Treatment opportunity. A classification of the management or treatment that would most improve for timber production the existing condition of the stand being sampled.

Tree. Woody plants having one erect perennial stem or trunk at least 3 inches d.b.h., a more or less definitely formed crown of foliage, and a height of at least 13 feet.

Tree grade. A classification of sawtimber trees based on the log grade of the butt log in the tree.

Unproductive forest land. (see: Woodland).

Upper-stem portion. That part of the main stem or fork of sawtimber trees above the saw-log top to minimum top diameter 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Urban and other areas. Areas developed for residential, industrial, or recreational purposes, school yards, cemeteries, roads, railroads, airports, beaches, powerlines and other rights-of-way, or other nonforest land not included in any other specified land use class.

Woodland. Forest land incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions.

STOCKING STANDARD

Density of trees and basal area per acre required for full stocking

D.b.h. class	Trees per acre for full stocking	Basal area per acre
Seedlings	600	--
2	560	--
4	460	--
6	340	67
8	240	84
10	155	85
12	115	90
14	90	96
16	72	101
18	60	106
20	51	111

CONVERSION FACTORS

Cubic feet of wood per average cord (excluding bark)

D.b.h. class	All species	Pine	Other softwood	Hardwood
6	60.6	61.0	68.2	60.0
8	68.5	68.1	76.0	68.4
10	73.4	73.1	81.4	73.4
12	76.7	76.7	85.2	76.4
14	79.0	79.4	88.2	78.4
16	80.7	81.6	90.4	79.8
18	81.9	83.3	92.3	80.8
20	82.9	84.8	93.8	81.5
22	83.7	86.0	95.1	82.1
24+	85.1	87.7	97.8	83.1
Average	75.2	73.7	84.1	75.2

Rough cord per M cubic feet (without bark) =

$$a + b\left[\frac{1}{d.b.h.}\right] + c\left[\frac{1}{d.b.h.}\right]^2$$

Where	*Pine*	*Other softwoods*	*Hardwoods*
a =	10.01850	9.15960	11.68410
b =	34.42135	28.75973	3.74431
c =	22.73994	25.54418	157.39417

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 above ground 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

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Table 1--Area, by land class, North Carolina, 1990

Land class	Area
	Acres
Forest land	
Timberland	18,710,381
Reserved timberland	524,359
Woodland	42,809
Total	19,277,549
Nonforest land	
Cropland	6,459,619
Pasture and range	1,559,632
Other[a]	3,931,420
Total	11,950,671
All land[b]	31,228,220

[a] Includes swampland, industrial, and urban areas, other nonforest land, and 167,925 acres classed as water by Forest Inventory and Analysis standards but defined by Bureau of Census as land.

[b] From the U.S. Bureau of Census, 1980.

Table 2--Area of timberland, by ownership class, North Carolina, 1990

Ownership class	Area
	Acres
National forest	1,082,380
Other Federal	
Bureau of Land Management	--
Indian	52,527
Miscellaneous Federal	437,283
Total	489,810
State	346,478
County and municipal	83,995
Forest industry	2,252,117
Forest industry-leased	168,261
Other private	
Farmer	5,041,869
Other individual	7,452,162
Other corporate	1,793,309
Total	14,287,340
All ownerships	18,710,381

Table 3--Area of timberland, by stand-size and ownership classes, North Carolina, 1990

Stand-size class	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Sawtimber	9,117,176	719,520	467,000	729,496	67,380	7,133,780
Poletimber	4,939,084	214,759	271,154	796,835	69,989	3,586,347
Sapling and seedling	4,500,942	145,161	177,448	676,169	29,487	3,472,677
Nonstocked	153,179	2,940	4,681	49,617	1,405	94,536
All classes	18,710,381	1,082,380	920,283	2,252,117	168,261	14,287,340

Table 4--Area of timberland, by stand-volume and ownership classes, North Carolina, 1990

Stand volume class (board feet/acre[a])	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Less than 2,000	6,615,111	204,367	287,874	1,204,592	76,148	4,842,130
2,000 - 3,999	2,712,806	130,955	176,550	273,256	45,552	2,086,493
4,000 - 5,999	2,268,064	198,231	139,548	215,289	24,302	1,690,694
6,000 - 7,999	1,908,850	145,767	109,954	137,862	10,965	1,504,302
8,000 - 9,999	1,480,089	116,357	70,884	106,207	8,476	1,178,165
10,000 or more	3,725,461	286,703	135,473	314,911	2,818	2,985,556
All classes	18,710,381	1,082,380	920,283	2,252,117	168,261	14,287,340

[a] International 1/4-inch rule.

Table 5--Area of timberland, by stocking class of growing-stock trees and ownership class, North Carolina, 1990

Stocking class	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Overstocked	1,551,634	38,749	63,240	286,192	29,031	1,134,422
Fully stocked	6,975,626	349,476	270,413	1,039,408	91,048	5,225,281
Moderately stocked	7,786,670	516,168	360,648	689,480	35,831	6,184,543
Poorly stocked	2,114,695	165,538	215,294	169,220	10,946	1,553,697
Nonstocked	281,756	12,449	10,688	67,817	1,405	189,397
All classes	18,710,381	1,082,380	920,283	2,252,117	168,261	14,287,340

Table 6--Area of timberland, by site and ownership classes, North Carolina, 1990

Site class (ft^3/acre/year)	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
> 164	317,273	20,110	151	9,002	--	288,010
120-164	791,974	78,008	8,371	25,639	--	679,956
85-119	5,628,654	272,913	144,697	611,498	78,178	4,521,368
50-84	9,710,281	486,544	418,757	1,346,522	79,876	7,378,582
20-49	2,262,199	224,805	348,307	259,456	10,207	1,419,424
All classes	18,710,381	1,082,380	920,283	2,252,117	168,261	14,287,340

Table 7--Area of timberland, by forest type and site index class, North Carolina, 1990

Forest type	All classes	Site index class (50-year base)								
		< 50	50-59	60-69	70-79	80-89	90-99	100-109	110-119	> 119
		Acres								
Softwood types										
White pine-hemlock	233,124	--	4,945	35,846	52,328	41,583	44,186	41,995	12,241	--
Spruce-fir	13,130	--	13,130	--	--	--	--	--	--	--
Longleaf pine	255,202	8,042	123,202	78,976	25,389	15,549	4,044	--	--	--
Slash pine	155,912	2,959	19,466	49,011	49,714	34,762	--	--	--	--
Loblolly pine	3,716,402	9,209	101,321	521,965	1,503,067	1,099,491	388,015	81,749	11,585	--
Shortleaf pine	409,017	7,380	41,135	149,853	154,136	45,470	7,791	3,252	--	--
Virginia pine	760,481	6,542	41,923	220,965	311,623	154,584	20,184	4,660	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	32,397	3,952	7,195	6,622	6,750	7,878	--	--	--	--
Pond pine	620,615	58,799	316,040	133,721	82,943	20,456	8,656	--	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--
Pitch pine	54,512	9,207	8,138	32,143	5,024	--	--	--	--	--
Table Mountain pine	11,112	--	7,355	--	3,757	--	--	--	--	--
Total	6,261,904	106,090	683,850	1,229,102	2,194,731	1,419,773	472,876	131,656	23,826	--
Hardwood types										
Oak-pine	2,580,187	20,012	239,949	520,913	870,424	574,506	283,310	57,037	10,784	3,252
Oak-hickory	6,344,558	46,409	311,355	960,952	1,954,278	1,496,904	932,960	476,746	110,042	54,912
Chestnut oak	523,508	52,881	77,873	159,058	116,761	93,750	13,722	9,463	--	--
Southern scrub oak	139,917	5,521	64,969	44,686	24,741	--	--	--	--	--
Oak-gum-cypress	2,490,400	13,664	191,918	361,012	940,072	609,814	270,224	75,119	28,577	--
Elm-ash-cottonwood	175,519	--	6,821	10,221	21,798	60,559	60,585	11,959	3,576	--
Maple-beech-birch	194,388	5,099	15,893	24,240	66,570	32,019	34,097	10,852	5,618	--
Total	12,448,477	143,586	908,778	2,081,082	3,994,644	2,867,552	1,594,898	641,176	158,597	58,164
All types	18,710,381	249,676	1,592,628	3,310,184	6,189,375	4,287,325	2,067,774	772,832	182,423	58,164

Table 8--Area of timberland, by forest type and ownership class, North Carolina, 1990

Forest type	All ownerships	Ownership class				
		National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Softwood types						
White pine-hemlock	233,124	23,674	2,894	10,495	--	196,061
Spruce-fir	13,130	8,323	--	--	--	4,807
Longleaf pine	255,202	12,281	95,715	16,117	4,109	126,980
Slash pine	155,912	--	6,689	70,260	26,601	52,362
Loblolly pine	3,716,402	37,706	125,771	1,136,028	120,657	2,296,240
Shortleaf pine	409,017	7,116	8,233	13,450	--	380,218
Virginia pine	760,481	10,163	5,145	19,634	3,724	721,815
Sand pine	--	--	--	--	--	--
Eastern redcedar	32,397	--	--	--	--	32,397
Pond pine	620,615	34,483	163,192	100,601	2,941	319,398
Spruce pine	--	--	--	--	--	--
Pitch pine	54,512	23,159	9,499	3,588	--	18,266
Table Mountain pine	11,112	11,112	--	--	--	--
Total	6,261,904	168,017	417,138	1,370,173	158,032	4,148,544
Hardwood types						
Oak-pine	2,580,187	143,980	135,753	190,705	3,448	2,106,301
Oak-hickory	6,344,558	598,946	149,548	203,681	4,936	5,387,447
Chestnut oak	523,508	92,591	9,443	31,588	--	389,886
Southern scrub oak	139,917	--	10,753	11,018	--	118,146
Oak-gum-cypress	2,490,400	17,179	190,522	430,456	1,845	1,850,398
Elm-ash-cottonwood	175,519	--	2,414	12,684	--	160,421
Maple-beech-birch	194,388	61,667	4,712	1,812	--	126,197
Total	12,448,477	914,363	503,145	881,944	10,229	10,138,796
All types	18,710,381	1,082,380	920,283	2,252,117	168,261	14,287,340

Table 9--Area of timberland, by forest type and stand-size class, North Carolina, 1990

Forest type	All stands	Stand-size class			Nonstocked areas
		Sawtimber	Poletimber	Sapling-seedling	
			Acres		
Softwood types					
White pine-hemlock	233,124	176,827	41,089	15,208	--
Spruce-fir	13,130	3,942	4,807	4,381	--
Longleaf pine	255,202	157,657	44,755	52,790	--
Slash pine	155,912	27,166	109,760	18,986	--
Loblolly pine	3,716,402	1,406,463	1,157,262	1,115,345	37,332
Shortleaf pine	409,017	233,067	152,085	20,560	3,305
Virginia pine	760,481	307,355	298,971	150,548	3,607
Sand pine	--	--	--	--	--
Eastern redcedar	32,397	--	11,044	21,353	--
Pond pine	620,615	234,016	219,223	145,340	22,036
Spruce pine	--	--	--	--	--
Pitch pine	54,512	35,732	18,780	--	--
Table Mountain pine	11,112	3,677	3,678	3,757	--
Total	6,261,904	2,585,902	2,061,454	1,548,268	66,280
Hardwood types					
Oak-pine	2,580,187	1,090,362	569,254	908,554	12,017
Oak-hickory	6,344,558	3,469,222	1,556,865	1,287,632	30,839
Chestnut oak	523,508	340,131	151,188	32,189	--
Southern scrub oak	139,917	5,726	21,608	110,043	2,540
Oak-gum-cypress	2,490,400	1,371,026	505,529	576,017	37,828
Elm-ash-cottonwood	175,519	101,900	40,408	29,536	3,675
Maple-beech-birch	194,388	152,907	32,778	8,703	--
Total	12,448,477	6,531,274	2,877,630	2,952,674	86,899
All types	18,710,381	9,117,176	4,939,084	4,500,942	153,179

Table 10--Area of timberland, by forest type-group, detailed forest type, and Survey unit, North Carolina, 1990

Forest type-group and detailed forest type	State	Southern Coastal	Northern Coastal	Piedmont	Mountains
			Acres		
White pine-hemlock					
White pine	158,014	--	--	3,681	154,333
White pine-hemlock	69,358	--	--	3,975	65,383
Hemlock	5,752	--	--	--	5,752
Total	233,124	--	--	7,656	225,468
Spruce-fir					
Balsam fir	4,807	--	--	--	4,807
Red spruce-balsam fir	8,323	--	--	--	8,223
Total	13,130	--	--	--	13,130
Longleaf-slash					
Longleaf pine	255,202	236,136	19,066	--	--
Slash pine	155,912	148,536	7,376	--	--
Total	411,114	384,672	26,442	--	--
Loblolly-shortleaf					
Loblolly pine	3,716,402	1,587,873	1,257,885	852,340	18,304
Shortleaf pine	409,017	18,511	6,012	361,159	23,335
Virginia pine	760,481	2,539	--	583,472	174,470
Eastern redcedar	32,397	--	--	32,397	--
Pond pine	620,615	348,036	272,579	--	--
Pitch pine	54,512	--	--	3,588	50,924
Table Mountain pine	11,112	--	--	--	11,112
Total	5,604,536	1,956,959	1,536,476	1,832,956	278,145
Total, all softwoods	6,261,904	2,341,631	1,562,918	1,840,612	516,743
Oak-pine					
White pine-N. red oak-white ash	227,490	--	--	8,784	218,706
Eastern red cedar-hardwood	21,283	--	--	14,128	7,155
Longleaf pine-scrub oak	110,011	108,647	--	1,364	--
Shortleaf pine-oak	286,077	18,529	2,583	224,343	40,622
Virginia pine-S. red oak	333,595	--	--	253,166	80,429
Loblolly pine-hardwood	1,289,898	546,909	455,439	287,550	--
Slash pine-hardwood	11,802	8,267	3,535	--	--
Other oak-pine	300,031	83,988	70,400	14,694	130,949
Total	2,580,187	766,340	531,957	804,029	477,861
Oak-hickory					
Post oak-black oak	69,880	2,881	--	56,617	10,382
Chestnut oak	523,508	2,774	--	166,530	354,204
White oak-red oak-hickory	1,340,308	137,817	145,689	638,439	418,363
White oak	29,672	2,883	--	17,216	9,573
N. red oak	14,743	--	--	--	14,743
Yellow-poplar-white oak-N. red oak	1,350,900	--	--	695,606	655,294
Southern scrub oak	139,917	139,917	--	--	--
Sweetgum-yellow-poplar	1,305,213	317,701	322,710	637,455	27,347
Mixed hardwood	2,233,842	253,361	148,637	560,748	1,271,096
Total	7,007,983	857,334	617,036	2,772,611	2,761,002
Oak-gum-cypress					
Swamp chestnut oak-cherrybark oak	53,767	16,550	26,501	10,716	--
Sweetgum-water oak-willow oak	713,286	357,789	276,290	79,207	--
Sugarberry-elm-green ash	214,129	82,196	47,183	84,750	--
Overcup oak-water hickory	3,647	--	--	3,647	--
Atlantic white cedar	33,609	20,864	12,745	--	--
Cypress-water tupelo	250,951	91,272	159,679	--	--
Sweetbay-blackgum-red maple	1,221,011	687,565	502,634	30,812	--
Total	2,490,400	1,256,236	1,025,032	209,132	--
Elm-ash-cottonwood					
River birch-sycamore	106,137	4,690	12,466	83,957	5,024
Cottonwood	2,478	--	2,478	--	--
Willow	29,114	10,147	11,307	7,660	--
Sycamore-pecan-elm	37,790	--	4,668	33,122	--
Total	175,519	14,837	30,919	124,739	5,024
Maple-beech-birch					
Sugar maple-beech-yellow birch	194,388	--	--	--	194,388
Total	194,388	--	--	--	194,388
Total, all hardwoods	12,448,477	2,894,747	2,204,944	3,910,511	3,438,275
All types	18,710,381	5,236,378	3,767,862	5,751,123	3,955,018

Table 11--Area of timberland, by stand-age and broad management classes, all ownerships, North Carolina, 1990

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak-pine	Upland hardwood	Lowland hardwood
			Acres			
0-10	2,785,119	760,911	370,059	573,139	805,802	275,208
11-20	1,926,571	648,141	412,252	250,118	466,661	149,399
21-30	1,510,046	519,392	464,855	152,197	256,140	117,462
31-40	1,762,566	144,103	801,573	177,936	474,049	164,905
41-50	1,964,648	--	719,526	278,321	715,294	251,507
51-60	2,202,090	3,942	554,590	305,448	1,020,975	317,135
61-70	1,732,580	--	276,821	245,297	935,569	274,893
71-80	1,188,259	--	146,583	107,471	690,022	244,183
81+	1,495,659	--	95,655	153,267	879,886	366,851
No manageable stand	2,142,843	22,034	321,467	336,993	957,973	504,376
All classes	18,710,381	2,098,523	4,163,381	2,580,187	7,202,371	2,665,919

Table 12--Area of timberland, by stand-age and broad management classes, public ownerships, North Carolina, 1990

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak-pine	Upland hardwood	Lowland hardwood
			Acres			
0-10	105,793	16,820	10,124	16,610	57,156	5,083
11-20	114,518	19,965	41,491	17,009	29,437	6,616
21-30	78,796	30,200	13,699	12,461	16,002	6,434
31-40	126,617	16,619	71,423	3,456	32,818	2,301
41-50	159,022	--	90,104	7,277	47,818	13,823
51-60	211,124	3,942	77,176	24,197	72,395	33,414
61-70	278,156	--	55,522	33,534	147,063	42,037
71-80	218,814	--	27,482	27,187	126,460	37,685
81+	343,865	--	33,795	47,639	244,974	17,457
No manageable stand	365,958	--	76,793	90,363	153,537	45,265
All classes	2,002,663	87,546	497,609	279,733	927,660	210,115

Table 13--Area of timberland, by stand-age and broad management classes, forest industry,[a] North Carolina, 1990

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak-pine	Upland hardwood	Lowland hardwood
			Acres			
0-10	520,284	351,946	9,701	68,452	52,735	37,450
11-20	520,380	386,209	51,365	27,396	36,079	19,331
21-30	434,286	352,914	51,782	4,299	10,339	14,952
31-40	155,376	55,751	56,937	12,160	17,481	13,047
41-50	120,947	--	52,962	23,430	5,273	39,282
51-60	128,397	--	48,795	8,661	29,488	41,453
61-70	97,335	--	18,359	16,036	23,048	39,892
71-80	82,489	--	11,140	2,496	21,596	47,257
81+	129,471	--	15,949	9,519	6,111	97,892
No manageable stand	231,413	13,130	51,265	21,704	50,885	94,429
All classes	2,420,378	1,159,950	368,255	194,153	253,035	444,985

[a] Includes 168,261 acres of other private land under long-term lease.

