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North Carolina's Forests, 2007

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Front cover: top left, Red spruce in western North Carolina. (photo courtesy of USDA Forest Service, Southern Research Station); top right, Yellow-poplar, Duke University, Durham, NC. (photo courtesy of Wikimedia.org); bottom right, Brices Creek in eastern North Carolina. (photo courtesy of USDA Forest Service, Southern Research Station). Back cover: top left, White oak in fall, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org); top right, Red spruce in western North Carolina. (photo courtesy of USDA Forest Service, Southern Research Station); bottom, Misty morning, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

Linville River, Avery County, NC.
(photo courtesy of Wikimedia.org)

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Patsy Pond Complex, Croatan National Forest, NC. (photo by Bill Lea, USDA, Forest Service,Southern Research Station)

Welcome...

Scott Bissette

Robert Doudrick

Welcome to the most detailed of the Forest Inventory and Analysis (FIA) State summary reports. Within these pages you will find statewide and regional information about the status of North Carolina's forest resource, from the number of trees and volume of wood currently growing in our State, to forest composition and stand structure, to identification of land ownership. This information is inherently critical to the quality of life, resource planning, and economic well-being of our State.

Data from ongoing studies of the total value-added impact of various industries, as classified under the North American Industry Classification System, show that North Carolina's forest products industry ranks as one of the top two in the North Carolina manufacturing economy. Consisting of more than 2,500 establishments employing more than 80,000 workers, North Carolina's forest products industry has a payroll exceeding $3 billion (Bardon and others 2010). The forest products industry is estimated to contribute more than $28 billion annually in economic benefits.[1] These numbers confirm forestry's role as a primary economic driver.

We know that forestry's economic impact has fluctuated in recent years, largely due to the economic downturn (Brandeis and others 2012). However, from research contained in this report, we also know that North Carolina's standing timber volumes are on the increase from declines recorded between 1990 and 2002. We also know that growth exceeds removals and that total forest area has begun to stabilize from declines recorded since 1990 to 18.0 million acres today. So, we can be confident that the resource will be there to support the industry and the economy into the future. Most importantly, our forests can support expanding industry investments while still providing clean watersheds, beautiful landscapes, and abundant wildlife.

The U.S. Forest Service completed the first inventory of the Nation's forests in the 1930s. Beginning in the latter 1990s, recognizing the importance of high yield forests in all of the Southern States, the U.S. Forest Service and State forestry agencies began working together to lay the foundation for collecting and producing inventory data to be available online on an annual basis. South Carolina's 2001 report was the first to be published under the enhanced FIA program. *North Carolina's Forests, 2007* is North Carolina's first report using the State's annual inventory locations. Valuable additions to this year's report include information for each region or unit within the State. In addition to statewide data, information is provided for the Southern Coastal Plain, Northern Coastal Plain, Piedmont, and Mountains units.

The North Carolina Forest Service looks forward to continuing our productive partnership with the U.S. Forest Service and to further emphasizing the relevance of forestry in the 21st century through the FIA program.

Scott Bissette

Scott Bissette
Assistant Commissioner, North Carolina Department of Agriculture & Consumer Services
North Carolina Forest Service

Robert L. Doudrick

Robert L. Doudrick
Director, Southern Research Station
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[1] Personal communication. 2009. D. Ashcraft, Office of the Executive Director of Development and College Relations, North Carolina State University, College of Natural Resources, Raleigh, NC 27699.

Foreword

The Forest and Rangeland Renewable Resources Research Act of 1978 authorized surveys of our Nation's forest resources. These surveys are part of a continuing, nationwide undertaking by the regional experiment stations of the U.S. Department of Agriculture Forest Service. Inventories of the 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia), the Commonwealth of Puerto Rico, and the Virgin Islands are conducted by the Southern Research Station (SRS), Forest Inventory and Analysis (FIA) Research Work Unit, operating from its headquarters in Knoxville, TN, and offices in Asheville, NC, and Starkville, MS. The primary objective of these appraisals is to develop and maintain the resource information needed to formulate sound forest policies and programs. Additional information about any aspect of this survey may be obtained from:

U.S. Department of Agriculture
Forest Service
Forest Inventory and Analysis
Southern Research Station
4700 Old Kingston Pike
Knoxville, TN 37919
Telephone: 865-862-2000
William G. Burkman
Program Manager

This resource bulletin highlights the results of the first complete cycle of annual inventory information for North Carolina's forest resources. Annual surveys of U.S. forests were originally mandated by the Agricultural Research Extension and Education Reform Act of 1998 (Farm Bill). The annual surveys differ from the previous periodic surveys in many ways. The annual surveys feature: (1) a nationally consistent, fixed-radius, four-point plot configuration; (2) a systematic national sampling design consisting of a base grid derived by subdividing the Environmental Monitoring and Assessment Program grid into approximately 6,000-acre hexagons; (3) integration of the forest inventory and forest health monitoring sampling designs; (4) annual measurement of a fixed proportion of permanent plots; (5) reporting of data or data summaries on FIA Web site within 6 months after yearly sampling; (6) a default 5-year moving average estimator, with provisions for optional estimators based on techniques for updating information; and (7) a summary report every 5 years. Additional information about annual surveys is available at http://fia.fs.fed.us/.

The SRS FIA Research Work Unit and the North Carolina Forest Service began data collection for this eighth survey of North Carolina in 2003. The strategy involves rotating measurements of five systematic samples (or panels), each of which represents about 20 percent of all plots in the State. A panel may take more than or less than 1 year to complete. This bulletin provides inventory statistics and discusses the principal findings from the measurement of all five panels of annual inventory data from the mapped-plot design. Forest land estimates and inventory volume, growth, removals, and mortality statistics are summarized from the data collected.

Seven previous periodic inventories completed in 1938, 1956, 1964, 1974, 1984, 1990, and 2002 provide statistics for measuring changes and trends at the State level. However, caution is advised when making comparisons at the sub-State level. The annual system represents a dramatic departure from methods used to conduct the previous periodic surveys. Moreover, the annual system continues to evolve as changing technologies are adapted and implemented to improve FIA surveys. The 2007 inventory, for instance, incorporates land area stratification estimates (see Area in appendix A—Inventory Methods) based on National Land Cover Data satellite

imagery, which replaces the aerial photography estimation method used in previous inventories. Improving the accuracy or efficiency of the FIA surveys is justification for altering how the inventory is conducted. However, change detection and trend analysis over time become more difficult due to differences in inventory methods.

The 2007 inventory data, as well as data for other States and survey years, are available at http://www.fia.fs.fed.us/tools-data/default.asp. Tabular summaries of the current resource statistics for North Carolina used in this report are available at http://srsfia2.fs.fed.us/states/north_carolina.shtml. Click on the 2007 survey year. Tabular data for previous surveys also are available at that Web site.

Brook trout. (photo courtesy of USDA Forest Service Southern Research Station, Bugwood.org)

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We gratefully acknowledge the North Carolina Forest Service (NCFS) for its role in collecting the field data. The following NCFS and SRS FIA field personnel contributed to the inventory effort:

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We appreciate the cooperation of other public agencies and private landowners in providing access to measurement plots. We also would like to thank Brett Butler, Research Forester with the Northern Research Station, for providing the data from the National Woodland Owner Survey of North Carolina.

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Salt marsh near North Carolina coast. (photo courtesy of USDA Forest Service Southern Research Station, Bugwood.org)

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Blackberry flowers, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

Area

• Total forest area decreased from 18.8 million acres in 2002 to 18.6 million acres in 2007. However, forest survey data collected since the economic downturn indicate forest area loss has abated. Forests continue to occupy about 60 percent of the land area of North Carolina.

• Timberland area totaled 18.1 million acres, down from 18.4 million acres in 2002. Hardwood forest types accounted for 12.2 million acres (67 percent) of timberland, and softwood forest types accounted for 5.7 million acres (32 percent). The remaining 1 percent consisted of timberland classified as nonstocked.