Table 14--Area of timberland, by stand-age and broad management classes, other private ownerships,[a] North Carolina, 1990

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak-pine	Upland hardwood	Lowland hardwood
			Acres			
0-10	2,159,042	392,145	350,234	488,077	695,911	232,675
11-20	1,291,673	241,967	319,396	205,713	401,145	123,452
21-30	996,964	136,278	399,374	135,437	229,799	96,076
31-40	1,480,573	71,733	673,213	162,320	423,750	149,557
41-50	1,684,679	--	576,460	247,614	662,203	198,402
51-60	1,862,569	--	428,619	272,590	919,092	242,268
61-70	1,357,089	--	202,940	195,727	765,458	192,964
71-80	886,956	--	107,961	77,788	541,966	159,241
81+	1,022,323	--	45,911	96,109	628,801	251,502
No manageable stand	1,545,472	8,904	193,409	224,926	753,551	364,682
All classes	14,287,340	851,027	3,297,517	2,106,301	6,021,676	2,010,819

[a] Excludes 168,261 acres of other private land under long-term lease to forest industry.

Table 15--Basal area per acre of live trees 5.0 inches d.b.h. and larger, by broad management class, species group, and ownership class, North Carolina, 1990

Broad management class and species group	All ownerships	National forest	Other public	Forest industry	Forest industry--leased	Other private
			Square feet			
Pine plantation						
Softwood	56.1	69.0	67.6	60.5	78.7	45.8
Hardwood	3.3	21.8	2.4	2.7	4.2	3.2
Total	59.3	90.9	70.0	63.2	82.9	48.9
Natural pine						
Softwood	69.4	64.8	62.8	66.7	44.3	70.9
Hardwood	15.2	18.4	10.2	14.5	4.3	15.8
Total	84.6	83.3	72.9	81.1	48.7	86.6
Oak-pine						
Softwood	26.3	28.3	27.9	22.3	7.6	26.4
Hardwood	35.7	38.2	29.9	30.7	7.6	36.4
Total	61.9	66.5	57.7	53.0	15.1	62.9
Upland hardwood						
Softwood	4.8	4.1	7.2	6.9	--	4.7
Hardwood	73.4	86.0	81.9	52.7	--	72.8
Total	78.2	90.1	89.1	59.6	--	77.5
Lowland hardwood						
Softwood	11.1	17.6	13.2	15.1	7.6	9.9
Hardwood	86.6	75.9	79.4	98.4	127.6	84.8
Total	97.6	93.4	92.6	113.5	135.1	94.7
All classes						
Softwood	30.3	21.0	38.2	43.2	71.3	27.5
Hardwood	48.0	64.4	39.7	31.6	6.7	51.0
Total	78.3	85.4	77.9	74.8	78.0	78.5

Note: Data may not add to totals because of rounding.

Table 16--Area of reserved timberland and woodland, by forest-type group, North Carolina, 1990

Forest-type group	All areas	Reserved timberland	Woodland
		Acres	
White pine-hemlock	16,051	16,051	--
Spruce-fir	9,525	9,525	--
Longleaf-slash pine	5,733	5,733	--
Loblolly-shortleaf pine	62,432	54,540	7,892
Oak-pine	35,334	35,334	--
Oak-hickory	338,408	324,536	13,872
Oak-gum-cypress	51,531	30,486	21,045
Elm-ash-cottonwood	--	--	--
Maple-beech-birch	48,154	48,154	--
All types	567,168	524,359	42,809

Table 17--Number of live trees on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 1.0–2.9	3.0–4.9	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
						Thousand trees							
Softwood													
Longleaf pine	71,350	26,123	12,405	9,577	6,128	6,642	4,521	3,316	1,809	583	163	83	--
Slash pine	50,230	4,707	11,420	16,560	12,320	4,040	802	349	32	--	--	--	--
Shortleaf pine	205,825	38,366	47,246	37,678	36,634	24,716	12,943	5,178	2,274	610	104	76	--
Loblolly pine	1,541,656	571,532	329,588	262,301	174,863	94,674	48,934	27,454	16,479	8,331	4,288	3,138	74
Pond pine	195,855	60,984	46,602	30,271	25,117	17,004	8,548	4,530	1,852	603	244	100	--
Virginia pine	425,560	155,302	100,417	66,574	52,001	32,579	13,162	4,464	894	127	40	--	--
Pitch pine	26,325	5,390	6,127	2,764	3,937	3,334	2,662	1,039	654	230	88	100	--
Table Mountain pine	6,561	1,411	2,025	1,832	438	326	96	388	28	--	17	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	147,250	73,969	31,347	13,337	9,360	6,068	3,782	3,113	2,135	1,491	1,099	1,397	152
Eastern hemlock	74,811	44,008	14,476	7,808	2,649	1,695	1,239	804	658	621	288	479	86
Spruce and fir	8,636	4,827	1,110	985	716	567	263	34	105	23	--	--	6
Baldcypress	16,650	3,333	2,719	1,467	1,627	1,323	1,331	1,214	869	767	606	1,135	259
Pondcypress	11,438	4,483	828	906	1,300	1,636	757	557	307	201	210	208	45
Cedars	189,291	123,123	41,661	13,989	5,699	3,094	965	413	120	109	72	34	12
Total softwoods	2,971,438	1,117,558	647,971	466,049	332,789	197,698	100,005	52,853	28,216	13,696	7,219	6,750	634
Hardwood													
Select white oaks[a]	396,185	188,724	74,261	40,308	29,763	20,651	15,197	11,312	6,807	3,942	2,197	2,674	349
Select red oaks[b]	115,933	48,950	20,075	12,453	8,469	5,648	5,644	4,513	3,547	2,295	1,768	2,190	381
Chestnut oak	161,434	50,067	29,602	20,962	19,530	13,863	9,056	6,775	4,430	2,765	1,931	2,164	289
Other white oaks	103,162	56,274	16,882	11,207	7,359	4,281	3,075	1,935	1,106	535	169	303	36
Other red oaks	761,956	460,309	115,279	60,410	42,055	29,225	20,761	14,254	8,237	5,171	2,946	2,993	316
Hickory	326,800	187,891	58,428	30,091	18,404	12,956	7,054	5,424	3,026	1,646	938	909	33
Yellow birch	18,119	9,457	2,624	2,181	1,622	887	198	366	350	157	68	169	40
Hard maple	70,937	44,549	13,337	4,568	3,739	1,759	938	417	708	487	202	206	27
Soft maple	2,145,356	1,535,379	344,952	121,627	64,449	32,549	20,345	11,510	6,557	4,078	1,883	1,890	137
Beech	107,941	66,389	19,518	6,967	3,957	3,833	2,184	1,577	1,439	909	476	617	75
Sweetgum	1,390,751	952,825	239,352	91,156	43,415	26,403	15,867	10,128	5,464	2,921	1,579	1,571	70
Tupelo and blackgum	816,535	524,749	127,145	59,836	35,523	23,606	16,503	10,806	7,306	4,482	2,641	3,153	785
Ash	271,294	180,088	43,996	21,949	9,101	6,262	3,814	2,684	1,326	877	691	484	22
Cottonwood	6,214	1,460	2,059	1,182	893	178	55	112	136	59	46	34	--
Basswood	21,794	13,014	2,599	872	1,466	959	1,170	706	550	153	187	118	--
Yellow-poplar	533,723	274,340	87,189	47,011	34,425	26,085	21,260	16,087	11,626	7,042	4,095	4,190	373
Bay and magnolia	408,510	322,278	52,848	18,231	8,101	4,662	1,253	741	215	93	49	39	--
Black cherry	204,860	159,797	28,055	9,304	4,567	1,835	581	318	119	137	80	67	--
Black walnut	8,890	3,637	1,493	897	886	688	741	211	244	68	--	25	--
Sycamore	12,466	3,715	2,866	1,851	1,137	908	605	287	485	234	107	227	44
Black locust	58,638	33,568	4,433	5,673	3,710	3,927	2,875	2,079	1,177	575	274	342	5
Elm	141,212	94,411	25,909	9,108	5,311	2,521	1,621	1,054	739	189	153	178	18
Other eastern hardwoods	2,944,902	2,161,923	541,742	148,932	53,542	20,890	8,876	4,368	2,238	1,119	456	765	51
Total hardwoods	11,027,612	7,373,794	1,854,644	726,776	401,424	244,576	159,673	107,664	67,832	39,934	22,936	25,308	3,051
All species	13,999,050	8,491,352	2,502,615	1,192,825	734,213	442,274	259,678	160,517	96,048	53,630	30,155	32,058	3,685

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 18--Number of growing-stock trees on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	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
						Thousand trees							
Softwood													
Longleaf pine	68,421	23,740	12,166	9,475	5,989	6,599	4,521	3,300	1,809	583	163	76	--
Slash pine	49,293	4,364	11,088	16,298	12,320	4,040	802	349	32	--	--	--	--
Shortleaf pine	199,753	35,325	45,725	36,361	36,463	24,716	12,943	5,156	2,274	610	104	76	--
Loblolly pine	1,507,869	546,886	322,566	260,964	174,451	94,414	48,873	27,419	16,479	8,331	4,288	3,124	74
Pond pine	165,064	38,099	40,269	29,458	24,448	16,968	8,548	4,530	1,797	603	244	100	--
Virginia pine	411,491	147,530	95,901	65,537	51,621	32,336	13,064	4,441	894	127	40	--	--
Pitch pine	23,456	4,837	4,692	2,019	3,801	3,334	2,662	1,039	654	230	88	100	--
Table Mountain pine	6,561	1,411	2,025	1,832	438	326	96	388	28	--	17	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	140,760	69,838	29,708	12,746	9,360	6,068	3,782	3,071	2,111	1,444	1,083	1,397	152
Eastern hemlock	68,090	38,889	13,304	7,566	2,649	1,695	1,142	804	634	597	288	439	83
Spruce and fir	8,516	4,827	1,110	985	619	567	263	34	105	--	--	--	6
Baldcypress	15,395	2,686	2,719	1,376	1,462	1,244	1,310	1,182	854	732	545	1,087	198
Pondcypress	11,298	4,483	828	906	1,300	1,584	757	557	307	153	210	197	16
Cedars	164,587	103,882	37,866	13,192	5,207	2,961	851	382	56	84	72	34	--
Total softwoods	2,840,554	1,026,797	619,967	458,715	330,128	196,852	99,614	52,652	28,034	13,494	7,142	6,630	529
Hardwood													
Select white oaks[a]	335,955	143,463	64,332	37,782	28,787	20,328	14,864	10,955	6,735	3,816	2,113	2,498	282
Select red oaks[b]	99,087	36,673	17,206	12,078	8,027	5,508	5,453	4,449	3,444	2,142	1,716	2,113	278
Chestnut oak	125,770	28,057	23,263	18,468	18,304	12,885	8,310	6,289	4,055	2,446	1,679	1,776	238
Other white oaks	81,807	39,528	14,113	10,413	7,022	4,088	2,890	1,784	1,011	470	169	290	29
Other red oaks	634,500	358,810	98,926	56,530	39,892	28,031	19,842	13,879	7,827	4,977	2,812	2,745	229
Hickory	247,624	122,775	49,752	27,157	16,980	12,677	6,888	5,120	2,960	1,582	868	835	30
Yellow birch	13,051	6,047	2,063	1,760	1,540	738	198	160	248	115	68	114	--
Hard maple	49,170	26,603	10,424	4,160	3,411	1,712	900	417	687	470	202	157	27
Soft maple	1,308,593	833,885	255,139	98,615	54,299	27,373	17,270	10,144	5,598	3,397	1,542	1,275	56
Beech	75,528	40,444	14,725	6,365	3,683	3,649	2,068	1,416	1,359	785	449	517	68
Sweetgum	1,121,652	724,298	208,797	85,046	41,500	25,646	15,357	9,921	5,285	2,748	1,537	1,461	56
Tupelo and blackgum	474,764	235,600	94,418	50,736	32,089	21,350	15,193	10,022	6,690	3,888	2,072	2,323	383
Ash	148,959	81,768	27,652	17,357	7,996	5,411	3,272	2,323	1,218	866	633	447	16
Cottonwood	5,846	1,276	1,900	1,182	893	178	55	112	120	59	37	34	--
Basswood	15,560	7,116	2,599	872	1,243	899	1,170	706	521	153	187	94	--
Yellow-poplar	481,652	236,891	78,105	44,257	33,310	25,438	20,784	15,962	11,537	6,956	4,029	4,054	329
Bay and magnolia	222,984	163,640	32,903	13,403	6,887	4,189	1,087	607	149	70	20	29	--
Black cherry	122,448	92,967	18,752	5,522	2,904	1,195	541	225	87	125	69	61	--
Black walnut	6,999	2,174	1,493	721	796	688	689	142	244	33	--	19	--
Sycamore	11,111	3,022	2,652	1,688	959	908	605	242	468	218	96	211	42
Black locust	42,596	23,569	3,631	4,615	2,204	2,878	2,159	1,751	924	467	194	199	5
Elm	92,703	52,723	20,992	7,829	5,105	2,353	1,532	1,004	681	175	143	152	14
Other eastern hardwoods	179,437	91,439	34,281	21,360	13,600	7,908	4,409	2,904	1,606	1,006	343	556	25
Total hardwoods	5,897,796	3,352,768	1,078,118	527,916	331,431	216,030	145,536	100,534	63,454	36,964	20,978	21,960	2,107
All species	8,738,350	4,379,565	1,698,085	986,631	661,559	412,882	245,150	153,186	91,488	50,458	28,120	28,590	2,636

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 19--Merchantable volume of live trees on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0 and larger
					Thousand cubic feet						
Softwood											
Longleaf pine	419,873	26,372	42,421	77,945	82,218	85,466	63,292	27,343	8,412	6,404	--
Slash pine	182,964	44,015	72,174	43,065	14,208	8,676	826	--	--	--	--
Shortleaf pine	1,292,917	109,907	265,074	333,686	274,690	160,271	99,201	34,145	8,018	7,925	--
Loblolly pine	6,552,082	668,520	1,093,602	1,140,104	970,059	831,955	707,497	481,102	317,659	326,324	15,260
Pond pine	802,651	79,059	151,742	189,077	148,246	113,956	66,246	30,001	15,373	8,951	--
Virginia pine	1,554,740	236,255	427,732	447,315	272,601	128,277	33,919	6,042	2,599	--	--
Pitch pine	203,568	8,129	23,531	38,936	51,801	30,019	25,472	10,932	6,088	8,660	--
Table Mountain pine	27,048	6,070	3,796	3,946	1,741	9,653	945	--	897	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	721,815	41,424	59,523	67,786	70,505	84,774	79,145	76,500	72,356	137,711	32,091
Eastern hemlock	223,865	17,991	13,669	15,476	20,567	18,944	24,264	30,254	18,540	44,558	19,602
Spruce and fir	21,015	2,935	3,404	5,054	4,689	712	2,749	304	--	--	1,168
Baldcypress	339,768	4,689	11,717	16,666	24,269	31,577	33,529	36,596	35,669	103,085	41,971
Pondcypress	117,609	2,942	8,809	19,392	14,070	14,420	11,247	8,419	11,697	18,479	8,134
Cedars	147,074	38,059	34,381	33,882	15,730	9,501	3,790	4,858	3,776	2,181	916
Total softwoods	12,606,989	1,286,367	2,211,575	2,432,330	1,965,394	1,528,201	1,152,122	746,496	501,084	664,278	119,142
Hardwood											
Select white oaks[a]	2,116,274	112,553	188,814	251,158	301,855	321,805	270,325	207,427	144,800	254,680	62,857
Select red oaks[b]	1,070,892	38,065	57,552	70,509	110,277	128,363	141,001	119,122	122,231	215,336	68,436
Chestnut oak	1,286,859	52,995	124,969	156,635	163,591	169,537	157,198	129,631	108,795	177,437	46,071
Other white oaks	319,794	29,656	41,219	45,528	49,185	45,626	37,398	23,410	9,848	28,399	9,525
Other red oaks	2,636,180	167,651	260,348	336,959	382,267	383,603	311,615	261,920	190,878	280,028	60,911
Hickory	994,294	72,653	111,621	156,726	137,453	150,224	120,325	88,982	63,564	87,282	5,464
Yellow birch	87,373	6,666	10,758	11,616	3,405	8,969	13,484	7,500	4,748	14,939	5,288
Hard maple	180,831	14,371	24,600	20,966	17,258	12,445	26,900	25,520	13,405	17,631	7,735
Soft maple	2,466,865	363,871	413,735	369,549	363,135	292,047	220,465	179,284	104,719	143,018	17,042
Beech	381,132	22,675	25,760	45,449	40,399	44,235	54,847	44,947	31,160	58,180	13,480
Sweetgum	2,106,181	227,357	277,113	328,269	315,803	299,803	226,170	155,603	111,236	152,427	12,400
Tupelo and blackgum	2,130,649	166,940	223,835	264,599	300,469	279,157	246,195	193,541	130,647	222,278	102,988
Ash	531,228	55,620	61,439	76,711	74,826	69,826	50,682	45,687	46,165	46,950	3,322
Cottonwood	28,922	2,591	5,427	2,231	940	3,494	5,185	3,252	2,603	3,199	--
Basswood	134,727	3,001	11,763	13,908	25,685	23,000	24,616	7,721	14,130	10,903	--
Yellow-poplar	3,315,641	151,136	246,932	334,976	444,123	494,269	489,564	384,935	285,701	417,714	66,291
Bay and magnolia	209,232	51,372	51,664	51,646	20,774	17,933	6,850	3,762	2,212	3,019	--
Black cherry	111,551	26,601	26,033	18,957	9,553	8,073	3,908	7,000	5,009	6,417	--
Black walnut	53,949	2,929	6,501	8,874	14,234	6,569	9,978	2,838	--	2,026	--
Sycamore	106,913	6,501	7,284	12,498	10,811	7,265	17,928	10,527	6,046	19,042	9,011
Black locust	282,082	14,686	21,012	44,225	46,967	51,430	38,038	24,304	14,900	25,168	1,352
Elm	211,513	20,941	33,513	30,835	31,570	28,353	28,120	9,481	9,614	16,723	2,363
Other eastern hardwoods	1,310,923	339,039	284,332	217,165	141,298	108,385	73,467	53,616	26,225	60,451	6,945
Total hardwoods	22,074,005	1,949,870	2,516,224	2,869,989	3,005,878	2,954,411	2,574,259	1,990,010	1,448,636	2,263,247	501,481
All species	34,680,994	3,236,237	4,727,799	5,302,319	4,971,272	4,482,612	3,726,381	2,736,506	1,949,720	2,927,525	620,623

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 20--Volume of growing stock on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0 and larger
						Thousand cubic feet					
Softwood											
Longleaf pine	418,255	26,148	41,955	77,616	82,218	85,232	63,292	27,343	8,412	6,039	--
Slash pine	182,616	43,667	72,174	43,065	14,208	8,676	826	--	--	--	--
Shortleaf pine	1,289,131	107,515	264,146	333,686	274,690	159,805	99,201	34,145	8,018	7,925	--
Loblolly pine	6,541,621	665,819	1,091,003	1,138,473	968,721	831,020	707,497	481,102	317,659	325,067	15,260
Pond pine	796,778	77,533	148,897	188,744	148,246	113,956	65,077	30,001	15,373	8,951	--
Virginia pine	1,546,314	233,681	426,211	445,184	270,921	127,757	33,919	6,042	2,599	--	--
Pitch pine	201,879	6,954	23,017	38,936	51,801	30,019	25,472	10,932	6,088	8,660	--
Table Mountain pine	27,048	6,070	3,796	3,946	1,741	9,653	945	--	897	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	716,907	39,530	59,523	67,786	70,505	84,131	78,630	75,277	71,723	137,711	32,091
Eastern hemlock	217,147	17,321	13,669	15,476	19,400	18,944	23,484	29,699	18,540	41,937	18,677
Spruce and fir	20,399	2,935	3,092	5,054	4,689	712	2,749	--	--	--	1,168
Baldcypress	325,016	4,429	11,098	16,200	23,866	31,097	33,293	35,438	33,571	100,378	35,646
Pondcypress	110,861	2,942	8,809	19,125	14,070	14,420	11,247	7,541	11,697	17,646	3,364
Cedars	136,399	36,222	32,420	32,755	14,172	8,826	1,992	4,055	3,776	2,181	--
Total softwoods	12,530,371	1,270,766	2,199,810	2,426,046	1,959,248	1,524,248	1,147,624	741,575	498,353	656,495	106,206
Hardwood											
Select white oaks[a]	2,065,313	107,445	184,667	248,647	297,681	315,352	268,384	203,014	141,881	243,802	54,440
Select red oaks[b]	1,031,527	37,007	55,825	69,178	107,493	126,617	138,162	113,421	119,555	209,482	54,787
Chestnut oak	1,195,775	48,233	120,124	148,795	154,531	160,516	147,367	119,679	99,843	155,703	40,984
Other white oaks	303,495	26,837	40,042	44,216	47,240	43,915	35,064	21,427	9,848	27,621	7,285
Other red oaks	2,541,242	157,298	252,175	326,445	370,748	377,432	302,613	256,372	185,434	264,862	47,863
Hickory	960,843	67,597	104,370	153,942	135,079	144,090	118,795	86,568	61,277	84,002	5,123
Yellow birch	67,884	6,195	10,163	10,788	3,405	4,249	9,921	6,071	4,748	12,344	--
Hard maple	173,114	13,542	22,232	20,409	16,894	12,445	26,621	24,766	13,405	15,065	7,735
Soft maple	2,158,616	307,393	363,754	324,785	324,054	268,537	198,536	159,112	92,377	110,389	9,679
Beech	355,366	20,844	24,276	44,081	39,334	40,569	52,712	40,706	30,009	50,503	12,332
Sweetgum	2,051,008	215,404	267,893	322,564	310,262	295,964	221,636	150,475	109,653	146,145	11,012
Tupelo and blackgum	1,936,774	146,845	208,772	248,534	284,571	267,144	234,215	178,541	114,153	186,694	67,305
Ash	487,671	45,984	55,841	68,520	68,492	64,498	48,396	45,449	43,556	44,051	2,884
Cottonwood	28,221	2,591	5,427	2,231	940	3,494	4,728	3,252	2,359	3,199	--
Basswood	129,950	3,001	10,238	13,296	25,685	23,000	23,563	7,721	14,130	9,316	--
Yellow-poplar	3,271,174	145,412	242,457	331,462	435,947	492,320	487,767	381,572	282,594	409,718	61,925
Bay and magnolia	178,460	39,329	44,915	48,085	19,297	15,875	4,809	2,973	836	2,341	--
Black cherry	85,439	17,928	18,064	13,396	9,320	6,308	3,376	6,541	4,503	6,003	--
Black walnut	48,826	2,597	5,960	8,874	13,781	4,590	9,978	1,691	--	1,355	--
Sycamore	102,994	6,000	6,611	12,498	10,811	6,910	17,618	9,960	5,762	18,012	8,812
Black locust	230,870	12,469	14,035	33,532	38,655	46,386	32,160	21,732	11,589	18,960	1,352
Elm	199,504	17,764	32,576	28,572	29,925	28,000	26,714	9,044	9,101	15,466	2,342
Other eastern hardwoods	607,894	65,889	96,471	100,829	82,070	79,392	58,616	49,459	21,448	49,218	4,502
Total hardwoods	20,211,960	1,513,604	2,186,888	2,623,679	2,826,215	2,827,603	2,471,751	1,899,546	1,378,061	2,084,251	400,362
All species	32,742,331	2,784,370	4,386,698	5,049,725	4,785,463	4,351,851	3,619,375	2,641,121	1,876,414	2,740,746	506,568

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 21 – –Volume of sawtimber on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0 and larger
				Thousand board feet					
Softwood									
Longleaf pine	1,793,342	315,427	395,557	456,767	365,347	166,546	53,300	40,398	– –
Slash pine	270,105	155,957	64,524	44,993	4,631	– –	– –	– –	– –
Shortleaf pine	4,167,790	1,245,794	1,247,398	818,991	552,519	201,947	49,684	51,457	– –
Loblolly pine	23,943,787	4,081,659	4,365,304	4,295,646	3,995,982	2,902,825	2,008,970	2,181,304	112,097
Pond pine	2,667,162	713,536	677,925	584,535	361,731	177,020	94,858	57,557	– –
Virginia pine	3,568,463	1,602,711	1,147,850	600,386	170,839	32,122	14,555	– –	– –
Pitch pine	794,926	130,768	220,527	147,947	138,444	63,618	37,316	56,306	– –
Table Mountain pine	84,705	15,610	8,182	50,073	5,289	– –	5,551	– –	– –
Spruce pine	– –	– –	– –	– –	– –	– –	– –	– –	– –
Sand pine	– –	– –	– –	– –	– –	– –	– –	– –	– –
Eastern white pine	3,331,076	240,370	306,537	415,439	422,032	428,807	426,547	872,036	219,308
Eastern hemlock	986,462	54,585	81,684	89,804	120,579	160,171	104,888	251,814	122,937
Spruce and fir	65,985	18,436	21,564	3,553	14,657	– –	– –	– –	7,775
Baldcypress	1,604,890	49,483	90,572	136,723	160,034	181,698	180,618	579,579	226,183
Pondcypress	462,283	61,407	55,050	64,804	54,166	39,339	63,191	102,329	21,997
Cedars	307,384	126,310	65,427	45,082	10,947	23,499	22,598	13,521	– –
Total softwoods	44,048,360	8,812,053	8,748,101	7,754,743	6,377,197	4,377,592	3,062,076	4,206,301	710,297
Hardwood									
Select white oaks[a]	6,821,314	– –	1,021,737	1,258,803	1,191,096	972,958	715,198	1,331,778	329,744
Select red oaks[b]	3,898,541	– –	358,952	487,077	585,591	514,435	569,902	1,073,860	308,724
Chestnut oak	3,809,505	– –	510,752	614,634	625,332	544,590	478,777	803,725	231,695
Other white oaks	878,484	– –	169,633	185,998	164,273	107,392	51,131	155,763	44,294
Other red oaks	8,249,323	– –	1,320,231	1,551,717	1,377,740	1,254,087	958,382	1,484,312	302,854
Hickory	2,816,851	– –	464,338	583,895	534,443	422,541	315,455	465,375	30,804
Yellow birch	185,726	– –	11,723	17,013	42,345	27,557	22,988	64,100	– –
Hard maple	519,218	– –	62,456	50,722	114,823	111,977	63,072	74,184	41,984
Soft maple	4,709,172	– –	1,062,110	1,023,367	838,857	721,861	442,608	565,987	54,382
Beech	1,048,210	– –	143,613	154,254	205,362	161,941	121,313	209,354	52,373
Sweetgum	5,788,275	– –	1,107,192	1,265,966	1,068,700	786,185	608,892	877,415	73,925
Tupelo and blackgum	5,808,648	– –	909,246	1,026,326	1,008,597	839,279	570,826	1,025,745	428,629
Ash	1,364,053	– –	220,836	248,894	210,710	213,137	217,024	236,224	17,228
Cottonwood	87,060	– –	3,164	14,601	21,869	16,313	12,689	18,424	– –
Basswood	433,420	– –	87,341	90,294	102,758	35,673	69,202	48,152	– –
Yellow-poplar	12,724,590	– –	1,569,682	2,140,484	2,393,682	2,041,086	1,616,886	2,533,773	428,997
Bay and magnolia	174,629	– –	62,965	61,492	20,167	13,333	3,841	12,831	– –
Black cherry	163,919	– –	31,567	25,635	15,484	32,993	23,732	34,508	– –
Black walnut	113,964	– –	46,497	16,686	38,214	6,769	– –	5,798	– –
Sycamore	362,716	– –	34,489	26,179	75,591	46,529	28,585	97,462	53,881
Black locust	640,573	– –	136,532	170,447	121,813	84,014	45,556	76,540	5,671
Elm	500,369	– –	102,368	108,394	113,576	41,044	43,397	78,582	13,008
Other eastern hardwoods	1,442,392	– –	283,411	313,814	250,490	225,331	99,290	246,371	23,685
Total hardwoods	62,540,952	– –	9,720,835	11,436,692	11,121,513	9,221,025	7,078,746	11,520,263	2,441,878
All species	106,589,312	8,812,053	18,468,936	19,191,435	17,498,710	13,598,617	10,140,822	15,726,564	3,152,175

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 22--Volume of sawtimber on timberland, by species, size class, and tree grade, North Carolina, 1990

Species	All size classes					Trees 15.0 inches d.b.h. and larger				
	All grades	Tree grade 1	Tree grade 2	Tree grade 3	Tree grade 4	All grades	Tree grade 1	Tree grade 2	Tree grade 3	Tree grade 4
	Thousand board feet									
Softwood										
Yellow pines[a]	37,290,280	7,358,524	8,582,018	21,349,738	--	13,902,213	5,021,315	3,897,717	4,983,181	--
Eastern white pine[b]	3,331,076	478,202	1,171,795	1,668,514	12,565	2,368,730	473,545	885,433	1,001,604	8,148
Spruce and fir[b]	65,985	--	17,465	48,520	--	22,432	--	13,127	9,305	--
Cypress[c]	2,067,173	926,937	632,985	442,355	64,896	1,609,134	926,937	520,278	143,500	18,419
Other eastern softwoods[b]	1,293,846	273,068	325,243	624,359	71,176	830,954	273,068	248,092	254,092	55,702
Total	44,048,360	9,036,731	10,729,506	24,133,486	148,637	18,733,463	6,694,865	5,564,647	6,391,682	82,269
Hardwood[c]										
Select white and red oaks	10,719,855	1,903,795	3,839,509	4,150,173	826,378	7,593,286	1,903,795	3,246,481	1,964,293	478,717
Other white and red oaks	12,937,312	1,525,286	3,910,390	5,950,980	1,550,656	8,584,347	1,525,286	3,285,692	3,006,643	766,726
Hickory	2,816,851	267,260	928,910	1,266,419	354,262	1,768,618	267,260	725,150	603,333	172,875
Yellow birch	185,726	26,491	89,280	52,451	17,504	156,990	26,491	78,217	37,226	15,056
Hard maple	519,218	48,727	159,470	226,019	85,002	406,040	48,727	147,288	145,331	64,694
Sweetgum	5,788,275	1,021,532	2,010,740	2,387,002	369,001	3,415,117	1,021,532	1,486,465	749,219	157,901
Ash, walnut, and black cherry	1,641,936	308,628	594,973	660,041	78,294	1,051,821	308,628	486,292	218,974	37,927
Yellow-poplar	12,724,590	3,103,682	4,694,389	4,222,915	703,604	9,014,424	3,103,682	3,605,049	1,898,416	407,277
Other eastern hardwoods	15,207,189	1,795,409	3,997,489	7,199,223	2,215,068	9,392,782	1,795,409	3,118,740	3,202,520	1,276,113
Total	62,540,952	10,000,810	20,225,150	26,115,223	6,199,769	41,383,425	10,000,810	16,179,374	11,825,955	3,377,286
All species	106,589,312	19,037,541	30,954,656	50,248,709	6,348,406	60,116,888	16,695,675	21,744,021	18,217,637	3,459,555

[a] For yellow pines, tree grade is based on "Southern Pine Tree Grades for Yard and Structural Lumber," Research Paper SE-40, published by the Southeastern Forest Experiment Station, Asheville, NC, 1968. Tree grade 4 does not apply to yellow pine.