• Oak-hickory was the predominant forest-type group and occupied 7.3 million acres. Loblolly-shortleaf forest-type group was second in prevalence with almost 5.3 million acres. Oak-pine forest-type group was a distant third with 2.3 million acres, followed by oak-gum-cypress with almost 1.9 million acres.

Ownership

• Nonindustrial private forest (NIPF) ownerships controlled 14.1 million acres (78 percent) of the State's timberland, down slightly from 14.2 million in 2002. Forest industry owned 1.4 million acres (8 percent), down from 1.6 million in 2002. Public ownerships held 2.5 million acres of timberland (14 percent), down slightly from 2.6 million acres in 2002.

• Within the NIPF group, private individuals owned 11.1 million acres of the State's timberland, down from 11.7 million acres in 2002.

• A National Woodland Owner Survey of North Carolina in 2006 estimated 11.2 million acres of timberland were held by 469,000 private individuals deemed as family forest ownerships. Approximately 448,000 of these family forests were <100 acres in size. Some 69,000 of these family forest landowners ranked the production of timber products as an important management objective. Just 18,000 family forest owners reported active management plans and 44,000 reported having participated in cost-share programs.

Volume

• In 2007, total all-live merchantable volume on timberland in North Carolina amounted to 35.8 billion cubic feet, up from 34.5 billion cubic feet in 2002 and 34.7 billion cubic feet in 1990.

• With 23.4 billion cubic feet, hardwoods made up 65 percent of all-live volume in the State. Softwood volume totaled almost 12.4 billion cubic feet.

Golden fall leaves of an American beech lit by sun, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

• White oaks, red oaks, soft maple, and sweetgum accounted for 3.7, 3.5, 2.7, and 2.3 billion cubic feet of the hardwood volume, respectively. Loblolly and shortleaf pines accounted for 8.3 billion cubic feet of the softwood volume.

Net Growth and Removals

• Total net annual growth of all-live trees on timberland averaged almost 1.5 billion cubic feet per year between 2002 and 2007 and removals averaged >1.1 billion cubic feet during the same period. Planted stands provided 337 million cubic feet of the net growth and 262 million cubic feet of the removals.

• Net growth for all-live softwood trees on timberland averaged 702 million cubic feet per year, and removals averaged 613 million cubic feet per year between 2002 and 2007. Softwood growth was up from the 1990-2002 average of 611 million cubic feet per year. However, softwood removals were down from the previous survey period average of 729 million cubic feet per year.

• Hardwood net growth averaged 748 million cubic feet per year, and removals averaged 533 million cubic feet per year between 2002 and 2007. Hardwood growth was up from the annual average of 602 million cubic feet observed between 1990 and 2002. Hardwood removals also increased from the annual average of 499 million cubic feet in the previous survey period.

Timber Products Impact

• The forest products industry continued its importance in North Carolina, contributing an estimated $28 billion annually to the State's economy and providing jobs for >80,000 people, despite reduction in the total output of primary timber products since 2002.

• There were 163 sawmills, pulpwood mills, and other primary wood-processing plants operating in North Carolina in 2007. These mills averaged 828 million cubic feet of timber products per year (including residential fuelwood and plant byproducts) between 2002 and 2007.

• Roundwood harvested for saw logs and pulpwood (the two leading products) amounted to 382 and 274 million cubic feet, respectively. These two products accounted for 79 percent of the total roundwood production for the State.

• The 6,357 nontimber forest products (NTFP) enterprises in North Carolina accounted for 25 percent of the entire southern NTFP industry. The State was one of the top five suppliers of wild-harvested American ginseng root and a major producer of galax leaves for the international floral industry.

Forest Health

• Total mortality of live trees on North Carolina's timberland averaged 404 million cubic feet per year between 2002 and 2007. Hardwood species represented 228 million cubic feet (56 percent) and softwoods represented 175 million cubic feet (43 percent) of total mortality. The <1 percent that remained was attributed to trees not measured.

• Standing-dead trees totaled 176 million on North Carolina's timberland. The leading identifiable causes of death to these snags, in descending order of prevalence, were competing vegetation, weather, disease, and insects.

• In descending order of prevalence, tree-of-heaven, mimosa, and royal paulownia were the most commonly detected invasive trees. The privets were the most common shrub, Japanese honeysuckle was the most frequent vine, and Nepalese browntop was the most frequently detected invasive grass.

Loblolly pine, young specimen, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

Introduction

The extent, condition, and health of North Carolina's forests are subject to many natural and human-induced impacts that continually shape these forests. Surveys conducted by the Forest Inventory and Analysis (FIA) program provide data useful in describing the distribution, characteristics, and health of forest resources at the State level. For instance, forest health can be evaluated by assessing the degree and cause of tree mortality. Current forest conditions can be better understood by evaluating past changes in forest structure caused by natural forces like weather, or from human influences such as forest management activities. Natural impacts to the forests can be gauged by assessing weather or fire damage to the forest resource. Human impacts can be determined by analyzing changes in land use and forest ownership, and tracking landowner priorities and values congruent with owning forest land. Gauging the importance of forest resources to a State's economy depends on accurate assessments of forest extent and condition.

A Word of Caution

This report provides a general assessment and descriptive analysis of North Carolina's forest resources based on data circa 2007. These current estimates of forest area, timberland, related classifications such as ownership and forest type, and timber volumes are presented and compared with previous values (Brown 1993, Brown and others 2006). Average annual rates of growth, removals, and mortality are summarized for the period since the previous inventory in 2002.

However, users should be aware that in a continual improvement mode, FIA has updated programs and algorithms used to process field data. On this basis, all previously posted and published data for the 2002 and 2007 forest surveys have been reprocessed and reposted, in some instances more than once. To compensate for these revisions and provide for the most reliably consistent comparison of all years referenced in this report, the latest data available in August 2013 were used as the foundation for trend analysis.

Changes in the Forest Survey

Although this inventory is similar in scope to the 2002 and prior inventories, it differs in sampling order, progression, and frequency. The major change was the shift to annual data collection, in which a portion of the samples across the entire State was measured each year. By contrast, the 2002 inventory was a closeout periodic inventory and all samples were measured progressively across the State beginning with the coast and finishing in the mountains. The changes in methods and sampling frequency have provided national consistency among FIA Research Work Units. These changes have initially complicated data comparison between surveys, but in the future, such comparisons will be easier to make between the latest annual inventory year and any of its previous annual inventory years. In this report we make general comparisons where differences between inventories can be reconciled or are considered minimal. The change in inventory methods limits the ability to directly compare current and previous resource estimates, and to track resource trends established by the periodic inventories of 2002 and before. However, the periodic inventory of 2002 has the advantage of incorporating the annual inventory plot design and matching degree of sample intensity. Regardless, comparisons to past data made in this report are offered with the understanding that changes noted in resource estimates over time are due to both measured differences and differences introduced as a result of altering inventory methods.

Barred owl. (photo courtesy USDA Forest Sevice Southern Research Station, Bugwood.org)

Land Use

Area and condition of North Carolina's forest land are determined in many respects by trends in ownership and by land use changes. Change in forest land ownership often brings with it a change in the reasons for owning the land. Knowing about the intent of forest landowners is essential to assessing the impact they might have on the management and availability of the State's forests. Traditional timber harvesting or other forest-product-based uses may be replaced by desires to develop and manage habitat for wildlife or provide new recreational opportunity. Change in ownership also can lead to a change in land use, particularly if there are plans to convert forest land for new cropland or pasture uses, or to develop for urban use. Loss of forest land to urbanization continues to be a concern. These losses are considered diversions from forest land to nonforest uses. However, the rate of conversion to development seems to have slowed recently, perhaps in response to the recent economic downturn. Owner decisions can also increase forest land, either through planting efforts or by allowing idle cropland or pasture to naturally revert to forest. These increases are considered additions to forest land from nonforest sources.