[b] For other softwoods (excluding cypress), tree grade is based on "Tree Grades for Eastern White Pine," Research Paper NE-214, published by the Northeastern Forest Experiment Station, Radnor, PA, 1971.

[c] For hardwoods and cypress, tree grades 1, 2, and 3 are based on "Hardwood Tree Grades for Factory Lumber," Research Paper NE-333, published by the Northeastern Forest Experiment Station, Radnor, PA, 1976. Grade 4 trees are sawtimber trees not qualifying as tree grades 1, 2, or 3. The butt log of these trees qualify as construction (tie and timber) logs based on "A Guide to Hardwood Log Grading (revised)," General Technical Report NE-1, published by the Northeastern Forest Experiment Station, Radnor, PA, 1971.

Table 23--Volume of live timber and associated green weight of forest biomass on timberland, by class of material, softwood, and hardwood, North Carolina, 1990

Class of material	Volume[a]			Associated green weight[b]		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Hundred thousand pounds*		
Sawtimber trees						
Saw-log portion	19,978,723	8,185,978	11,792,745	15,048,214	5,911,848	9,136,366
Upper stem	2,968,861	873,817	2,095,044	2,237,180	633,660	1,603,520
Total[c]	22,947,584	9,059,795	13,887,789	17,285,394	6,545,508	10,739,886
Poletimber trees[c]	9,794,747	3,470,576	6,324,171	7,024,083	2,490,804	4,533,279
All growing stock[c]	32,742,331	12,530,371	20,211,960	24,309,477	9,036,312	15,273,165
Rough trees[c]	1,554,223	50,140	1,504,083	1,159,367	37,821	1,121,546
Rotten trees[c]	384,440	26,478	357,962	308,233	20,765	287,468
Saplings[d]	5,178,887	987,889	4,190,998	3,751,556	619,823	3,131,733
Stumps, tops, and limbs[e]	7,540,340	2,325,555	5,214,785	5,593,819	1,670,475	3,923,344
Total, all classes	47,400,221	15,920,433	31,479,788	35,122,452	11,385,196	23,737,256

[a] Excludes bark.

[b] Includes bark.

[c] Bole portion only.

[d] Includes entire tree above ground.

[e] Of live trees 5.0 inches d.b.h. and larger.

Table 24--Total volume of live trees on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 1.0–2.9	3.0–4.9	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
						Thousand cubic feet							
Softwood													
Longleaf pine	504,580	5,916	13,498	36,070	50,842	90,152	93,530	96,384	71,031	30,604	9,383	7,170	--
Slash pine	238,395	1,319	13,160	60,074	87,110	49,888	16,147	9,771	926	--	--	--	--
Shortleaf pine	1,588,579	10,285	57,140	150,791	319,708	387,160	313,752	181,614	111,866	38,394	8,994	8,875	--
Loblolly pine	8,202,791	125,924	335,877	948,320	1,334,238	1,329,775	1,110,019	942,815	797,481	540,388	356,054	364,891	17,009
Pond pine	1,005,132	12,288	46,295	106,018	182,874	220,290	170,398	130,091	75,331	34,018	17,400	10,129	--
Virginia pine	2,036,155	36,283	143,428	311,717	512,151	522,109	314,587	147,232	38,790	6,898	2,960	--	--
Pitch pine	244,720	1,294	6,527	10,287	28,144	45,413	59,879	34,550	29,236	12,530	6,965	9,895	--
Table Mountain pine	34,783	449	2,616	7,701	4,429	4,540	1,987	10,975	1,072	--	1,014	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	904,473	19,381	38,191	55,695	72,154	80,056	82,254	98,333	91,532	88,319	83,352	158,314	36,892
Eastern hemlock	293,389	12,037	17,811	25,678	16,786	18,231	23,911	21,804	27,859	34,634	21,168	51,119	22,351
Spruce and fir	27,967	1,335	1,105	4,019	4,226	6,050	5,494	829	3,188	378	--	--	1,343
Baldcypress	419,604	893	4,770	7,243	15,111	20,655	29,624	38,231	40,383	44,012	42,906	123,650	52,126
Pondcypress	154,795	820	1,245	4,803	12,179	25,454	18,067	18,268	14,165	10,735	14,633	23,288	11,138
Cedars	265,070	28,770	49,232	55,079	43,006	40,839	18,585	11,266	4,523	5,634	4,415	2,531	1,190
Total softwoods	15,920,433	256,994	730,895	1,783,495	2,682,958	2,840,612	2,258,234	1,742,163	1,307,383	846,544	569,244	759,862	142,049
Hardwood													
Select white oaks[a]	2,819,826	45,158	100,941	166,068	247,408	318,298	377,508	400,102	334,594	256,487	178,633	315,490	79,139
Select red oaks[b]	1,378,266	12,843	31,364	53,336	73,692	88,260	136,914	158,696	174,115	147,001	150,622	265,490	85,933
Chestnut oak	1,644,813	11,861	38,958	75,456	159,455	194,602	201,080	207,300	191,440	157.766	132,811	217,374	56,710
Other white oaks	452,877	13,800	24,830	44,756	55,098	58,602	62,478	57,594	46,894	29,455	12,219	35,111	12,040
Other red oaks	3,605,537	102,304	158,258	258,294	344,991	427,790	477,296	475,053	384,614	322,146	234,246	344,782	75,763
Hickory	1,358,969	37,641	70,164	113,384	147,269	196,654	169,009	182,987	145,717	107,391	76,665	105,509	6,579
Yellow birch	117,327	2,368	4,469	9,314	13,774	14,486	4,187	11,111	16,553	9,313	5,777	18,708	7,267
Hard maple	252,171	10,480	18,699	20,303	31,203	25,779	20,943	14,990	32,329	30,594	16,062	21,460	9,329
Soft maple	3,992,285	365,043	546,104	518,065	522,535	452,814	438,909	350,910	264,461	214,542	125,445	172,392	21,065
Beech	521,191	14,682	23,203	34,403	34,160	57,759	50,744	54,898	68,027	55,773	38,511	72,275	16,756
Sweetgum	3,026,834	204,358	293,538	337,783	344,129	388,216	366,251	343,957	258,122	177,140	126,230	172,910	14,200
Tupelo and blackgum	3,006,364	131,722	172,850	246,418	288,905	330,243	369,881	342,183	302,916	238,988	162,887	281,299	138,072
Ash	739,832	47,471	58,168	80,114	75,326	90,737	87,088	80,573	58,080	52,138	52,661	53,619	3,857
Cottonwood	39,202	475	3,672	3,905	6,759	2,654	1,105	4,064	6,025	3,760	3,062	3,721	--
Basswood	163,495	3,382	4,463	3,821	13,972	16,112	29,571	26,367	28,143	8,888	16,150	12,626	--
Yellow-poplar	3,985,421	65,903	124,994	201,340	293,925	386,610	505,459	558,870	551,503	432,773	320,665	468,514	74,865
Bay and magnolia	414,995	76,073	70,626	75,334	65,126	62,597	24,976	21,355	8,235	4,478	2,614	3,581	--
Black cherry	229,610	53,119	38,170	36,257	32,174	22,769	11,353	9,542	4,661	8,212	5,860	7,493	--
Black walnut	68,894	747	2,765	3,958	8,107	10,736	17,113	7,813	11,821	3,420	--	2,414	--
Sycamore	131,619	1,033	4,261	8,832	8,923	14,764	12,663	8,543	20,839	12,220	7,025	22,059	10,457
Black locust	362,212	7,612	6,234	20,326	26,675	54,539	57,569	62,546	46,217	29,594	18,139	31,145	1,616
Elm	312,629	20,236	33,142	30,772	42,092	37,271	37,586	33,563	33,059	11,105	11,257	19,705	2,841
Other eastern hardwoods	2,855,419	496,402	636,412	503,964	369,644	272,153	174,818	132,024	89,569	64,876	32,098	74,319	9,140
Total hardwoods	31,479,788	1,724,713	2,466,285	2,846,203	3,205,342	3,524,445	3,634,501	3,545,041	3,077,934	2,378,060	1,729,639	2,721,996	625,629
All species	47,400,221	1,981,707	3,197,180	4,629,698	5,888,300	6,365,057	5,892,735	5,287,204	4,385,317	3,224,604	2,298,883	3,481,858	767,678

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 25--Green weight of forest biomass on timberland, by species and diameter class, North Carolina, 1990

Species	All classes	Diameter class (inches at breast height) 1.0–2.9	3.0–4.9	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
						Hundred thousand pounds							
Softwood													
Longleaf pine	398,901	4,787	11,584	26,179	39,063	70,479	74,320	77,300	57,175	24,576	7,655	5,783	--
Slash pine	186,176	1,011	12,206	45,068	67,887	38,971	12,604	7,677	752	--	--	--	--
Shortleaf pine	1,095,444	5,835	34,637	89,983	217,570	272,713	224,010	130,204	80,161	27,587	6,417	6,327	--
Loblolly pine	5,885,883	62,179	198,020	672,210	979,518	974,236	813,066	688,900	576,196	390,295	256,742	262,370	12,151
Pond pine	707,323	6,718	26,055	73,479	129,844	157,600	122,574	93,623	54,041	24,010	12,297	7,082	--
Virginia pine	1,511,743	31,348	116,430	236,516	373,256	380,770	229,846	107,877	28,481	5,051	2,168	--	--
Pitch pine	163,835	1,021	5,934	6,789	18,842	30,431	39,596	22,723	19,209	8,327	4,499	6,464	--
Table Mountain pine	21,968	385	2,375	4,113	2,608	2,811	1,262	7,055	697	--	662	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	555,249	8,096	17,339	35,414	48,444	53,233	53,985	63,589	58,196	54,388	50,387	92,291	19,887
Eastern hemlock	213,074	7,205	11,322	20,002	14,408	15,830	18,965	17,192	20,515	24,742	14,773	34,297	13,823
Spruce and fir	20,274	796	714	2,754	3,221	4,426	4,084	628	2,450	329	--	--	872
Baldcypress	329,840	476	3,002	3,418	9,238	14,143	21,782	29,386	31,347	35,041	34,687	101,912	45,408
Pondcypress	107,219	318	778	2,175	6,688	15,736	12,034	12,821	10,200	7,980	11,044	18,116	9,329
Cedars	188,267	17,789	31,463	39,386	31,609	30,302	14,529	8,426	3,451	4,706	3,673	2,111	822
Total softwoods	11,385,196	147,964	471,859	1,257,486	1,942,196	2,061,681	1,642,657	1,267,401	942,871	607,032	405,004	536,753	102,292
Hardwood													
Select white oaks[a]	2,289,190	35,706	74,674	117,779	195,404	254,987	305,907	328,356	276,752	213,555	149,751	267,513	68,806
Select red oaks[b]	1,116,181	10,832	23,359	38,886	59,477	72,196	111,964	130,103	142,274	119,852	121,719	215,475	70,044
Chestnut oak	1,288,507	10,806	30,578	53,485	119,350	149,178	154,918	163,389	151,611	125,274	106,765	176,498	46,655
Other white oaks	364,467	10,021	17,044	31,038	43,141	46,795	51,232	48,317	39,671	24,922	10,590	30,934	10,762
Other red oaks	2,992,614	84,010	119,439	188,902	281,789	356,857	400,805	402,984	326,270	273,313	199,562	293,117	65,566
Hickory	1,096,967	32,737	61,417	80,150	112,426	152,683	134,686	149,736	120,589	90,168	64,976	91,408	5,991
Yellow birch	90,664	1,952	3,669	6,599	10,122	10,574	3,300	8,886	12,789	7,211	4,544	15,030	5,988
Hard maple	207,970	8,757	15,628	14,518	24,554	20,896	17,308	12,461	27,263	25,799	13,732	18,629	8,425
Soft maple	2,898,510	276,730	387,194	360,050	389,601	332,004	321,197	257,259	193,139	155,453	89,871	121,541	14,471
Beech	416,223	12,029	19,588	19,992	25,371	45,211	40,626	44,826	55,799	46,107	31,827	60,951	13,896
Sweetgum	2,167,889	136,394	194,825	217,562	243,870	278,900	268,353	255,937	194,192	134,902	96,543	134,927	11,484
Tupelo and blackgum	2,078,769	93,372	120,080	126,041	174,860	211,567	246,520	238,391	219,466	178,262	125,430	224,251	120,529
Ash	458,307	28,952	36,689	59,339	52,166	57,829	52,937	48,818	33,797	29,273	28,720	27,877	1,910
Cottonwood	26,890	328	2,505	2,142	4,384	1,785	761	2,865	4,327	2,726	2,290	2,777	--
Basswood	108,450	2,280	3,052	2,233	8,631	10,546	19,408	17,492	19,031	6,133	10,974	8,670	--
Yellow-poplar	2,813,072	48,681	83,041	121,801	198,622	267,559	355,068	397,282	395,423	313,066	233,619	342,873	56,037
Bay and magnolia	251,338	46,577	43,233	40,532	39,682	39,070	15,673	13,856	5,374	3,051	1,824	2,466	--
Black cherry	141,593	25,432	25,508	21,217	20,993	15,290	7,724	6,586	3,274	5,861	4,200	5,508	--
Black walnut	57,866	613	2,254	3,149	6,569	9,038	14,353	6,530	10,108	3,028	--	2,224	--
Sycamore	94,961	701	2,946	4,288	5,567	9,703	8,917	6,101	15,530	9,428	5,471	17,713	8,596
Black locust	349,350	6,285	5,172	17,342	25,102	51,378	56,014	61,184	46,293	29,434	18,196	31,320	1,630
Elm	202,327	14,760	23,217	18,175	26,060	22,957	23,768	21,672	21,660	7,342	7,537	13,157	2,022
Other eastern hardwoods	2,225,151	414,437	534,229	355,052	273,445	195,535	130,348	101,646	70,523	52,212	26,877	62,858	7,989
Total hardwoods	23,737,256	1,302,392	1,829,341	1,900,272	2,341,186	2,612,538	2,741,787	2,724,677	2,385,155	1,856,372	1,355,018	2,167,717	520,801
All species	35,122,452	1,450,356	2,301,200	3,157,758	4,283,382	4,674,219	4,384,444	3,992,078	3,328,026	2,463,404	1,760,022	2,704,470	623,093

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 26--Volume of growing stock on timberland, by species and forest-type group, North Carolina, 1990

Species	All types	Forest-type group: White pine-hemlock	Spruce-fir	Longleaf-slash	Loblolly-shortleaf	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch
					Thousand cubic feet					
Softwood										
Longleaf pine	418,255	--	--	286,530	56,094	62,904	12,727	--	--	--
Slash pine	182,616	--	--	175,882	4,426	1,849	459	--	--	--
Shortleaf pine	1,289,131	5,611	--	--	882,846	248,311	149,264	2,000	1,099	--
Loblolly pine	6,541,621	--	--	44,691	5,228,196	801,566	279,112	186,609	1,447	--
Pond pine	796,778	--	--	11,080	661,230	76,481	3,225	44,762	--	--
Virginia pine	1,546,314	24,616	--	--	1,206,892	208,501	105,461	--	844	--
Pitch pine	201,879	19,332	--	--	82,193	69,157	31,197	--	--	--
Table mountain pine	27,048	2,290	--	--	13,943	6,062	4,753	--	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--
Eastern white pine	716,907	406,795	--	--	25,044	173,340	111,728	--	--	--
Eastern hemlock	217,147	61,801	856	--	--	54,480	75,331	--	--	24,679
Spruce and fir	20,399	--	14,263	--	--	3,524	1,873	--	--	739
Baldcypress	325,016	--	--	--	3,462	11,367	1,612	306,470	2,105	--
Pondcypress	110,861	--	--	--	2,462	8,163	541	99,695	--	--
Cedars	136,399	--	--	--	27,527	16,751	22,020	69,517	584	--
Total softwoods	12,530,371	520,445	15,119	518,183	8,194,315	1,742,456	799,303	709,053	6,079	25,418
Hardwood										
Select white oaks[a]	2,065,313	19,580	--	374	98,958	250,747	1,585,032	106,600	3,325	697
Select red oaks[b]	1,031,527	4,865	--	--	20,988	60,258	867,422	33,860	4,237	39,897
Chestnut oak	1,195,775	14,139	--	--	6,399	57,806	1,110,583	601	--	6,247
Other white oaks	303,495	--	--	443	38,306	42,157	178,540	42,908	1,141	--
Other red oaks	2,541,242	19,865	--	3,527	158,850	387,370	1,538,408	416,362	8,586	8,274
Hickory	960,843	1,925	--	348	32,820	82,013	788,723	40,707	6,712	7,595
Yellow birch	67,884	10,083	929	--	--	5,900	14,119	--	--	36,853
Hard maple	173,114	--	--	--	334	321	70,031	1,723	--	100,705
Soft maple	2,158,616	16,849	--	1,196	157,113	192,602	981,017	752,763	38,102	18,974
Beech	355,366	4,353	--	--	4,991	30,046	222,995	18,735	1,014	73,232
Sweetgum	2,051,008	--	--	1,489	280,267	238,815	802,844	694,535	33,058	--
Tupelo and blackgum	1,936,774	1,059	--	1,466	48,880	111,007	196,958	1,572,574	4,830	--
Ash	487,671	--	--	--	3,487	7,919	141,858	278,874	29,951	25,582
Cottonwood	28,221	--	--	--	--	--	--	25,150	3,071	--
Basswood	129,950	1,119	--	--	250	2,803	85,559	284	--	39,935
Yellow-poplar	3,271,174	26,449	--	924	226,342	344,976	2,429,045	198,931	26,402	18,105
Bay and magnolia	178,460	1,179	--	--	23,081	10,410	37,137	100,253	--	6,400
Black cherry	85,439	--	--	434	11,603	6,184	51,365	2,949	2,672	10,232
Black walnut	48,826	1,346	--	--	--	4,216	33,767	7,781	1,716	--
Sycamore	102,994	--	--	--	3,178	1,317	31,478	11,293	55,728	--
Black locust	230,870	2,096	--	--	1,720	5,965	207,667	--	1,906	11,516
Elm	199,504	--	--	816	12,360	7,646	68,546	94,848	14,551	737
Other eastern hardwoods	607,894	10,052	--	224	8,888	24,255	379,898	75,958	68,832	39,787
Total hardwoods	20,211,960	134,959	929	11,241	1,138,815	1,874,733	11,822,992	4,477,689	305,834	444,768
All species	32,742,331	655,404	16,048	529,424	9,333,130	3,617,189	12,622,295	5,186,742	311,913	470,186

[a] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[b] Includes cherrybark, northern red, and shumard oaks.

Table 27--Volume of growing stock on timberland, by ownership class, species group, and diameter class, North Carolina, 1990

Ownership class and species group	All classes	Diameter class (inches at breast height) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0 and larger
					Thousand cubic feet						
National forest											
Softwood	545,562	29,318	53,974	74,582	77,276	84,052	61,881	46,365	27,624	57,957	32,533
Hardwood	1,913,044	105,831	169,928	231,740	214,897	224,641	247,047	191,902	160,971	292,861	73,226
Total	2,458,606	135,149	223,902	306,322	292,173	308,693	308,928	238,267	188,595	350,818	105,759
Other public											
Softwood	754,999	62,322	118,652	155,879	132,708	101,757	75,794	39,972	24,592	36,729	6,594
Hardwood	781,186	71,709	100,762	118,095	105,537	107,765	68,867	82,948	51,722	67,354	6,427
Total	1,536,185	134,031	219,414	273,974	238,245	209,522	144,661	122,920	76,314	104,083	13,021
Forest industry											
Softwood	1,884,476	298,619	492,027	415,312	249,720	144,403	86,397	63,655	41,939	78,951	13,453
Hardwood	1,432,828	153,826	200,322	176,505	192,250	160,942	137,566	133,522	101,229	147,112	29,554
Total	3,317,304	452,445	692,349	591,817	441,970	305,345	223,963	197,177	143,168	226,063	43,007
Forest industry–leased											
Softwood	208,067	26,420	70,102	63,564	32,992	10,045	3,808	545	591	--	--
Hardwood	19,337	3,937	4,728	3,886	2,825	480	2,250	571	660	--	--
Total	227,404	30,357	74,830	67,450	35,817	10,525	6,058	1,116	1,251	--	--
Other private											
Softwood	9,137,267	854,087	1,465,055	1,716,709	1,466,552	1,183,991	919,744	591,038	403,607	482,858	53,626
Hardwood	16,065,565	1,178,301	1,711,148	2,093,453	2,310,706	2,333,775	2,016,021	1,490,603	1,063,479	1,576,924	291,155
Total	25,202,832	2,032,388	3,176,203	3,810,162	3,777,258	3,517,766	2,935,765	2,081,641	1,467,086	2,059,782	344,781
All ownerships											
Softwood	12,530,371	1,270,766	2,199,810	2,426,046	1,959,248	1,524,248	1,147,624	741,575	498,353	656,495	106,206
Hardwood	20,211,960	1,513,604	2,186,888	2,623,679	2,826,215	2,827,603	2,471,751	1,899,546	1,378,061	2,084,251	400,362
Total	32,742,331	2,784,370	4,386,698	5,049,725	4,785,463	4,351,851	3,619,375	2,641,121	1,876,414	2,740,746	506,568

Table 28--Volume of sawtimber on timberland, by ownership class, species group, and diameter class, North Carolina, 1990

Ownership class and species group	All classes	Diameter class (inches at breast height) 9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0 and larger
				Thousand board feet					
National forest									
Softwood	2,399,751	270,846	343,146	423,225	339,077	267,162	168,238	368,921	219,136
Hardwood	6,402,161	--	738,751	896,885	1,083,536	899,886	807,536	1,558,225	417,342
Total	8,801,912	270,846	1,081,897	1,320,110	1,422,613	1,167,048	975,774	1,927,146	636,478
Other public									
Softwood	2,815,078	582,245	603,282	528,529	425,892	238,184	152,005	239,469	45,472
Hardwood	2,164,499	--	360,781	428,128	302,461	399,490	265,709	369,066	38,864
Total	4,979,577	582,245	964,063	956,657	728,353	637,674	417,714	608,535	84,336
Forest industry									
Softwood	5,014,958	1,484,744	1,115,241	732,699	475,335	371,409	249,582	498,736	87,212
Hardwood	4,051,298	--	645,289	635,624	613,936	638,949	513,950	816,202	187,348
Total	9,066,256	1,484,744	1,760,530	1,368,323	1,089,271	1,010,358	763,532	1,314,938	274,560
Forest industry–leased									
Softwood	453,555	226,485	147,006	51,987	21,058	3,303	3,716	--	--
Hardwood	27,353	--	9,007	2,050	9,976	3,169	3,151	--	--
Total	480,908	226,485	156,013	54,037	31,034	6,472	6,867	--	--
Other private									
Softwood	33,365,018	6,247,733	6,539,426	6,018,303	5,115,835	3,497,534	2,488,535	3,099,175	358,477
Hardwood	49,895,641	--	7,967,007	9,474,005	9,111,604	7,279,531	5,488,400	8,776,770	1,798,324
Total	83,260,659	6,247,733	14,506,433	15,492,308	14,227,439	10,777,065	7,976,935	11,875,945	2,156,801
All ownerships									
Softwood	44,048,360	8,812,053	8,748,101	7,754,743	6,377,197	4,377,592	3,062,076	4,206,301	710,297
Hardwood	62,540,952	--	9,720,835	11,436,692	11,121,513	9,221,025	7,078,746	11,520,263	2,441,878
Total	106,589,312	8,812,053	18,468,936	19,191,435	17,498,710	13,598,617	10,140,822	15,726,564	3,152,175

Table 29--Volume of growing stock on timberland, by broad management class, species group, and stand-age class, North Carolina, 1990

Broad management class and species group	All classes	No manageable stand	Stand-age class (years)								
			0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81+
			Thousand cubic feet								
Pine plantation											
Softwood	2,127,048	2,921	35,806	701,267	1,010,594	362,555	--	13,905	--	--	--
Hardwood	126,317	--	5,176	33,526	51,697	27,490	--	8,428	--	--	--
Total	2,253,365	2,921	40,982	734,793	1,062,291	390,045	--	22,333	--	--	--
Natural pine											
Softwood	7,121,014	116,697	62,051	292,751	720,158	1,725,471	1,617,834	1,345,300	654,742	385,662	200,348
Hardwood	1,159,627	7,085	12,869	37,142	86,055	210,559	249,820	259,863	148,100	81,510	66,624
Total	8,280,641	123,782	74,920	329,893	806,213	1,936,030	1,867,654	1,605,163	802,842	467,172	266,972
Oak-pine											
Softwood	1,742,456	117,085	47,135	89,087	97,875	153,626	269,438	335,030	292,877	114,866	225,437
Hardwood	1,874,733	61,176	62,762	76,084	81,763	137,432	345,518	403,648	298,358	154,298	253,694
Total	3,617,189	178,261	109,897	165,171	179,638	291,058	614,956	738,678	591,235	269,164	479,131
Upland hardwood											
Softwood	824,721	59,324	25,294	37,927	31,283	69,545	86,204	159,572	139,506	112,173	103,893
Hardwood	12,267,760	571,850	210,503	264,025	313,777	741,136	1,493,960	2,352,191	2,269,919	1,806,311	2,244,088
Total	13,092,481	631,174	235,797	301,952	345,060	810,681	1,580,164	2,511,763	2,409,425	1,918,484	2,347,981
Lowland hardwood											
Softwood	715,132	43,249	8,194	15,480	18,725	35,192	69,963	83,789	91,562	112,074	236,904
Hardwood	4,783,523	228,079	50,214	80,742	129,621	262,754	520,440	833,404	843,050	658,624	1,176,595
Total	5,498,655	271,328	58,408	96,222	148,346	297,946	590,403	917,193	934,612	770,698	1,413,499
All classes											
Softwood	12,530,371	339,276	178,480	1,136,512	1,878,635	2,346,389	2,043,439	1,937,596	1,178,687	724,775	766,582
Hardwood	20,211,960	868,190	341,524	491,519	662,913	1,379,371	2,609,738	3,857,534	3,559,427	2,700,743	3,741,001
Total	32,742,331	1,207,466	520,004	1,628,031	2,541,548	3,725,760	4,653,177	5,795,130	4,738,114	3,425,518	4,507,583

Table 30--Average net annual growth and removals of live timber and growing stock on timberland, by species, North Carolina, 1984-1989

Species	Live timber[a]		Growing stock	
	Net annual growth	Annual timber removals	Net annual growth	Annual timber removals
	Thousand cubic feet			
Softwood				
Yellow pines	546,874	483,555	545,975	482,423
Eastern white pine	23,089	16,627	22,993	16,627
Spruce and fir	637	--	631	--
Cypress	9,358	8,192	9,302	7,864
Other eastern softwoods	11,038	4,974	10,918	4,852
Total softwoods	590,996	513,348	589,819	511,766
Hardwood				
Select white and red oaks	83,814	70,470	83,453	67,810
Other white and red oaks	108,348	89,033	107,204	85,623
Hickory	20,359	17,097	20,154	16,194
Yellow birch	1,047	105	1,025	105
Hard maple	3,811	454	3,759	429
Sweetgum	70,833	63,916	70,051	61,703
Ash, walnut, and black cherry	19,786	12,144	18,967	10,730
Yellow-poplar	106,814	82,026	106,302	81,039
Tupelo and blackgum	32,929	35,989	32,193	33,264
Bay and magnolia	8,884	2,579	8,314	1,990
Other eastern hardwoods	129,701	87,134	118,338	68,967
Total hardwoods	586,326	460,947	569,760	427,854
All species	1,177,322	974,295	1,159,579	939,620

[a] Merchantable portion only.

Table 31--Average net annual growth and removals of growing stock on timberland, by ownership class, softwood, and hardwood, North Carolina, 1984-1989

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet					
National forest	50,245	14,763	35,482	25,171	5,465	19,706
Other public	50,123	29,085	21,038	23,079	15,520	7,559
Forest industry	199,825	153,178	46,647	132,857	92,791	40,066
Forest industry-leased	17,967	16,925	1,042	8,921	8,748	173
Other private	841,419	375,868	465,551	749,592	389,242	360,350
All ownerships	1,159,579	589,819	569,760	939,620	511,766	427,854

Table 32--Average net annual growth and removals of sawtimber on timberland, by species, North Carolina, 1984-1989

Species	Net annual growth	Annual timber removals
	Thousand board feet	
Softwood		
Yellow pines	2,234,101	1,881,859
Eastern white pine	140,296	81,621
Spruce and fir	2,508	--
Cypress	47,496	38,691
Other eastern softwoods	44,526	12,987
Total softwoods	2,468,927	2,015,158
Hardwood		
Select white and red oaks	389,945	247,284
Other white and red oaks	473,953	287,162
Hickory	83,706	58,689
Yellow birch	2,828	431
Hard maple	12,799	979
Sweetgum	242,031	190,818
Ash, walnut, and black cherry	65,043	29,487
Yellow-poplar	533,925	352,287
Tupelo and blackgum	143,375	109,219
Bay and magnolia	21,416	3,769
Other eastern hardwoods	346,814	180,446
Total hardwoods	2,315,835	1,460,571
All species	4,784,762	3,475,729

Table 33--Average net annual growth and removals of sawtimber on timberland, by ownership class, softwood, and hardwood, North Carolina, 1984-1989

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand board feet					
National forest	235,955	71,461	164,494	90,326	22,535	67,791
Other public	211,403	127,736	83,667	78,528	51,728	26,800
Forest industry	689,381	549,868	139,513	407,520	267,284	140,236
Forest industry-leased	77,722	76,308	1,414	15,977	15,977	--
Other private	3,570,301	1,643,554	1,926,747	2,883,378	1,657,634	1,225,744
All ownerships	4,784,762	2,468,927	2,315,835	3,475,729	2,015,158	1,460,571

Table 34--Average annual mortality of live timber, growing stock, and sawtimber on timberland, by species, North Carolina, 1984-1989

Species	Live timber[a]	Growing stock	Sawtimber
	Thousand cubic feet		*Thousand board feet*
Softwood			
Yellow pines	108,725	107,345	268,561
Eastern white pine	4,479	4,479	22,311
Spruce and fir	647	647	2,263
Cypress	948	781	3,253
Other eastern softwoods	3,672	3,204	6,847
Total softwoods	118,471	116,456	303,235
Hardwood			
Select white and red oaks	19,305	16,686	53,108
Other white and red oaks	63,071	52,975	160,101
Hickory	12,758	11,235	36,784
Yellow birch	745	537	367
Hard maple	1,293	787	2,764
Sweetgum	10,747	9,370	23,385
Ash, walnut, and black cherry	7,947	6,435	14,983
Yellow-poplar	12,679	12,024	29,750
Tupelo and blackgum	10,665	7,209	15,988
Bay and magnolia	2,545	1,292	3,241
Other eastern hardwoods	53,677	31,150	70,886
Total hardwoods	195,432	149,700	411,357
All species	313,903	266,156	714,592

[a] Merchantable portion only.

Table 35--Average annual mortality of growing stock and sawtimber on timberland, by ownership class, softwood, and hardwood, North Carolina, 1984-1989

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*		
National forest	22,465	5,437	17,028	71,913	18,894	53,019
Other public	9,782	5,256	4,526	25,652	11,416	14,236
Forest industry	23,091	10,884	12,207	56,955	16,898	40,057
Forest industry-leased	1,807	1,705	102	2,380	2,380	--
Other private	209,011	93,174	115,837	557,692	253,647	304,045
All ownerships	266,156	116,456	149,700	714,592	303,235	411,357

Table 36--Average annual mortality of growing stock and sawtimber on timberland, by cause of death, softwood, and hardwood, North Carolina, 1984-1989

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*		
Fire	5,110	3,504	1,606	11,659	8,491	3,168
Insects	31,821	26,603	5,218	100,408	84,286	16,122
Disease	35,808	9,606	26,202	102,270	22,189	80,081
Weather	74,754	35,737	39,017	258,280	122,546	135,734
Suppression	34,104	16,719	17,385	20,074	7,048	13,026
Animals	3,106	59	3,047	9,567	273	9,294
Undetermined	81,453	24,228	57,225	212,334	58,402	153,932
All causes	266,156	116,456	149,700	714,592	303,235	411,357

Table 37--Average annual output of timber products, by product, species group, and type of material, North Carolina, 1984–1989

Product and species group	Standard units	Total output		Roundwood products		Plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Saw logs	*k fbm*[a]						
Softwood		1,187,611	213,984	1,132,871	204,121	54,740	9,863
Hardwood		706,432	116,959	699,275	115,774	7,157	1,185
Total		1,894,043	330,943	1,832,146	319,895	61,897	11,048
Veneer logs and bolts	*k fbm*[a]						
Softwood		280,422	48,769	280,422	48,769	--	--
Hardwood		138,052	21,913	138,052	21,913	--	--
Total		418,474	70,682	418,474	70,682	--	--
Pulpwood[b]	*Cords*[c]						
Softwood		3,738,257	271,223	2,721,033	197,420	1,017,224	73,803
Hardwood		2,281,148	174,812	1,945,863	149,118	335,285	25,694
Total		6,019,405	446,035	4,666,896	346,538	1,352,509	99,497
Poles and piling	*h pieces*						
Softwood		1,515	1,863	1,515	1,863	--	--
Hardwood		--	--	--	--	--	--
Total		1,515	1,863	1,515	1,863	--	--
Posts (round and split)	*k pieces*						
Softwood		3,459	1,153	3,459	1,153	--	--
Hardwood		4,243	2,700	4,243	2,700	--	--
Total		7,702	3,853	7,702	3,853	--	--
Other[d]	*k ft*^{3}						
Softwood		46,012	46,012	10,681	10,681	35,331	35,331
Hardwood		29,553	29,553	13,969	13,969	15,584	15,584
Total		75,565	75,565	24,650	24,650	50,915	50,915
Total industrial products							
Softwood		--	583,004	--	464,007	--	118,997
Hardwood		--	345,937	--	303,474	--	42,463
Total		--	928,941	--	767,481	--	161,460
Fuelwood[e]	*Cords*						
Softwood		181,825	13,192	166,016	12,045	15,809	1,147
Hardwood		1,226,568	93,996	1,187,590	91,009	38,978	2,987
Total		1,408,393	107,188	1,353,606	103,054	54,787	4,134
All products							
Softwood		--	596,196	--	476,052	--	120,144
Hardwood		--	439,933	--	394,483	--	45,450
Total		--	1,036,129	--	870,535	--	165,594

[a] International 1/4–inch rule.