The 2000 Census (U.S. Department of Commerce, Bureau of the Census 2002) reported that >8.0 million people lived in North Carolina. At the time of the 2002 forest inventory, the population had risen to an estimated 8.3 million people, and further increased to an estimated 9.1 million people (North Carolina Office of State Budget and Management 2009) by the 2007 forest inventory. Subsequently, the 2010 Census (U.S. Department of Commerce, Bureau of the Census 2012) reported the population in North Carolina at nearly 9.6 million individuals, or about

196 people per square mile of land. Since the 2000 census, an additional 1.5 million people now live in the State, making North Carolina one of the fastest growing States in the country. The majority of the increase stems from net migration into the State. Increased population can bring increased pressure on limited natural resources, including the State's forest land.

Table 1 summarizes the broad category distribution of land in North Carolina by land use since 1990. Some general trends are apparent. Total land area of North Carolina is about 31.1 million acres, including 173,000 acres of noncensus water defined by the U.S. Bureau of the Census as land. Forests occupy almost 60 percent of the State's land area, or about 18.6 million acres. The remaining 12.6 million acres of land reflect a variety of nonforest uses such as agriculture and urban development. Total nonforest land increased by about 0.4 million acres between 1990 and 2002 and has increased by 0.2 million acres since 2002. Land used for cropland has declined by 12 percent since 2002. Pasture has increased by 20 percent since 2002. Another trend in land use is the increase in other nonforest land (which includes urban, industrial, and other developed areas), which has risen by 11 percent since 2002 to 5.6 million acres in 2007. Tracking these trends is important because shifts in agriculture and urban land uses often have direct impact on the extent and condition of North Carolina's forest land.

Clearing land for agriculture was once the primary reason for loss of forest. Although conversions to agriculture still occur, the principal threat to loss of forest land since 1990 has been urbanization, as evidenced by the steady increase in area of other nonforest land (table 1). The loss of forest land due to urbanization is permanent, whereas clearing of forest land for crops or pasture can be reversed in many instances. In fact, idle cropland and pasture continue to be the primary source for new acres of forest land, either from planting or from natural reversion.

Table 1—Land area by land use and survey year, North Carolina

Land use	Survey year		
	1990	2002	2007
	acres		
Forest land			
Timberland	18,710,381	18,374,501	18,055,447
Reserved	524,359	378,931	380,131
Other forest[a]	42,809	68,912	146,579
Total	19,277,549	18,822,344	18,582,157
Nonforest land			
Cropland	6,459,619[b]	5,709,808	5,042,947
Pasture	1,559,632[b]	1,454,805	1,742,200
Other nonforest[c]	3,763,495[b]	5,032,221	5,592,876
Noncensus water[d]	167,925	149,220	173,372
Total	11,950,671	12,346,054	12,551,395
All land	31,228,220[e]	31,168,398[f]	31,133,552[f]
Census water	3,234,560[e]	3,275,315	3,310,157
Total area	34,462,780	34,443,713	34,443,709
Percent land area forested	61.73	60.39	59.69

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

[a] Unproductive lands incapable of producing 20 cubic feet of wood per acre, per year, due to adverse site conditions.

[b] From Brown (1993).

[c] Includes areas classified as urban, industrial, swampland, and other nonforest, etc.

[d] Areas classified as water by Forest Inventory and Analysis standards, but defined by U.S. Bureau of Census as land.

[e] From the U.S. Bureau of the Census, 1991.

[f] From the U.S. Bureau of the Census, 2002.

Timberland Classification

As shown in table 1, 18.1 million acres (97 percent) of North Carolina's 18.6 million acres in forest were classified as timberland. These 18.1 million acres were defined as capable of producing at least 20 cubic feet of industrial wood per acre per year and not classified as reserved and withdrawn from timber production. The area of timberland in 2007 was down 2 percent from 18.4 million acres in 2002. North Carolina also had 380,000 acres classified as reserved timberland. These were largely under public ownership and primarily located in the national forest wilderness areas and on national park and preserve lands. The decrease since 1990 figures resulted from reclassification of certain national wildlife refuge lands. The remaining other forest land consisted largely of unproductive or adverse sites. The area of other forest land has increased somewhat since 1990. Reasons for this change are unclear and could be related to the changes in inventory techniques. Since the acres classified as timberland are the ones subject to viable forest management activities and thus are most apt to influence forest economics of the State, the remainder of this report will concentrate on timberland.

Timberland Distribution

FIA surveys divide North Carolina into four units or regions (fig. 1). The Southern Coastal Plain unit is the lower portion of the eastern half of the State, bordering South Carolina. The Northern Coastal Plain unit is the upper portion of the eastern half of the State, bordering Virginia. The Piedmont unit is roughly the center one-third of the State and borders Virginia along the top and South Carolina along the bottom. The Mountains unit is the entire western one-fourth of the State, largely bordering Tennessee to the left.

Since 2002, area of cropland decreased in all four survey units (tables 1A, 1B, 1C, and 1D). Partially offsetting the decreased cropland, area in pasture increased in all but the Mountains unit, where it declined slightly. The area of other nonforest land (primarily urban) increased in all the units, although the increase was only 1 percent in the Mountains unit. The increase in area of other nonforest land in the Piedmont unit almost equaled that of the remaining units combined and accounted for 48 percent of the State's total increase in that land use category.

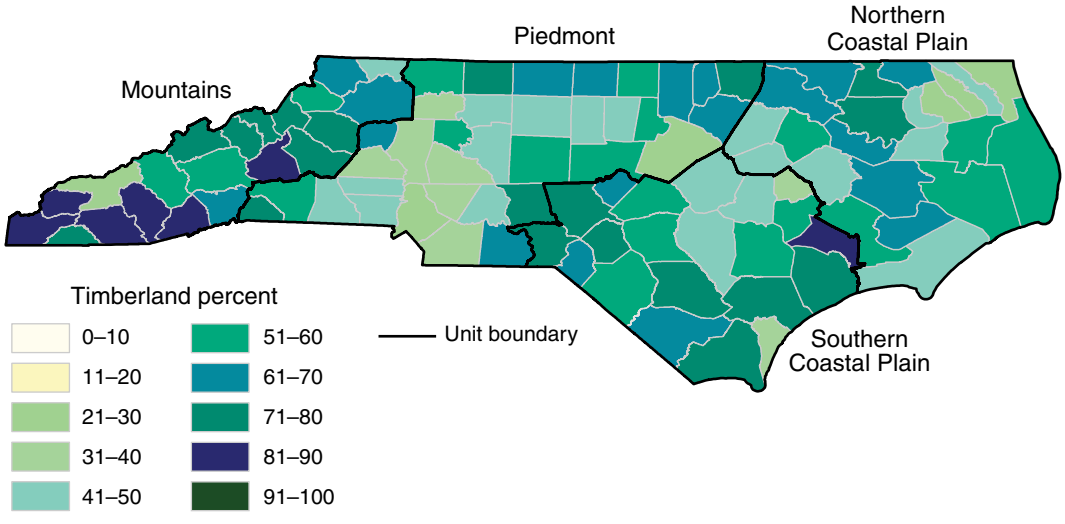


Figure 1—Timberland as a percentage of all land by county, North Carolina, 2007. (Coastal boundaries encompass census water areas.)

Table 1A—Land area by land use and survey year, Southern Coastal Plain unit, North Carolina

Land use	Survey year		
	1990	2002	2007
	acres		
Forest land			
Timberland	5,236,378	5,237,274	5,083,747
Reserved	17,200	0	0
Other forest[a]	0	6,276	41,824
Total	5,253,578	5,243,550	5,125,571
Nonforest land			
Cropland	[b]	1,857,813	1,655,909
Pasture	[b]	159,058	296,817
Other nonforest[c]	[b]	1,079,086	1,225,290
Noncensus water[d]	30,720	28,079	46,891
Total	3,136,483	3,124,036	3,224,906
All land	8,390,061[e]	8,367,586[f]	8,350,477[f]
Census water	[g]	393,052	410,161
Total area	[g]	8,760,637	8,760,638
Percent land area forested	62.62	62.67	61.38

0 = no sample for cell.