[b] Roundwood figures include an estimated 17,752,000 cubic feet of roundwood chipped at other primary wood–using plants.

[c] Rough–wood basis (includes chips converted to equivalent standard cords).

[d] Includes litter, mulch, particleboard, charcoal, and other specialty products.

[e] Excludes approximately 74,855,000 cubic feet of wood residues and 53,831,000 cubic feet of bark used for industrial fuel.

Table 46--Area of timberland, by county and ownership class, North Carolina, 1990--Continued

County	All ownerships	National forest	Other public	Forest industry[a]	Other private
			Acres		
Lee	108,109	--	208	7,432	100,469
Lenoir	125,530	--	755	11,756	113,019
Lincoln	90,826	--	132	680	90,014
McDowell	239,261	67,611	820	20,123	150,707
Macon	269,638	140,303	29	522	128,784
Madison	211,293	50,568	1,453	412	158,860
Martin	175,218	--	763	62,948	111,507
Mecklenburg	132,831	--	2,507	--	130,324
Mitchell	105,101	17,498	2,849	1,513	83,241
Montgomery	256,555	36,807	286	34,487	184,975
Moore	334,158	--	7,824	54,466	271,868
Nash	180,496	--	184	7,955	172,357
New Hanover	49,329	--	3,822	3,509	41,998
Northampton	211,383	--	698	29,224	181,461
Onslow	343,657	--	105,976	110,104	127,577
Orange	146,622	--	4,462	1,798	140,362
Pamlico	132,421	--	1,099	47,058	84,264
Pasquotank	49,813	--	4,139	3,666	42,008
Pender	459,450	--	62,568	232,742	164,140
Perquimans	76,070	--	661	22,730	52,679
Person	149,798	--	685	6,685	142,428
Pitt	208,306	--	476	21,966	185,864
Polk	118,359	--	5,489	12,926	99,944
Randolph	311,657	4,140	1,069	4,448	302,000
Richmond	237,353	--	32,258	40,028	165,067
Robeson	280,949	--	898	34,127	245,924
Rockingham	208,080	--	1,448	1,013	205,619
Rowan	150,498	--	748	616	149,134
Rutherford	267,970	--	598	28,842	238,530
Sampson	338,055	--	424	43,731	293,900
Scotland	123,144	--	22,619	10,548	89,977
Stanly	111,927	--	425	3,694	107,808
Stokes	183,554	--	339	865	182,350
Surry	189,185	--	877	578	187,730
Swain	101,754	20,877	29,515	119	51,243
Transylvania	203,070	76,916	1,122	--	125,032
Tyrrell	153,112	--	5,795	36,362	110,955
Union	178,026	--	1,587	2,298	174,141
Vance	102,275	--	9,322	3,417	89,536
Wake	246,464	--	15,821	2,012	228,631
Warren	195,445	--	1,008	33,321	161,116
Washington	87,254	--	1,422	41,366	44,466
Watauga	126,867	393	252	6,048	120,174
Wayne	144,623	--	1,340	3,247	140,036
Wilkes	341,422	--	10,229	23,620	307,573
Wilson	100,588	--	838	1,894	97,856
Yadkin	91,905	--	209	463	91,233
Yancey	157,117	35,051	60	1,962	120,044
Total	18,710,381	1,082,380	920,283	2,420,378	14,287,340

[a] Includes 168,261 acres of other private land under long-term lease.

Table 47--Area of timberland, by county and broad management class, North Carolina, 1990

County	All ownerships	Pine plantation	Natural pine	Oak–pine	Upland hardwood	Lowland hardwood
			Acres			
Alamance	126,888	3,303	29,733	6,850	77,091	9,911
Alexander	100,729	--	37,077	18,035	45,617	--
Alleghany	70,596	8,225	4,112	8,226	50,033	--
Anson	248,527	67,033	70,026	40,111	61,183	10,174
Ashe	166,423	--	5,099	10,348	150,976	--
Avery	114,418	--	5,445	6,939	102,034	--
Beaufort	323,964	153,721	56,868	36,596	30,969	45,810
Bertie	311,563	58,941	62,989	35,743	59,325	94,565
Bladen	416,315	96,529	116,003	57,866	35,050	110,867
Brunswick	407,162	132,479	113,103	35,659	24,497	101,424
Buncombe	266,786	--	10,179	19,563	237,044	--
Burke	235,508	1,543	70,453	60,240	103,272	--
Cabarrus	108,406	7,905	32,541	8,610	51,384	7,966
Caldwell	232,783	5,773	44,296	39,508	143,206	--
Camden	74,511	--	8,673	2,744	26,015	37,079
Carteret	157,678	15,324	82,860	19,442	10,133	29,919
Caswell	165,055	6,852	55,240	31,625	55,830	15,508
Catawba	115,396	18,106	28,786	18,107	45,871	4,526
Chatham	302,103	28,127	78,415	58,794	122,676	14,091
Cherokee	251,890	12,179	46,308	46,440	146,963	--
Chowan	53,678	14,756	10,432	10,154	15,548	2,788
Clay	103,253	4,508	13,140	8,887	76,718	--
Cleveland	138,801	12,678	24,640	34,765	66,718	--
Columbus	420,770	115,706	76,477	31,789	46,471	150,327
Craven	310,504	66,148	60,994	65,301	23,169	94,892
Cumberland	233,266	1,935	104,450	48,867	27,870	50,144
Currituck	63,038	5,718	15,260	11,645	8,694	21,721
Dare	142,212	--	69,889	8,049	9	64,265
Davidson	181,866	7,308	26,410	27,175	113,481	7,492
Davie	75,257	8,006	18,680	--	35,229	13,342
Duplin	291,037	28,140	69,611	58,525	59,733	75,028
Durham	89,242	2,278	28,255	14,303	31,363	13,043
Edgecombe	149,103	14,760	25,668	16,362	35,672	56,641
Forsyth	112,697	3,607	25,250	18,253	58,372	7,215
Franklin	191,027	32,700	51,555	27,731	67,156	11,885
Gaston	111,665	--	36,070	23,567	48,777	3,251
Gates	144,759	30,622	26,430	21,667	16,811	49,229
Graham	164,174	--	15,667	5,752	142,755	--
Granville	225,121	20,580	63,961	17,131	109,745	13,704
Greene	78,228	2,883	14,436	8,649	23,083	29,177
Guilford	164,815	5,802	43,942	14,018	81,232	19,821
Halifax	279,652	48,047	55,553	46,860	77,193	51,999
Harnett	221,237	38,926	44,384	40,444	71,230	26,253
Haywood	180,188	7,083	3,942	18,987	150,176	--
Henderson	150,188	--	14,409	33,091	102,688	--
Hertford	147,420	34,612	27,814	31,557	31,556	21,881
Hoke	162,933	12,075	48,286	58,403	16,028	28,141
Hyde	235,119	21,145	111,939	26,096	9,868	66,071
Iredell	161,551	8,866	31,661	4,318	108,071	8,635
Jackson	263,288	--	10,173	9,797	243,318	--
Johnston	239,997	22,478	61,137	35,865	49,670	70,847
Jones	221,076	94,190	47,069	13,534	11,750	54,533

Continued

Table 47--Area of timberland, by county and broad management class, North Carolina, 1990--Continued

County	All ownerships	Pine plantation	Natural pine	Oak–pine	Upland hardwood	Lowland hardwood
			Acres			
Lee	108,109	10,738	9,419	20,324	61,349	6,279
Lenoir	125,530	15,900	11,657	14,262	14,127	69,584
Lincoln	90,826	7,348	23,359	10,002	43,450	6,667
McDowell	239,261	390	51,459	28,881	153,507	5,024
Macon	269,638	--	8,254	33,842	227,542	--
Madison	211,293	--	22,795	18,499	169,999	--
Martin	175,218	41,116	20,822	34,690	21,085	57,505
Mecklenburg	132,831	4,204	42,925	9,293	72,205	4,204
Mitchell	105,101	--	5,202	3,499	96,400	--
Montgomery	256,555	51,864	42,547	51,750	99,295	11,099
Moore	334,158	50,454	89,473	52,938	111,588	29,705
Nash	180,496	17,509	38,633	38,311	50,291	35,752
New Hanover	49,329	--	21,013	8,152	6,462	13,702
Northampton	211,383	20,813	43,125	36,698	69,112	41,635
Onslow	343,657	81,505	120,647	38,619	21,454	81,432
Orange	146,622	4,129	34,259	17,743	73,638	16,853
Pamlico	132,421	19,365	60,662	8,641	13,064	30,689
Pasquotank	49,813	916	5,585	916	14,920	27,476
Pender	459,450	112,289	155,100	56,659	14,920	120,482
Perquimans	76,070	28,206	--	11,691	13,993	22,180
Person	149,798	4,457	34,645	15,398	83,750	11,548
Pitt	208,306	30,176	35,382	34,073	42,106	66,569
Polk	118,359	6,512	27,984	35,191	48,672	--
Randolph	311,657	6,855	25,522	36,146	238,880	4,254
Richmond	237,353	52,149	69,319	38,797	64,389	12,699
Robeson	280,949	15,548	64,083	40,278	35,063	125,977
Rockingham	208,080	6,476	90,734	15,577	82,831	12,462
Rowan	150,498	8,902	24,858	24,856	79,354	12,528
Rutherford	267,970	27,191	74,760	54,881	99,211	11,927
Sampson	338,055	36,165	82,263	64,929	68,926	85,772
Scotland	123,144	24,992	43,492	19,545	30,251	4,864
Stanly	111,927	7,714	28,750	10,355	61,514	3,594
Stokes	183,554	136	50,299	17,878	111,665	3,576
Surry	189,185	--	33,129	33,129	115,565	7,362
Swain	101,754	--	19,747	3,416	78,591	--
Transylvania	203,070	5,954	5,954	41,678	149,484	--
Tyrrell	153,112	16,782	41,869	19,682	--	74,779
Union	178,026	5,781	27,873	29,440	101,001	13,931
Vance	102,275	13,431	25,771	11,203	47,393	4,477
Wake	246,464	5,530	87,068	21,351	100,859	31,656
Warren	195,445	8,764	55,313	28,196	93,301	9,871
Washington	87,254	26,555	4,446	6,882	6,730	42,641
Watauga	126,867	--	9,614	1,512	115,741	--
Wayne	144,623	8,938	26,190	22,236	63,423	23,836
Wilkes	341,422	9,320	81,504	63,937	186,661	--
Wilson	100,588	18,202	13,591	8,157	40,773	19,865
Yadkin	91,905	3,650	22,479	18,247	40,231	7,298
Yancey	157,117	--	14,016	14,819	128,282	--
Total	18,710,381	2,098,523	4,163,381	2,580,187	7,202,371	2,665,919

Table 48--Merchantable volume of live timber 5.0 inches d.b.h. and larger on timberland, by county and species group, North Carolina, 1990

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Alamance	245,681	62,236	684	87,439	95,322
Alexander	163,398	71,277	5,276	40,182	46,663
Alleghany	134,163	2,145	23,283	37,693	71,042
Anson	381,154	231,551	911	81,875	66,817
Ashe	339,726	10,044	14,842	115,099	199,741
Avery	275,536	--	18,167	104,039	153,330
Beaufort	594,205	330,778	11,279	182,347	69,801
Bertie	664,950	198,645	26,669	310,337	129,299
Bladen	510,502	227,665	23,681	172,271	86,885
Brunswick	508,566	254,739	62,547	127,562	63,718
Buncombe	635,657	30,916	16,819	167,361	420,561
Burke	384,115	78,525	112,969	83,403	109,218
Cabarrus	160,370	67,709	5,101	33,637	53,923
Caldwell	466,552	35,934	104,069	115,613	210,936
Camden	181,951	34,495	6,863	122,115	18,478
Carteret	239,139	156,427	778	62,160	19,774
Caswell	320,331	131,880	1,587	95,548	91,316
Catawba	184,841	59,101	11,129	29,705	84,906
Chatham	545,069	243,802	7,826	151,929	141,512
Cherokee	501,223	82,423	81,174	80,973	256,653
Chowan	98,337	50,457	1,376	36,594	9,910
Clay	188,043	56,316	3,064	25,624	103,039
Cleveland	218,672	61,063	1,044	60,402	96,163
Columbus	828,058	377,278	26,967	311,323	112,490
Craven	549,656	279,550	11,709	193,196	65,201
Cumberland	340,243	196,314	14,822	78,346	50,761
Currituck	124,325	49,811	7,979	59,436	7,099
Dare	296,718	118,835	24,459	130,598	22,826
Davidson	305,356	71,725	2,196	107,290	124,145
Davie	138,149	26,458	2,773	50,365	58,553
Duplin	459,255	163,941	6,850	198,088	90,376
Durham	248,968	111,771	1,293	75,671	60,233
Edgecombe	251,761	81,116	5,512	94,336	70,797
Forsyth	274,511	67,308	689	98,812	107,702
Franklin	327,909	179,572	447	70,177	77,713
Gaston	228,913	88,160	262	69,965	70,526
Gates	325,534	106,925	20,770	165,901	31,938
Graham	411,896	25,472	51,960	134,984	199,480
Granville	493,276	193,629	2,006	163,258	134,383
Greene	112,305	32,358	6,304	29,507	44,136
Guilford	365,919	125,833	979	160,187	78,920
Halifax	526,854	203,384	3,797	193,996	125,677
Harnett	303,961	139,091	428	73,840	90,602
Haywood	484,582	16,217	65,824	143,752	258,789
Henderson	389,558	39,388	47,254	101,969	200,947
Hertford	275,453	97,346	6,201	113,197	58,709
Hoke	175,560	109,531	1,219	43,662	21,148
Hyde	415,169	242,377	13,109	140,692	18,991
Iredell	221,666	67,818	2,270	68,671	82,907
Jackson	569,184	9,942	35,770	137,148	386,324
Johnston	456,177	160,747	1,111	153,374	140,945
Jones	330,535	176,827	14,801	79,431	59,476

Continued

Table 48--Merchantable volume of live timber 5.0 inches d.b.h. and larger on timberland, by county and species group, North Carolina, 1990--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Lee	205,473	67,761	1,080	66,382	70,250
Lenoir	215,730	47,148	12,478	87,543	68,561
Lincoln	165,080	51,912	671	52,848	59,649
McDowell	542,548	74,381	34,738	119,125	314,304
Macon	638,719	33,432	28,533	159,068	417,686
Madison	529,143	37,171	62,885	176,756	252,331
Martin	377,364	88,230	31,525	210,182	47,427
Mecklenburg	279,764	91,530	9,656	100,322	78,256
Mitchell	307,196	4,871	16,220	118,410	167,695
Montgomery	411,999	181,824	638	97,314	132,223
Moore	524,302	283,280	11,450	95,491	134,081
Nash	354,019	157,775	7,320	110,009	78,915
New Hanover	52,359	18,823	4,718	17,011	11,807
Northampton	366,187	144,688	2,786	118,068	100,645
Onslow	485,764	250,120	6,955	154,156	74,533
Orange	362,285	111,194	934	138,262	111,895
Pamlico	224,084	117,543	3,290	80,440	22,811
Pasquotank	112,302	26,146	6,497	73,729	5,930
Pender	611,929	340,503	28,527	153,800	89,099
Perquimans	132,957	37,391	7,706	57,809	30,051
Person	253,287	77,437	4,458	73,685	97,707
Pitt	400,343	129,999	27,641	190,505	52,198
Polk	205,271	66,265	1,753	41,863	95,390
Randolph	473,952	54,631	3,460	137,447	278,414
Richmond	317,703	192,189	526	81,474	43,514
Robeson	573,174	154,388	29,447	310,730	78,609
Rockingham	423,938	206,438	--	87,414	130,086
Rowan	305,205	87,470	4,239	94,458	119,038
Rutherford	437,540	189,344	3,616	70,084	174,496
Sampson	410,689	167,278	6,300	159,709	77,402
Scotland	154,845	103,036	6,668	32,815	12,326
Stanly	160,771	58,051	542	39,822	62,356
Stokes	380,926	116,364	1,179	114,802	148,581
Surry	339,671	72,786	12,022	88,856	166,007
Swain	218,786	33,742	599	77,568	106,877
Transylvania	519,041	13,885	46,853	133,910	324,393
Tyrrell	293,859	107,801	25,697	142,156	18,205
Union	264,014	75,690	3,137	57,329	127,858
Vance	204,204	91,083	--	64,642	48,479
Wake	594,483	223,622	--	221,476	149,385
Warren	423,479	169,380	436	154,941	98,722
Washington	176,604	39,569	17,223	101,974	17,838
Watauga	288,718	--	20,277	105,513	162,928
Wayne	245,532	110,932	--	71,440	63,160
Wilkes	759,742	171,892	105,844	201,097	280,909
Wilson	192,805	55,159	2,525	71,845	63,276
Yadkin	187,317	57,712	2,398	44,055	83,152
Yancey	402,259	7,125	44,800	100,596	249,738
Total	34,680,994	11,035,843	1,571,146	11,024,011	11,049,994

Table 49--Volume of growing stock on timberland, by county and species group, North Carolina, 1990

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Alamance	234,225	62,236	684	83,633	87,672
Alexander	154,903	70,947	5,276	38,977	39,703
Alleghany	122,338	2,145	22,768	32,136	65,289
Anson	371,770	231,551	911	77,509	61,799
Ashe	313,647	10,044	14,095	105,736	183,772
Avery	256,289	--	18,167	99,250	138,872
Beaufort	575,787	330,626	11,279	172,256	61,626
Bertie	626,369	198,339	24,106	287,843	116,081
Bladen	484,002	226,585	21,292	157,620	78,505
Brunswick	485,974	253,558	62,413	115,379	54,624
Buncombe	557,173	27,978	16,819	158,017	354,359
Burke	356,151	76,421	111,103	74,116	94,511
Cabarrus	154,772	67,324	5,101	32,266	50,081
Caldwell	436,648	35,934	100,499	111,344	188,871
Camden	167,203	34,495	6,372	110,462	15,874
Carteret	228,487	156,203	--	57,220	15,064
Caswell	307,217	131,248	1,587	88,038	86,344
Catawba	176,675	58,660	10,795	26,897	80,323
Chatham	523,853	242,722	6,661	144,349	130,121
Cherokee	464,942	82,423	81,174	78,241	223,104
Chowan	92,866	50,457	1,376	33,921	7,112
Clay	170,718	56,316	3,064	25,352	85,986
Cleveland	209,031	60,709	1,044	57,161	90,117
Columbus	798,361	376,392	24,557	293,691	103,721
Craven	518,176	279,221	9,658	174,559	54,738
Cumberland	324,289	196,314	14,161	71,944	41,870
Currituck	120,170	49,811	7,705	56,022	6,632
Dare	265,362	117,824	21,891	122,369	3,278
Davidson	292,528	71,725	2,196	101,936	116,671
Davie	134,186	26,458	2,773	48,738	56,217
Duplin	433,728	163,941	6,850	186,616	76,321
Durham	239,346	111,518	1,293	70,073	56,462
Edgecombe	237,071	80,826	5,512	88,807	61,926
Forsyth	267,846	66,788	689	95,553	104,816
Franklin	323,427	179,572	447	68,287	75,121
Gaston	217,690	87,063	262	66,820	63,545
Gates	311,410	106,925	19,020	155,354	30,111
Graham	370,765	25,472	51,035	125,304	168,954
Granville	484,745	193,005	2,006	159,133	130,601
Greene	99,140	32,358	5,345	25,464	35,973
Guilford	357,586	125,833	979	156,532	74,242
Halifax	513,416	203,384	3,233	188,301	118,498
Harnett	294,455	138,560	428	70,993	84,474
Haywood	427,522	15,743	64,872	130,147	216,760
Henderson	357,134	39,041	46,747	94,036	177,310
Hertford	251,946	96,940	6,201	96,222	52,583
Hoke	168,322	109,531	1,219	40,806	16,766
Hyde	401,119	241,497	13,109	133,390	13,123
Iredell	209,054	67,560	2,270	61,773	77,451
Jackson	525,134	9,942	35,770	132,340	347,082
Johnston	430,471	160,080	1,111	144,896	124,384
Jones	312,303	176,233	14,380	71,470	50,220

Continued

Table 49--Volume of growing stock on timberland, by county and species group, North Carolina, 1990--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Lee	196,707	67,761	1,080	61,965	65,901
Lenoir	204,656	47,148	12,478	82,938	62,092
Lincoln	159,910	51,912	671	51,077	56,250
McDowell	509,219	74,381	34,738	115,231	284,869
Macon	585,870	33,432	28,533	153,291	370,614
Madison	496,189	37,002	62,885	170,947	225,355
Martin	355,772	87,689	30,943	196,506	40,634
Mecklenburg	261,415	91,250	6,444	92,617	71,104
Mitchell	294,564	4,871	16,220	113,326	160,147
Montgomery	389,321	180,845	638	89,146	118,692
Moore	488,055	282,851	10,027	86,705	108,472
Nash	340,828	157,441	7,320	100,828	75,239
New Hanover	49,328	18,823	4,291	15,458	10,756
Northampton	351,848	144,284	2,786	112,041	92,737
Onslow	457,801	249,681	5,834	141,386	60,900
Orange	351,178	111,194	934	134,226	104,824
Pamlico	215,296	116,768	3,290	76,175	19,063
Pasquotank	106,788	26,146	6,497	68,842	5,303
Pender	589,286	340,097	27,725	143,911	77,553
Perquimans	120,869	37,391	7,706	53,579	22,193
Person	244,350	77,437	3,542	69,407	93,964
Pitt	379,827	129,805	26,298	175,985	47,739
Polk	195,286	66,265	1,753	38,920	88,348
Randolph	449,466	53,450	2,933	130,368	262,715
Richmond	298,601	191,882	526	74,261	31,932
Robeson	524,105	153,604	28,516	272,581	69,404
Rockingham	408,179	206,438	--	82,411	119,330
Rowan	288,990	87,188	3,863	86,383	111,556
Rutherford	418,831	189,344	3,616	65,460	160,411
Sampson	384,801	166,302	6,300	151,711	60,488
Scotland	147,815	102,877	6,550	30,100	8,288
Stanly	151,592	57,407	542	36,391	57,252
Stokes	362,758	116,364	1,179	109,755	135,460
Surry	314,256	72,409	12,022	82,301	147,524
Swain	200,233	33,228	599	73,352	93,054
Transylvania	467,269	13,885	46,853	126,725	279,806
Tyrrell	272,983	107,160	25,031	129,091	11,701
Union	248,758	75,690	3,137	48,144	121,787
Vance	201,048	91,083	--	62,264	47,701
Wake	569,338	223,622	--	207,186	138,530
Warren	412,448	169,380	436	152,342	90,290
Washington	161,285	39,147	17,004	92,048	13,086
Watauga	262,437	--	20,277	97,601	144,559
Wayne	234,091	110,342	--	65,458	58,291
Wilkes	719,734	171,892	105,186	194,403	248,253
Wilson	184,180	55,159	2,525	67,329	59,167
Yadkin	178,359	57,712	2,398	41,846	76,403
Yancey	378,669	7,125	42,298	98,809	230,437
Total	32,742,331	11,003,642	1,526,729	10,322,126	9,889,834

Table 50--Volume of sawtimber on timberland, by county and species group, North Carolina, 1990

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Alamance	729,762	160,616	1,042	273,452	294,652
Alexander	351,289	135,045	23,305	89,275	103,664
Alleghany	400,176	5,175	75,147	100,660	219,194
Anson	1,116,830	802,327	--	174,850	139,653
Ashe	1,004,786	19,942	59,859	354,610	570,375
Avery	855,534	--	92,612	297,159	465,763
Beaufort	1,686,446	1,007,489	49,921	437,571	191,465
Bertie	2,083,801	616,855	122,197	945,364	399,385
Bladen	1,501,779	764,126	94,899	370,562	272,192
Brunswick	1,313,852	650,419	219,617	295,509	148,307
Buncombe	2,071,922	96,249	83,236	621,914	1,270,523
Burke	1,085,748	187,311	466,702	175,523	256,212
Cabarrus	421,451	172,192	12,452	94,726	142,081
Caldwell	1,528,876	112,492	500,716	338,581	577,087
Camden	557,682	181,186	25,615	303,703	47,178
Carteret	826,774	655,050	--	130,608	41,116
Caswell	900,631	387,200	3,757	267,023	242,651
Catawba	481,203	95,173	45,358	74,290	266,382
Chatham	1,639,166	761,484	2,990	453,405	421,287
Cherokee	1,533,373	289,790	382,474	187,941	673,168
Chowan	359,074	199,864	6,815	120,224	32,171
Clay	561,177	190,630	15,744	84,217	270,586
Cleveland	667,021	175,856	2,332	188,553	300,280
Columbus	2,549,688	1,283,832	112,532	860,454	292,870
Craven	1,780,707	1,005,790	47,494	536,099	191,324
Cumberland	1,117,974	828,373	57,744	157,023	74,834
Currituck	429,463	245,497	32,459	137,138	14,369
Dare	748,566	426,082	99,283	205,906	17,295
Davidson	821,659	138,913	2,410	311,845	368,491
Davie	447,022	82,211	4,619	185,857	174,335
Duplin	1,523,798	630,759	35,682	599,356	258,001
Durham	815,229	382,506	4,575	233,738	194,410
Edgecombe	777,023	272,627	25,894	286,513	191,989
Forsyth	820,467	186,667	1,677	270,319	361,804
Franklin	1,000,826	585,670	--	209,379	205,777
Gaston	759,712	332,687	--	216,463	210,562
Gates	938,067	352,705	90,914	415,188	79,260
Graham	1,288,099	116,856	275,868	334,701	560,674
Granville	1,499,043	615,723	--	490,830	392,490
Greene	343,322	131,774	31,244	77,836	102,468
Guilford	1,197,153	373,659	--	600,995	222,499
Halifax	1,826,719	807,962	17,528	635,834	365,395
Harnett	997,347	497,510	2,324	254,969	242,544
Haywood	1,527,866	58,237	264,991	542,994	661,644
Henderson	1,236,532	97,107	223,571	323,708	592,146
Hertford	867,333	380,206	31,486	282,269	173,372
Hoke	636,242	472,514	5,437	113,045	45,246
Hyde	1,287,454	854,892	65,032	306,519	61,011
Iredell	682,019	231,566	8,135	198,699	243,619
Jackson	1,685,810	47,525	171,310	419,081	1,047,894
Johnston	1,595,694	696,117	5,971	484,917	408,689
Jones	1,002,301	553,434	68,430	223,143	157,294

Continued

Table 50--Volume of sawtimber on timberland, by county and species group, North Carolina, 1990--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Lee	604,414	283,564	--	144,752	176,098
Lenoir	752,174	214,256	62,478	252,127	223,313
Lincoln	556,500	149,200	--	205,674	201,626
McDowell	1,672,979	169,882	170,991	320,670	1,011,436
Macon	2,062,502	144,473	153,975	553,331	1,210,723
Madison	1,820,450	122,404	293,098	631,201	773,747
Martin	1,191,795	318,320	161,775	577,533	134,167
Mecklenburg	783,941	236,989	7,640	308,305	231,007
Mitchell	1,026,042	13,849	68,265	408,601	535,327
Montgomery	1,106,151	591,068	--	206,242	308,841
Moore	1,500,340	962,545	43,976	208,457	285,362
Nash	1,331,708	684,363	36,892	333,518	276,935
New Hanover	150,590	69,232	21,636	30,559	29,163
Northampton	1,188,485	518,430	14,895	354,046	301,114
Onslow	1,515,272	898,583	24,163	372,289	220,237
Orange	1,255,945	452,931	--	450,590	352,424
Pamlico	792,981	490,307	17,404	230,308	54,962
Pasquotank	406,551	141,649	25,795	220,031	19,076
Pender	1,846,173	1,063,479	130,274	400,535	251,885
Perquimans	315,384	94,395	33,816	119,006	68,167
Person	682,405	201,373	9,713	184,411	286,908
Pitt	1,466,853	449,738	143,133	699,452	174,530
Polk	548,825	134,456	10,051	122,159	282,159
Randolph	1,281,626	107,551	12,333	367,830	793,912
Richmond	907,949	640,768	--	193,422	73,759
Robeson	1,840,946	700,925	130,258	806,240	203,523
Rockingham	947,367	415,157	--	202,964	329,246
Rowan	913,763	296,260	8,022	269,797	339,684
Rutherford	1,132,368	507,911	7,849	150,710	465,898
Sampson	1,303,355	602,753	24,421	501,739	174,442
Scotland	583,673	437,750	24,999	101,167	19,757
Stanly	446,167	148,730	2,084	117,521	177,832
Stokes	1,002,009	307,054	6,088	287,999	400,868
Surry	823,450	200,284	44,562	184,848	393,756
Swain	659,782	86,294	2,056	274,452	296,980
Transylvania	1,563,391	52,091	192,124	381,672	937,504
Tyrrell	740,485	373,724	57,166	272,649	36,946
Union	693,876	247,023	3,781	130,050	313,022
Vance	657,462	327,993	--	187,325	142,144
Wake	2,148,367	899,406	--	763,579	485,382
Warren	1,300,156	569,635	--	464,027	266,494
Washington	512,140	153,274	59,439	259,723	39,704
Watauga	802,939	--	71,426	266,856	464,657
Wayne	954,292	545,433	--	222,544	186,315
Wilkes	2,317,185	495,803	496,525	547,874	776,983
Wilson	671,199	231,791	12,183	243,175	184,050
Yadkin	568,377	164,597	2,173	125,010	276,597
Yancey	1,357,040	16,715	197,221	331,975	811,129
Total	106,589,312	37,290,280	6,758,080	31,283,483	31,257,469

Table 51--Net annual change[a] of growing stock on timberland, by county and species group, North Carolina, 1990

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Alamance	183	−2,653	−34	2,100	770
Alexander	43	1,358	7	−741	−581
Alleghany	898	37	−1,432	861	1,432
Anson	2,283	−1,186	16	2,216	1,237
Ashe	3,094	309	−1,536	2,747	1,574
Avery	288	--	445	−791	634
Beaufort	10,178	11,785	−81	−297	−1,229
Bertie	2,762	1,841	92	3,066	−2,237
Bladen	2,905	−246	405	1,396	1,350
Brunswick	2,861	1,414	594	379	474
Buncombe	9,067	689	636	3,206	4,536
Burke	2,393	−2,221	2,819	1,314	481
Cabarrus	2,464	2,598	15	633	−782
Caldwell	−1,627	−1,468	−507	446	−98
Camden	121	1,049	−134	−257	−537
Carteret	−1,598	−3,286	--	1,375	313
Caswell	5,026	−430	17	2,897	2,542
Catawba	3,957	849	381	706	2,021
Chatham	−6,862	−5,705	62	1,234	−2,453
Cherokee	8,439	−1,289	2,764	2,811	4,153
Chowan	1,307	3,148	9	−1,342	−508
Clay	1,710	−412	153	711	1,258
Cleveland	4,438	1,089	102	1,294	1,953
Columbus	12,320	10,845	−41	1,946	−430
Craven	7,070	4,059	196	2,347	468
Cumberland	5,791	2,409	338	1,653	1,391
Currituck	−2,731	−2,148	131	465	−1,179
Dare	4,955	2,202	−657	3,384	26
Davidson	3,935	1,635	32	2,017	251
Davie	2,107	918	98	−38	1,129
Duplin	−3,256	−1,301	−97	918	−2,776
Durham	1,590	−454	20	1,131	893
Edgecombe	−11,630	−1,607	−805	−6,230	−2,988
Forsyth	3,506	231	−177	1,327	2,125
Franklin	−1,054	2,051	7	−1,789	−1,323
Gaston	1,829	−146	−56	1,574	457
Gates	3,891	56	501	3,202	132
Graham	5,901	279	1,217	2,831	1,574
Granville	10,716	4,747	42	3,975	1,952
Greene	−3,999	−1,945	1	−1,941	−114
Guilford	1,917	1,122	94	2,614	−1,913
Halifax	−1,850	3,183	45	−2,657	−2,421
Harnett	1,902	2,673	4	−1,403	628
Haywood	2,500	160	1,504	−574	1,410
Henderson	25	659	609	1,265	−2,508
Hertford	1,848	5,203	−399	−2,214	−742
Hoke	4,066	3,148	55	255	608
Hyde	13,606	8,120	274	4,882	330
Iredell	−109	605	−580	−2,030	1,896
Jackson	6,372	−3	749	1,346	4,280
Johnston	−5,429	−1,227	28	−4,590	360
Jones	7,790	8,414	−209	−296	−119