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

[a] Unproductive lands incapable of producing 20 cubic feet of wood per acre, per year, due to adverse site conditions.

[b] Not available in previous unit reports for 1990 or in FIADB for 1990.

[c] Includes areas classified as urban, industrial, swampland, and other nonforest, etc.

[d] Areas classified as water by Forest Inventory and Analysis standards, but defined by U.S. Bureau of Census as land.

[e] From the U.S. Bureau of the Census, 1991.

[f] From the U.S. Bureau of the Census, 2002.

[g] Not available in previous unit reports for 1990 or in EVALIDATOR for 1990.

Table 1B—Land area by land use and survey year, Northern Coastal Plain unit, North Carolina

Land use	Survey year		
	1990	2002	2007
	acres		
Forest land			
Timberland	3,767,862	3,783,403	3,689,755
Reserved	56,278	18,029	18,372
Other forest[a]	31,567	56,607	96,613
Total	3,855,707	3,858,039	3,804,740
Nonforest land			
Cropland	[b]	2,020,145	1,885,259
Pasture	[b]	45,941	59,740
Other nonforest[c]	[b]	748,092	883,703
Noncensus water[d]	65,575	28,433	36,908
Total	2,794,546	2,842,611	2,865,610
All land	6,715,828[e]	6,700,650[f]	6,670,350[f]
Census water	[g]	2,644,467	2,674,769
Total area	[g]	9,345,118	9,345,118
Percent land area forested	57.41	57.58	57.04

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

[a] Unproductive lands incapable of producing 20 cubic feet of wood per acre, per year, due to adverse site conditions.

[b] Not available in previous unit reports for 1990 or in FIADB for 1990.

[c] Includes areas classified as urban, industrial, swampland, and other nonforest, etc.

[d] Areas classified as water by Forest Inventory and Analysis standards, but defined by U.S. Bureau of Census as land.

[e] From the U.S. Bureau of the Census, 1991.

[f] From the U.S. Bureau of the Census, 2002.

[g] Not available in previous unit reports for 1990 or in EVALIDATOR for 1990.

Table 1C—Land area by land use and survey year, Piedmont unit, North Carolina

Land use	Survey year		
	1990	2002	2007
	acres		
Forest land			
Timberland	5,751,123	5,484,877	5,349,603
Reserved	33,547	6,008	5,927
Other forest[a]	0	0	2,111
Total	5,784,670	5,490,885	5,357,641
Nonforest land			
Cropland	[b]	1,554,197	1,273,273
Pasture	[b]	838,526	1,000,749
Other nonforest[c]	[b]	2,485,478	2,754,931
Noncensus water[d]	60,752	67,707	61,128
Total	4,687,553	4,945,907	5,090,081
All land	10,472,223[e]	10,436,792[f]	10,447,722[f]
Census water	[g]	193,600	182,670
Total area	[g]	10,630,392	10,630,392
Percent land area forested	55.24	52.61	51.28

0 = no sample for the cell.

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

[a] Unproductive lands incapable of producing 20 cubic feet of wood per acre, per year, due to adverse site conditions.

[b] Not available in previous unit reports for 1990 or in FIADB for 1990.

[c] Includes areas classified as urban, industrial, swampland, and other nonforest, etc.

[d] Areas classified as water by Forest Inventory and Analysis standards, but defined by U.S. Bureau of Census as land.

[e] From the U.S. Bureau of the Census, 1991.

[f] From the U.S. Bureau of the Census, 2002.

[g] Not available in previous unit reports for 1990 or in EVALIDATOR for 1990.

Table 1D—Land area by land use and survey year, Mountains unit, North Carolina

Land use	Survey year		
	1990	2002	2007
	acres		
Forest land			
Timberland	3,955,018	3,868,947	3,932,342
Reserved	417,334	354,894	355,832
Other forest[a]	11,242	6,029	6,031
Total	4,383,594	4,229,870	4,294,205
Nonforest land			
Cropland	[b]	277,653	228,506
Pasture	[b]	411,280	384,894
Other nonforest[c]	[b]	719,565	728,952
Noncensus water[d]	10,878	25,000	28,446
Total	1,266,511	1,433,497	1,370,798
All land	5,650,105[e]	5,663,367[f]	5,665,003[f]
Census water	[g]	44,196	42,558
Total area	[g]	5,707,562	5,707,562
Percent land area forested	77.58	74.69	75.80

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

[a] Unproductive lands incapable of producing 20 cubic feet of wood per acre, per year, due to adverse site conditions.

[b] Not available in previous unit reports for 1990 or in FIADB for 1990.

[c] Includes areas classified as urban, industrial, swampland, and other nonforest, etc.

[d] Areas classified as water by Forest Inventory and Analysis standards, but defined by U.S. Bureau of Census as land.

[e] From the U.S. Bureau of the Census, 1991.

[f] From the U.S. Bureau of the Census, 2002.

[g] Not available in previous unit reports for 1990 or in EVALIDATOR for 1990.

Timberland as a percentage of land area by county (fig. 1) shows the most heavily forested part of the State to be the Mountains unit followed by the Southern Coastal Plain unit. Six counties in the Mountains unit and one county in the Southern Coastal Plain unit were >80 percent timberland. One county (Swain) in the Mountains unit contains a large portion of the Great Smoky Mountains National Park, which is reserved; otherwise it would have been in a higher timberland percentage category. Counties with the least timberland contained large metropolitan areas or extensive areas in farmland.

Owner Objectives—Family Forest Survey

The care and management of nearly 11.2 million acres of North Carolina's private timberland was in the hands of some 469,000 individuals (table 2). Predicting what these family forest landowners intend to do with their land is difficult without some knowledge of their interests and ownership objectives. The National Woodland Owner Survey (NWOS) (Butler 2008) gathers information about family forest owners and the land they own. This information provides some insight as to how they might manage and use their forest lands in the years to come.

The size of a forested tract often dictates how, or if, that particular forest parcel will be managed. The rule of thumb is that it is not financially viable to manage for timber products on parcels <10 acres in size. In North Carolina, 9 percent (1.0 million acres) of the family forest timberland was in tracts ranging from 1 to 9 acres (table 2). However, 55 percent (260,000) of the total family forest owners were in this category.

Table 2—Area and number of family forests by size of forest landholdings, North Carolina, 2006

Size of forest landholdings[a]	Area		Ownership	
	Acres	SE	Number	SE
acres	*thousand*	*percent*	*thousand*	*percent*
1–9	1,035	28.7	260	21.6
10–19	1,029	28.6	81	18.3
20–49	2,289	15.2	77	11.9
50–99	1,907	17.7	30	13.3
100–199	1,957	17.0	15	12.7
200–499	1,325	23.5	5	16.6
500–999	635	39.4	1	23.6
1,000–4,999	953	30.7	1	31.3
5,000–9,999	31	437.9	<1	100.1
10,000+	32	356.8	<1	100.2
Total	11,194	2.1	469	11.8

SE = sampling error.
[a] From National Woodland Owner Survey, 2006.

Another 34 percent (158,000) of the family forest owners had tracts ranging from 10 to 49 acres in size. This category accounted for 30 percent (3.3 million acres) of the total family forest timberland. The remaining 11 percent (54,000) of family forest owners controlled 61 percent (6.8 million acres) of the family forest timberland.

Family forest timberlands are held for a variety of reasons and are subject to owner-related decisions to realize these goals and objectives. Maximizing the financial potential and managing for the production of wood products is not always the primary reason for ownership. The NWOS queried a sample of family forest owners with a list of reasons and their responses were assessed (table 3) based on cumulative size of land-holdings (acres) involved per reason and by number of owners per reason.