Continued

Table 51--Net annual change[a] of growing stock on timberland, by county and species group, North Carolina, 1990--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Lee	2,212	167	26	1,303	716
Lenoir	619	−902	−1,217	2,235	503
Lincoln	−4,276	−3,558	108	219	−1,045
McDowell	9,396	1,770	1,208	2,651	3,767
Macon	6,666	288	509	2,009	3,860
Madison	7,920	603	1,445	3,305	2,567
Martin	−6,074	−8,540	1,173	458	835
Mecklenburg	2,764	249	265	1,145	1,105
Mitchell	3,443	114	391	823	2,115
Montgomery	−3,661	510	−181	−945	−3,045
Moore	6,732	5,333	191	−494	1,702
Nash	−6,752	−2,336	220	−2,649	−1,987
New Hanover	914	3	133	486	292
Northampton	3,493	5,951	−928	−593	−937
Onslow	8,616	3,938	125	3,419	1,134
Orange	−1,168	−2,647	−72	375	1,176
Pamlico	−554	360	81	−1,487	492
Pasquotank	−4,327	−1,967	55	−1,427	−988
Pender	13,064	9,510	543	2,178	833
Perquimans	−427	30	207	85	−749
Person	3,780	1,119	89	664	1,908
Pitt	−2,551	−2,948	−188	1,525	−940
Polk	5,206	1,939	29	886	2,352
Randolph	1,865	−287	−77	229	2,000
Richmond	6,823	3,544	42	2,464	773
Robeson	6	−2,229	465	381	1,389
Rockingham	7,088	6,457	--	−524	1,155
Rowan	3,260	−2,038	42	2,608	2,648
Rutherford	6,015	5,370	197	1,772	−1,324
Sampson	−333	−2,716	166	2,433	−216
Scotland	3,229	2,165	−20	706	378
Stanly	790	−375	58	606	501
Stokes	4,629	−1,129	44	3,456	2,258
Surry	3,919	−727	−991	2,584	3,053
Swain	2,173	520	104	1,461	88
Transylvania	6,221	238	1,731	1,973	2,279
Tyrrell	4,098	1,427	331	2,179	161
Union	3,138	370	25	990	1,753
Vance	841	−966	--	1,175	632
Wake	227	−3,244	11	3,657	−197
Warren	5,153	229	50	3,103	1,771
Washington	3,712	2,456	668	1,428	−840
Watauga	−1,039	--	676	−2,551	836
Wayne	−8,566	−9,315	--	−268	1,017
Wilkes	−7,487	−3,399	−1,892	−4,542	2,346
Wilson	−3,844	−2,346	75	−2,302	729
Yadkin	2,867	−658	196	1,194	2,135
Yancey	2,230	61	671	−112	1,610
Total	219,959	63,552	14,501	79,605	62,301

[a] Average net annual growth minus annual timber removals.

Table 52--Net annual change[a] of sawtimber on timberland, by county and species group, North Carolina, 1990

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Alamance	5,788	−6,275	111	8,238	3,714
Alexander	−2,326	1,255	219	−476	−3,324
Alleghany	5,129	182	−6,285	5,149	6,083
Anson	9,585	−3,663	--	7,655	5,593
Ashe	11,673	591	−9,078	11,835	8,325
Avery	8,326	--	2,979	−2,417	7,764
Beaufort	70,612	76,094	−606	1,376	−6,252
Bertie	−20,600	−25,419	1,664	8,757	−5,602
Bladen	21,649	11,180	1,749	1,559	7,161
Brunswick	21,966	8,006	3,554	6,094	4,312
Buncombe	51,591	3,639	3,520	17,696	26,736
Burke	22,629	−2,014	15,440	2,838	6,365
Cabarrus	8,542	9,740	106	411	−1,715
Caldwell	5,439	−7,028	1,349	4,698	6,420
Camden	−81	4,474	−595	−1,951	−2,009
Carteret	1,374	−5,498	--	4,999	1,873
Caswell	23,212	226	170	12,694	10,122
Catawba	24,606	9,851	1,892	4,316	8,547
Chatham	−19,315	−17,663	1,513	3,509	−6,674
Cherokee	42,518	3,672	13,629	8,085	17,132
Chowan	7,500	13,132	54	−4,215	−1,471
Clay	16,089	5,541	1,108	4,646	4,794
Cleveland	18,090	5,480	12	4,666	7,932
Columbus	83,191	72,850	993	7,913	1,435
Craven	42,622	28,629	1,213	8,770	4,010
Cumberland	24,469	12,033	1,412	5,920	5,104
Currituck	−13,645	−11,097	566	1,587	−4,701
Dare	21,160	9,798	−1,593	12,800	155
Davidson	15,646	8,341	155	7,948	−798
Davie	3,708	3,311	241	−2,102	2,258
Duplin	−9,030	−7,782	−361	3,567	−4,454
Durham	15,757	1,584	68	7,968	6,137
Edgecombe	−51,996	−17,946	−4,505	−22,161	−7,384
Forsyth	17,575	3,828	−511	4,311	9,947
Franklin	2,135	10,775	--	−4,450	−4,190
Gaston	7,896	−967	--	7,106	1,757
Gates	7,157	−10,895	1,937	12,373	3,742
Graham	36,391	1,824	6,833	15,874	11,860
Granville	52,023	23,685	--	17,412	10,926
Greene	−11,725	−5,950	442	−6,440	223
Guilford	9,456	10,205	−322	9,718	−10,145
Halifax	−39,108	−13,382	263	−15,273	−10,716
Harnett	2,567	1,406	22	−2,838	3,977
Haywood	23,793	1,351	9,598	2,394	10,450
Henderson	7,370	5,299	6,001	6,120	−10,050
Hertford	6,249	12,964	−1,876	−4,499	−340
Hoke	20,059	15,209	331	2,153	2,366
Hyde	66,013	45,261	1,413	17,542	1,797
Iredell	6,561	4,391	−1,918	−3,193	7,281
Jackson	36,059	731	4,896	5,612	24,820
Johnston	−26,477	−11,293	166	−19,751	4,401
Jones	25,930	26,253	−885	−2,997	3,559

Continued

Table 52--Net annual change[a] of sawtimber on timberland, by county and species group, North Carolina, 1990--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Lee	8,163	-3,827	384	6,766	4,840
Lenoir	657	-3,305	-6,741	6,822	3,881
Lincoln	-15,920	-18,101	120	6,314	-4,253
McDowell	44,208	4,090	6,349	14,605	19,164
Macon	42,639	2,124	3,253	12,564	24,698
Madison	44,593	3,439	10,679	17,384	13,091
Martin	-25,395	-40,191	3,744	5,294	5,758
Mecklenburg	14,438	-352	926	6,863	7,001
Mitchell	18,196	642	2,239	6,202	9,113
Montgomery	-426	9,102	104	-4,390	-5,242
Moore	35,194	20,539	1,724	-2,000	14,931
Nash	-18,116	-10,224	1,183	-3,971	-5,104
New Hanover	2,713	-119	658	1,144	1,030
Northampton	10,278	13,594	-4,168	2,350	-1,498
Onslow	42,883	25,495	352	10,319	6,717
Orange	3,490	-9,221	--	2,825	9,886
Pamlico	5,166	2,275	447	482	1,962
Pasquotank	-11,375	-5,386	310	-2,152	-4,147
Pender	48,164	30,456	2,763	7,918	7,027
Perquimans	6,537	6,653	966	1,087	-2,169
Person	18,724	5,297	155	2,861	10,411
Pitt	3,287	-8,613	-860	13,283	-523
Polk	19,666	8,719	186	2,517	8,244
Randolph	5,657	-254	-13	-3,432	9,356
Richmond	29,149	22,128	89	5,208	1,724
Robeson	2,964	-7,452	3,038	1,647	5,731
Rockingham	34,517	27,738	--	-1,593	8,372
Rowan	15,083	-8,732	303	9,800	13,712
Rutherford	34,236	29,487	1,506	4,628	-1,385
Sampson	1,715	-19,681	783	15,118	5,495
Scotland	14,458	8,979	-346	3,102	2,723
Stanly	-1,096	-3,277	119	1,170	892
Stokes	21,926	-283	278	10,423	11,508
Surry	27,603	5,749	-1,597	9,692	13,759
Swain	10,613	2,785	251	9,023	-1,446
Transylvania	25,901	1,516	8,483	7,179	8,723
Tyrrell	11,334	1,086	258	8,968	1,022
Union	13,111	575	695	4,113	7,728
Vance	5,933	-3,747	--	4,890	4,790
Wake	21,872	-993	--	20,901	1,964
Warren	29,954	10,311	--	13,303	6,340
Washington	19,471	10,171	2,582	8,750	-2,032
Watauga	-2,328	--	2,547	-8,943	4,068
Wayne	-38,945	-47,606	--	469	8,192
Wilkes	-3,952	-5,878	-3,500	-11,820	17,246
Wilson	-7,123	-10,387	406	-4,625	7,483
Yadkin	13,565	844	162	3,474	9,085
Yancey	9,849	158	3,626	590	5,475
Total	1,309,033	352,242	101,527	410,668	444,596

[a] Average net annual growth minus annual timber removals.

Table 53--Green weight of forest biomass on timberland, by county and species group, North Carolina, 1990

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Hundred thousand pounds		
Alamance	250,463	56,446	1,331	80,104	112,582
Alexander	176,924	73,451	4,189	36,111	63,173
Alleghany	136,602	2,029	19,889	34,444	80,240
Anson	385,257	208,521	1,337	89,488	85,911
Ashe	346,359	10,046	12,774	105,891	217,648
Avery	270,787	--	14,775	93,297	162,715
Beaufort	587,973	297,711	10,459	194,497	85,306
Bertie	687,117	187,543	25,821	322,375	151,378
Bladen	525,631	210,867	23,336	184,090	107,338
Brunswick	531,240	249,794	57,785	138,351	85,310
Buncombe	640,509	30,047	14,291	143,746	452,425
Burke	392,708	72,152	92,120	90,653	137,783
Cabarrus	172,319	61,310	7,714	39,696	63,599
Caldwell	458,866	32,599	83,510	107,115	235,642
Camden	178,851	30,146	6,897	119,740	22,068
Carteret	233,321	136,213	845	69,285	26,978
Caswell	325,838	120,569	2,669	96,545	106,055
Catawba	193,638	57,452	9,595	29,580	97,011
Chatham	547,399	213,859	10,086	155,409	168,045
Cherokee	525,996	70,525	64,839	87,439	303,193
Chowan	99,953	44,469	1,258	41,717	12,509
Clay	199,467	48,383	2,526	28,128	120,430
Cleveland	229,148	56,381	1,693	55,854	115,220
Columbus	812,175	332,620	25,851	317,278	136,426
Craven	543,351	250,866	11,746	207,601	73,138
Cumberland	343,894	173,997	13,770	85,187	70,940
Currituck	122,213	41,945	7,514	62,817	9,937
Dare	291,230	102,974	24,181	127,030	37,045
Davidson	329,473	69,569	4,395	110,584	144,925
Davie	145,540	24,438	3,826	49,124	68,152
Duplin	466,409	147,963	6,960	198,751	112,735
Durham	242,230	99,204	1,477	74,647	66,902
Edgecombe	245,499	71,224	4,972	90,543	78,760
Forsyth	269,298	60,388	1,032	91,501	116,377
Franklin	324,217	157,209	1,033	73,898	92,077
Gaston	222,159	75,695	778	66,034	79,652
Gates	328,994	97,730	20,578	170,966	39,720
Graham	400,980	20,063	40,736	124,735	215,446
Granville	498,512	171,779	3,955	164,168	158,610
Greene	119,661	28,575	6,311	30,318	54,457
Guilford	354,004	110,797	3,000	145,640	94,567
Halifax	539,009	183,558	3,995	201,846	149,610
Harnett	328,793	131,243	412	71,840	125,298
Haywood	467,923	12,831	52,962	122,983	279,147
Henderson	377,551	32,272	36,910	91,842	216,527
Hertford	294,477	87,916	5,990	127,872	72,699
Hoke	187,853	101,565	1,167	45,376	39,745
Hyde	401,408	211,233	12,851	150,003	27,321
Iredell	242,858	66,544	2,143	69,145	105,026
Jackson	589,042	8,549	29,944	126,854	423,695
Johnston	456,291	141,031	1,105	149,155	165,000
Jones	327,173	164,422	14,498	85,361	62,892

Continued

Table 53--Green weight of forest biomass on timberland, by county and species group, North Carolina, 1990--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Hundred thousand pounds		
Lee	206,963	59,066	1,336	65,052	81,509
Lenoir	216,850	41,787	12,107	87,444	75,512
Lincoln	166,347	46,470	1,300	48,527	70,050
McDowell	567,833	72,931	29,375	117,722	347,805
Macon	649,809	26,861	23,099	145,761	454,088
Madison	509,480	32,825	49,814	154,283	272,558
Martin	391,100	79,625	32,265	219,644	59,566
Mecklenburg	282,035	82,747	12,727	97,127	89,434
Mitchell	296,548	4,474	14,780	98,462	178,832
Montgomery	424,889	160,823	1,158	107,503	155,405
Moore	558,695	263,000	12,373	99,610	183,712
Nash	345,392	133,936	6,786	110,367	94,303
New Hanover	57,064	18,521	4,853	17,728	15,962
Northampton	380,894	132,712	2,788	123,869	121,525
Onslow	473,719	227,230	7,854	154,807	83,828
Orange	356,996	96,044	3,158	130,397	127,397
Pamlico	221,987	103,617	3,275	84,802	30,293
Pasquotank	105,704	21,492	7,485	69,337	7,390
Pender	637,471	316,564	27,716	182,945	110,246
Perquimans	135,905	34,171	7,141	57,905	36,688
Person	271,396	70,351	5,408	79,915	115,722
Pitt	405,013	118,731	27,301	196,754	62,227
Polk	226,842	69,294	1,498	41,300	114,750
Randolph	515,955	54,691	5,239	142,172	313,853
Richmond	330,968	177,686	692	84,858	67,732
Robeson	548,311	135,472	27,593	289,673	95,573
Rockingham	435,329	193,574	288	89,902	151,565
Rowan	300,828	76,212	5,280	91,235	128,101
Rutherford	456,970	176,971	4,906	73,449	201,644
Sampson	437,996	158,996	5,945	165,134	107,921
Scotland	160,750	94,438	5,875	31,545	28,892
Stanly	180,110	53,172	1,461	46,888	78,589
Stokes	398,514	112,542	1,103	116,809	168,060
Surry	359,287	67,247	9,996	89,202	192,842
Swain	217,074	28,225	1,649	68,122	119,078
Transylvania	518,163	11,343	38,140	126,480	342,200
Tyrrell	290,297	94,235	24,861	146,529	24,672
Union	290,504	66,372	4,656	68,037	151,439
Vance	206,560	79,724	600	66,240	59,996
Wake	578,214	195,069	798	212,478	169,869
Warren	417,540	148,208	1,058	148,793	119,481
Washington	172,026	35,530	17,142	97,659	21,695
Watauga	291,237	--	19,896	93,640	177,701
Wayne	239,694	93,408	--	69,453	76,833
Wilkes	740,058	148,114	82,533	185,062	324,349
Wilson	191,066	48,640	2,333	67,895	72,198
Yadkin	191,377	53,690	3,060	42,266	92,361
Yancey	396,109	5,729	39,391	88,381	262,608
Total	35,122,452	9,971,273	1,413,923	10,969,817	12,767,439

Brown, Mark J. 1993. North Carolina's forests, 1990. Resour. Bull. SE-142. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 101 pp.

Since 1984, area of timberland in North Carolina declined by less than 1 percent and currently totals 18.7 million acres. Nonindustrial private forest landowners control 76 percent of the State's timberland. Volume of softwood growing stock increased 4 percent, and hardwood growing-stock volume also increased 4 percent. Softwood net annual growth rose 18 percent to 590 million cubic feet, whereas hardwood growth declined 9 percent to 570 million cubic feet. Annual removals of softwood and hardwood growing stock increased 19 and 36 percent, respectively. Annual softwood mortality leveled off, while hardwood mortality nearly doubled.

KEYWORDS: Timberland, forest ownership, timber volumes, timber growth, timber removals, timber mortality.

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KEYWORDS: Timberland, forest ownership, timber volumes, timber growth, timber removals, timber mortality.

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