Based on the acres involved, the primary reason for owning timberland was "to pass land on to children or other heirs," which involved 7.4 million acres, or 66 percent, of the family forest timberland. This reason involved the second highest number of family forest owners at 300,000.

The second reason for owning family forest timberland was "for land investment" and applied to 6.2 million acres and the fifth highest number of family forest owners at 240,000. Although practically tied for second, the third reason for owning timberland was "to enjoy beauty or scenery," which also involved 6.2 million acres, but the highest number of family forest owners at 310,000.

The fourth reason for owning timberland was "part of farm or ranch," which involved 5.7 million acres, and was important to the

Table 3—Area and number of family forests by reason for owning forest land, North Carolina, 2006

Reason[a,b]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
To enjoy beauty or scenery	6,207	6.3	310	17.1
To protect nature and biologic diversity	5,258	7.5	210	17.2
For land investment	6,213	6.3	240	18.6
Part of home or vacation home	5,153	9.0	251	17.2
Part of farm or ranch	5,690	8.1	150	21.2
Privacy	5,118	7.7	274	17.9
To pass land on to children or other heirs	7,401	5.2	300	15.4
To cultivate/collect nontimber forest products	1,290	24.1	54	40.5
For production of firewood or biofuel	1,217	25.4	25	24.1
For production of saw logs, pulpwood, or other timber products	4,033	9.5	69	26.6
Hunting or fishing	3,498	10.8	80	17.8
For recreation other than hunting or fishing	2,475	14.3	126	30.2
No answer	212	104.8	8	82.7

SE = sampling error.

Numbers include landowners who ranked each objective as very important (1) or important (2) on a seven-point Likert scale.

[a] Categories are not exclusive.

[b] From National Woodland Owner Survey, 2006.

seventh highest number of family forest owners at 150,000. The fifth reason for owning timberland was "to protect nature and biologic diversity," which involved almost 5.3 million acres and the sixth highest number of family forest owners at 210,000.

The "production of saw logs, pulpwood, or other timber products" as a reason for owning timberland was eighth with 4.0 million acres and tenth in number of family forest owners at 69,000. The reason of "hunting and fishing" was ninth in both acreage (3.5 million acres) and number of family forest owners (80,000). The "production of firewood or biofuel" reason for owning timberland involved just 1.2 million acres and 25,000 family forest owners.

Inheritance, investment, and scenery-related reasons for ownership were more popular than financial and production-oriented reasons, signifying family forest owners' close ties to the land. Reasons like farm, nature, home, and privacy, were apparently highly valued personal benefits from timberland ownership.

However, recent forestry activity on North Carolina's family forests provided strong evidence of forest management and financial gain from wood production. In the 5 years preceding the survey, about 3.3 million acres underwent a timber harvest, almost 1.9 million were site prepped for planting, and 2.9 million acres had trees planted (table 4). In addition, family forest owners implemented wildlife habitat improvement on 1.5 million acres of

Table 4—Area and number of family forests by recent (past 5 years) forestry activity, North Carolina, 2006

Activity[a,b]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
Timber harvest	3,329	12.1	45	25.6
Collection of NTFPs	715	42.2	33	84.0
Site preparation	1,860	17.7	47	49.6
Tree planting	2,921	12.4	74	33.6
Fire hazard reduction	1,518	21.0	30	33.3
Application of chemicals	1,038	28.5	23	42.4
Road/trail maintenance	3,053	12.1	52	23.9
Wildlife habitat improvement	1,501	21.3	33	53.7
Posting land	4,951	9.4	104	20.8
Private recreation	4,613	10.0	109	24.4
Public recreation	883	37.3	30	60.2
None of the above	2,714	13.3	177	26.9

SE = sampling error.
NTFPs = nontimber forest products.
[a] Categories are not exclusive.
[b] From National Woodland Owner Survey, 2006.

timberland. The fact that a segment of the family forest owners benefited financially from traditional forestry-related activities on their timberland combined with the many other reasons for owning timberland supports an optimistic outlook for sustaining the wood supply from these private lands.

To provide additional insight and further assess the future of these family forest timberlands, the NWOS queried landowners about their potential forest-related plans for the next 5 years (table 5). The "leave it as is-no activity" and "minimal activity to maintain forest land" responses combined, accounted for 6.7 million acres and 258,000 owners. This response indicated the majority of family forest owners and 60 percent of their acreage would remain in timberland for the time being. Another 72,000 owners with almost 1.1 million acres, planned to "buy more forest land," and 54,000 owners with 1.5 million acres have "no current plans." Plans for 48,000 owners with 1.8 million acres involved "giving some or all of their forest land to heirs." Regarding input to the timber supply, 25,000 family forest owners planned to harvest saw logs or pulpwood from their 2.5 million acres of timberland.

Together, the plans to sell, subdivide, or convert forest land involved a combined 24,000 family forest owners with 1.1 million acres. Although these changes may not result in positive outcomes for the State's private timberland, the number of

Table 5—Area and number of family forests by landowners' future (next 5 years) plans for their forest land, North Carolina, 2006

Future plans[a,b]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
Leave it as is–no activity	3,385	12.3	178	21.9
Minimal activity to maintain forest land	3,328	12.3	80	24.5
Harvest firewood	1,466	21.6	31	20.7
Harvest saw logs or pulpwood	2,538	13.8	25	22.2
Collect nontimber forest products	434	64.1	4	57.9
Sell some or all of their forest land	736	38.1	12	38.8
Give some or all of their forest land to heirs	1,786	18.6	48	23.1
Subdivide some or all of their forest land and sell subdivisions	126	145.1	3	66.2
Buy more forest land	1,055	28.0	72	53.9
Convert some or all of their forest land to another use	256	88.3	9	63.0
Convert another land use to forest land	455	53.0	5	41.3
No current plans	1,536	22.7	54	29.5
Unknown	660	44.3	25	44.7
Other	157	117.3	6	60.1
No answer	460	54.1	11	55.7

SE = sampling error.

NTFPs = nontimber forest products.

[a] Categories are not exclusive.

[b] From National Woodland Owner Survey, 2006.

owners responding as such was relatively low. Note, however, that since these categories are not exclusive, the same lands may be involved in some responses and the economy may determine whether some of these plans are realized.

The number of family forest owners with a management plan was very low. Eighty-seven percent of owners did not have a management plan in effect (table 6). These 409,000 owners without a management plan accounted for 7.8 million acres, or 70 percent of the family forests in North Carolina. The number of family forests that participated in cost-share programs was low as well. Just 44,000 owners with almost 3.3 million acres participated in cost-share programs (table 7). However, in the previous 5 years, participation had dropped to 27,000 owners with 1.9 million acres. This change largely reflects the paucity of available cost-share programs.

Table 6—Area and number of family forests by management plan status, North Carolina 2006

Management plan[a,b]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
Yes	2,512	14.0	18	20.5
No	7,804	4.8	409	13.4
Do not remember	252	99.6	11	73.3
No answer	626	43.7	31	36.5

SE = sampling error.
[a] Categories are not exclusive.
[b] From National Woodland Owner Survey, 2006.

Table 7—Area and number of family forests by participation in cost-share programs, North Carolina, 2006

Cost-share program[a,b]	Area		Owners	
	Acres	SE	Number	SE
	thousand	*percent*	*thousand*	*percent*
Yes	3,272	11.2	44	38.5
No	7,217	5.2	402	13.3
No answer	704	39.2	23	38.9
Participated in past 5 years				
Yes	1,927	17.1	27	62.8
No	8,461	4.2	420	12.7
Uncertain	31	437.9	<1	100.1
No answer	775	36.2	22	39.5

SE = sampling error.
[a] Categories are not exclusive.
[b] From National Woodland Owner Survey, 2006.

Timberland Statistics: Area

Trends

The nearly 18.1 million acres of timberland recorded for North Carolina in 2007 continued a downward trend in area of timberland for the State (fig. 2A). This was a 0.3 million-acre decrease from the reprocessed 18.4 million acres now recorded for the 2002 survey. Caution should be used in the comparison because of the aforementioned magnitude of changes in the FIA survey methods, and users are advised to read the inventory methods in appendix A of this report. Despite that caveat, evidence of real change in North Carolina's timberland area does exist. Appendix D contains 35 tables with information describing this resource. For instance, the many metropolitan areas found in the Piedmont unit continued to expand and increase the area of the "other nonforest land" category (table 1), often at the expense of previously forested areas. It remains to be seen if the 2007 economic recession has slowed this expansion.

Occurrence

The decrease in timberland occurred differently across the four survey units of the State. The Southern and Northern Coastal Plain units (figs. 2B and 2C) both experienced their first declines in area of timberland since 1990. The Mountains unit (fig. 2E) actually increased in timberland area and reversed a decline recorded in 2002. The Piedmont unit (fig. 2D) continued its downward trend in area of timberland. The Southern Coastal Plain lost about 3.0 percent, or 150,000 acres, of its timber-land since 2002. The Northern Coastal Plain lost 2.5 percent, or <100,000 acres, whereas the Mountains unit gained 1.6 percent, or 60,000 acres of timberland. The Piedmont unit lost 2.5 percent, or 135,000 acres, since 2002, following a 4.6-percent loss, or 266,000 acres, from the 1990 survey.

Misty morning, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

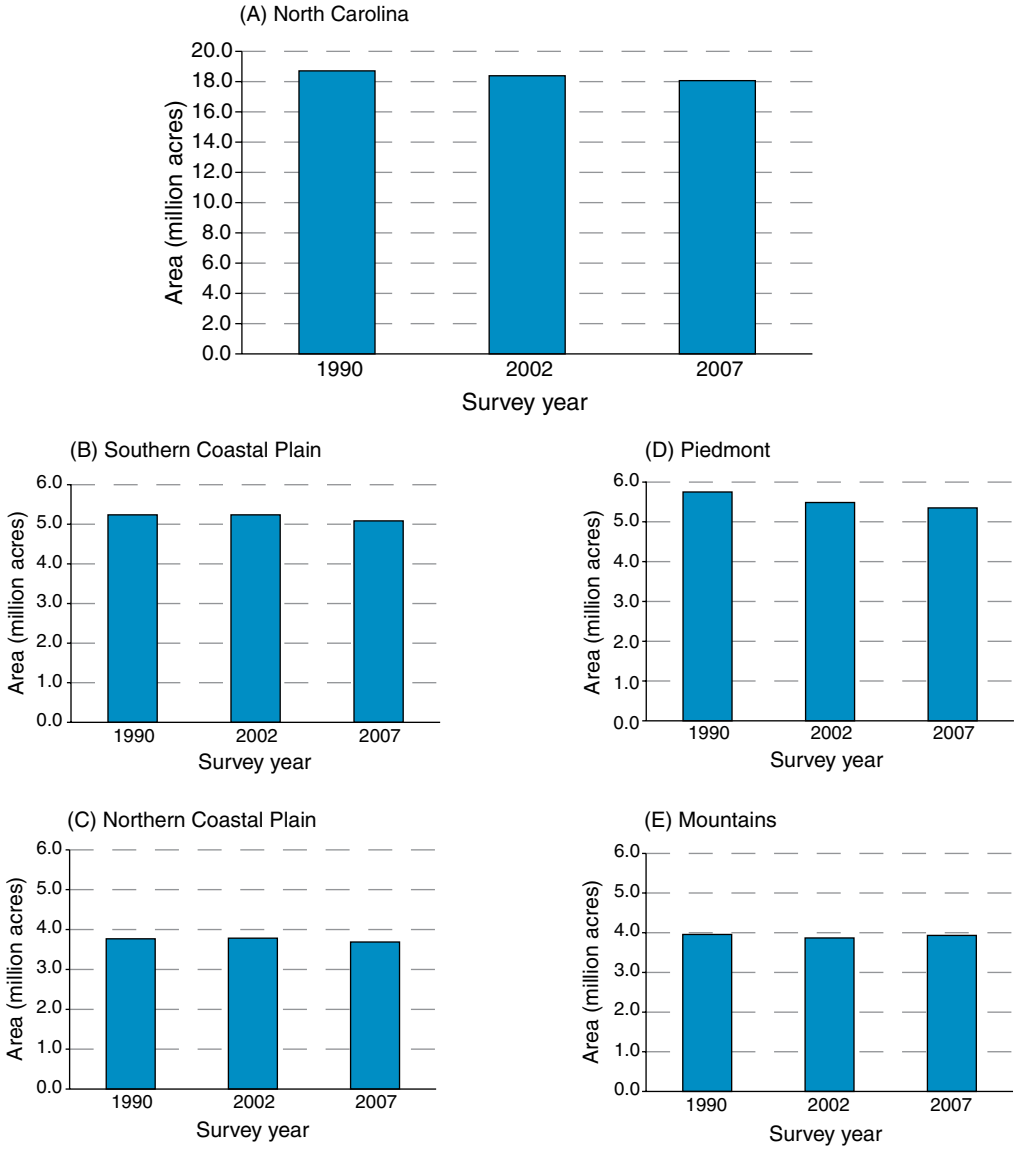


Figure 2—Area of timberland in (A) North Carolina by survey year and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

Ownership

Although in a downward trend, the private individual category continued to control most, 64 percent, of North Carolina's timberland in 2007. The "other corporate" category was second with 15 percent, followed by forest industry with 8 percent and national forest with 7 percent (fig. 3A). Area of timberland owned by private individuals dominated each of the four survey units. Beyond the private individual category, the order of category dominance differed by survey unit. The Southern Coastal Plain order (fig. 3B) was similar to that at the State level, but in the Northern Coastal Plain (fig. 3C), forest industry was second, and other corporate was third. In the Piedmont (fig. 3D), other corporate was second, and the State and local category was third. In the Mountains (fig. 3E), national forest ownership was clearly second, and other corporate was third.

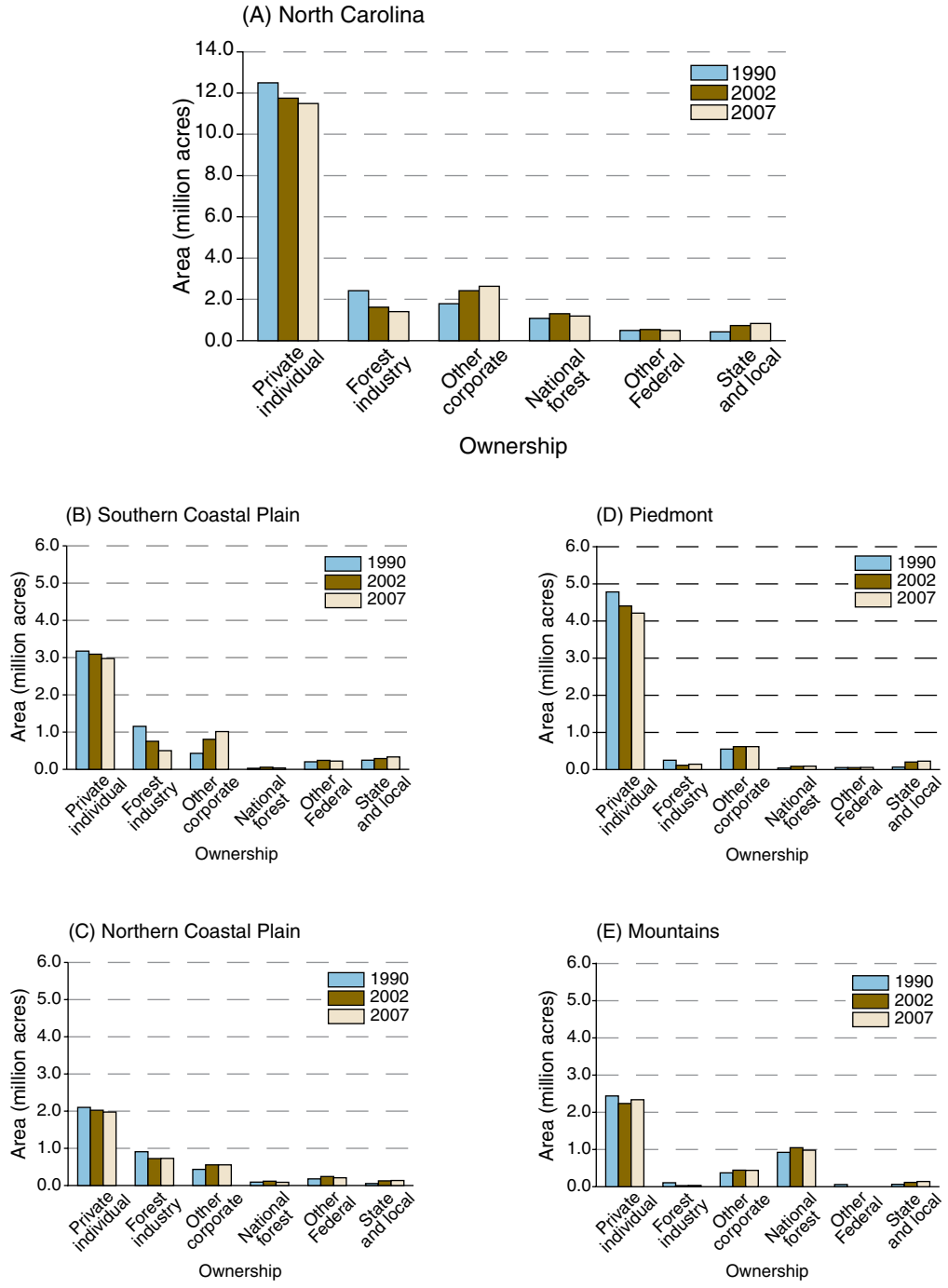


Figure 3—Area of timberland in (A) North Carolina by ownership, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

The decrease in area of North Carolina's timberland was also distributed differently by ownership category. At the State level, most of the decrease in timberland was recorded in the private individual and forest industry lands categories. Area of privately owned timberland decreased 2.5 percent since 2002, from nearly 11.8 million to 11.5 million acres in 2007. Forest industry timberland decreased 13 percent from >1.6

million to 1.4 million acres in 2007. Much of the lost private individual and forest industry category timberland was absorbed by increased area of timberland in the State and other corporate ownership categories.

By survey unit for instance, the decreased timberland in the private individual owner category occurred in three of the State's four survey units. It increased in the Mountains unit, where it recovered from a decline recorded in 2002. However, the decreased timberland in the forest industry category occurred only in the Southern Coastal Plain unit. Forest industry timberland actually increased slightly since 2002 in the Northern Coastal Plain unit. Although most forest industry timberland is found in the Coastal Plain units, the small amount located in the Piedmont and Mountains units increased slightly as well.

An increase in "other corporate" timberland often corresponds with a decrease in forest industry timberland. The link between the two was exhibited quite well by the downturn in forest industry timberland and upturn of other corporate timberland in the Southern Coastal Plain from 2002 to 2007. Simultaneously, in the Northern Coastal Plain, little change in the area of forest industry timberland resulted in little change in other corporate timberland from 2002 to 2007. The other corporate timberland acres are largely held in Timber Investment and Management Organizations (TIMOs), Real Estate Investment Trusts (REITs), Limited Liability Corporations, and similar organizations. As long as these timberland acres were owned and managed by forest industry, there was some assurance that they would remain in the timber- land base and contribute to the State's wood supply. However, new landowners may have other management goals and priorities in mind.

Most of the State's 11.5 million acres of private individual timberland, 37 percent, was located in the Piedmont unit, and 26 percent was located in the Southern Coastal Plain unit. The Mountains unit accounted for 20 percent, and the Northern Coastal Plain unit accounted for the remaining 17 percent.

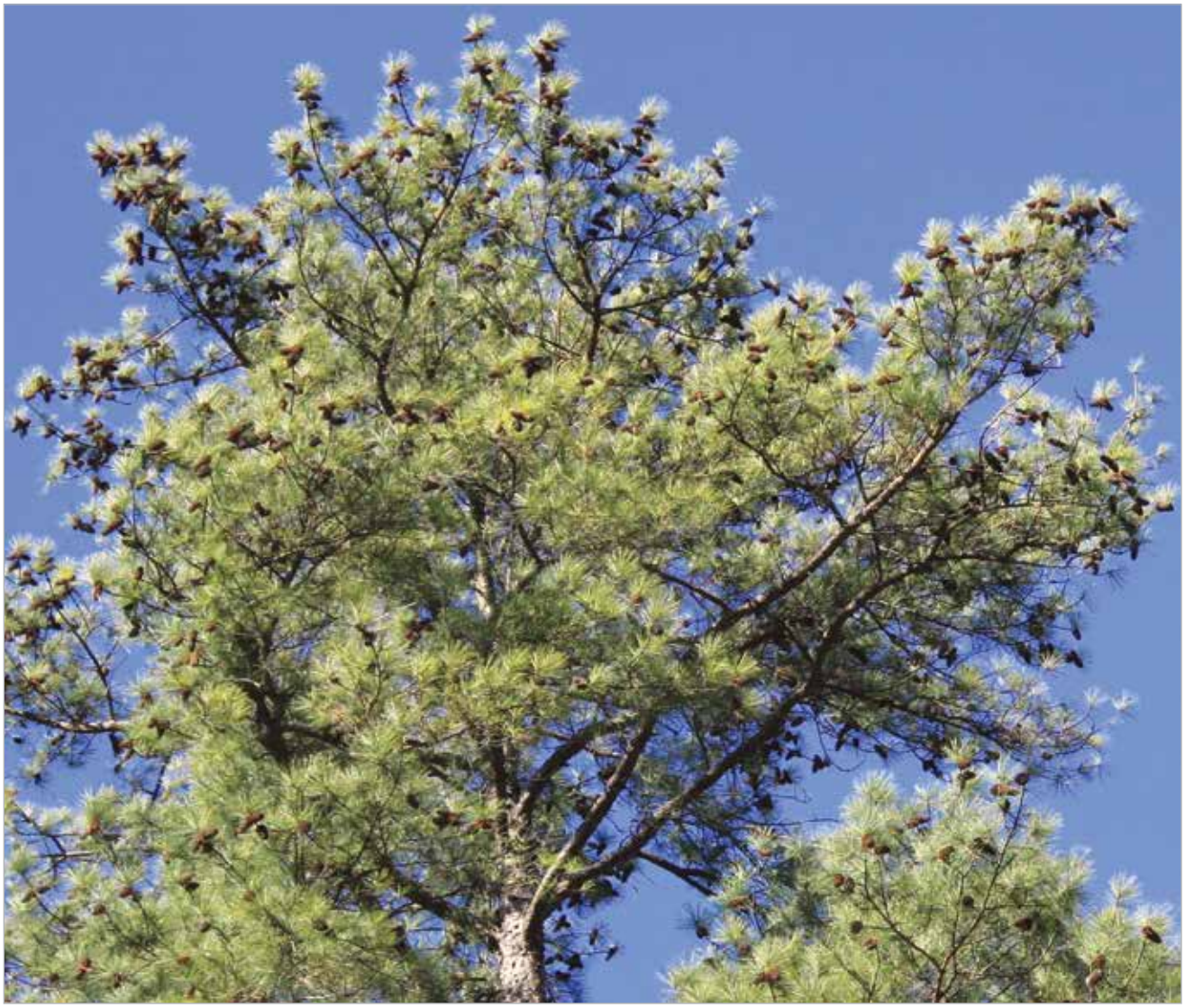
Most of the State's 1.4 million acres of forest industry timberland, 52 percent, was located in the Northern Coastal Plain unit, and 36 percent was located in the Southern Coastal Plain unit. The Piedmont unit accounted for 10 percent, and the Mountains unit accounted for the remaining 2 percent.

Most of the State's 2.6 million acres of other corporate timberland, 39 percent, was located in the Southern Coastal Plain unit, and 23 percent was located in the Piedmont unit. The Northern Coastal Plain unit accounted for 21 percent, and the Mountains unit accounted for the remaining 17 percent.

Most of the State's 1.2 million acres of national forest timberland, 82 percent, was located in the Mountains unit, and 8 percent was located in the Piedmont unit. The Northern Coastal Plain unit accounted for 7 percent, and the Southern Coastal Plain unit accounted for the remaining 3 percent.

Most of the State's 0.5 million acres of other Federal timberland, 46 percent, was located in the Southern Coastal Plain unit, and 43 percent was located in the Northern Coastal Plain unit. The Piedmont unit accounted for the remaining 11 percent, as none was recorded for the Mountains unit.

Most of the State's 0.8 million acres of State and local government timberland, 40 percent, was located in the Southern Coastal Plain unit, and 27 percent was located in the Piedmont unit. The Mountains unit accounted for 17 percent, and the Northern Coastal Plain unit accounted for the remaining 16 percent.



Lobolly pine, crown branches with many cones. Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

Forest Types

North Carolina has a very diverse mix of ecoregions within its State boundaries. With elevations ranging from sea level to more than 6,600 feet, many physiographic classes are present. From cypress ponds, pocosins, drains, swamps, floodplains, coves, uplands, flatwoods, and deep sands, to dry tops, many forest types and even transitional types are encountered. Among these types numerous tree species exist, some less common than others and some even rare. For this reason, the accompanying species list is limited to some 106 tree species historically identified on sample plots (appendix C). Furthermore, the most common species associations can be combined into forest types. The individual forest types are named for the species forming a plurality of the stocking. Forest types are collapsed into forest-type groups for better graphical representation in the figures. The forest-type groups of spruce-fir, white-red-jack pine, longleaf-slash pine, loblolly-shortleaf pine, oak-pine, other

hardwoods, oak-hickory, maple-beech-birch, elm-ash-cottonwood, oak-gum-cypress, and nonstocked are typically used in the Southern United States.

Collectively, the hardwood forest types accounted for 12.2 million acres, or 67 percent of North Carolina's timberland, and softwood forest types accounted for 32 percent. Nonstocked areas made up the remaining 1 percent.

Separately, the most common forest-type group that occurred in the State was oak-hickory forest types (fig. 4A). The oak-hickory forest-type group accounted for nearly 7.3 million acres, or 40 percent, of North Carolina's timberland. Loblolly-shortleaf pine types were next with 5.3 million acres, or 29 percent of the State's timberland. Oak-pine types were third with 2.3 million acres, or 13 percent of the State's timberland. The area of timberland classified as an oak-gum-cypress forest type was fourth and accounted for almost 1.9 million acres, or 10 percent of the State total. Areas having insufficient stocking of trees to determine a forest type were classified as nonstocked. Nonstocked timberland accounted for 162,000 acres.

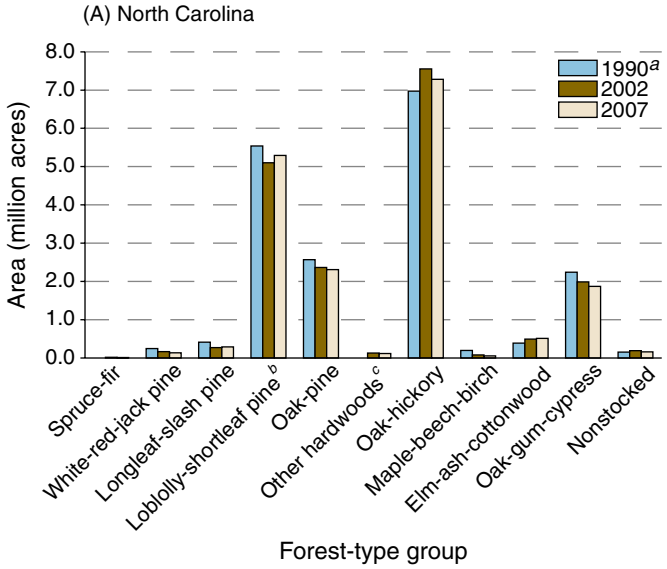
Most of the State's 7.3 million acres of oak-hickory forest-type timberland, 42 percent, was located in the Mountains unit, and 39 percent was located in the Piedmont unit. The Southern Coastal Plain unit accounted for 12 percent, and the Northern Coastal Plain unit accounted for the remaining 7 percent.

Most of the State's 5.3 million acres of loblolly-shortleaf forest-type timberland, 41 percent, was located in the Southern Coastal Plain unit, and 32 percent was located in the Northern Coastal Plain unit. The Piedmont unit accounted for 25 percent, and the Mountains unit accounted for the remaining 2 percent.

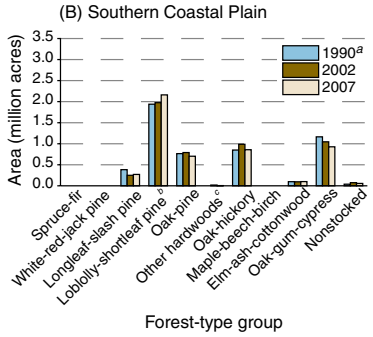
Most of the State's 2.3 million acres of oak-pine forest-type timberland, 34 percent, was located in the Piedmont unit, and 30 percent was located in the Southern Coastal Plain unit. The Northern Coastal Plain unit accounted for 19 percent, and the Mountains unit accounted for the remaining 17 percent.

Most of the State's nearly 1.9 million acres of oak-gum-cypress forest type timberland, 49 percent, was located in the Southern Coastal Plain unit, and 44 percent was located in the Northern Coastal Plain unit. The Piedmont unit accounted for the remaining 7 percent, as none was recorded in the Mountains unit.

As might be expected, the forest-type group order of prevalence at the State level was very different by survey unit. In the Southern Coastal Plain unit (fig. 4B), the most common forest-type group present was loblolly-shortleaf pine, which accounted for 43 percent of the unit's timberland. Oak-gum-cypress type was second, with 18 percent of the timberland, and third was oak-hickory with 17 percent. Oak-pine came in fourth with 14 percent. Although the Northern Coastal Plain unit's (fig. 4C) order of forest type prevalence matched that of the Southern Coastal Plain, the percentages varied by forest type. Loblolly-shortleaf pine type accounted for 46 percent, oak-gum-cypress 22 percent, oak-hickory 14 percent, and oak-pine 12 percent of the timberland in the Northern Coastal Plain unit. The Piedmont unit (fig. 4D) came closest to following the statewide order of prevalence. It matched the first three but differed on the fourth. In the Piedmont, oak-hickory forest type accounted for 52 percent of the timberland, followed by loblolly-shortleaf with 25 percent, oak-pine with 15 percent, and then elm-ash-cottonwood with 5 percent. The Mountains unit (fig. 4E) was the most dominated by one forest-type group. In the Mountains, oak-hickory accounted for 79 percent of the timberland. Oak-pine was second with 10 percent, white-red-jack pine was third with >3 percent, and loblolly-shortleaf pine was fourth with <3 percent of the timberland in the Mountains unit.



[a] 1990 survey data incorporated spruce-fir with loblolly-shortleaf pine and other hardwoods with oak-hickory.
[b] Includes other softwoods.
[c] Includes exotic hardwoods and aspen-birch.



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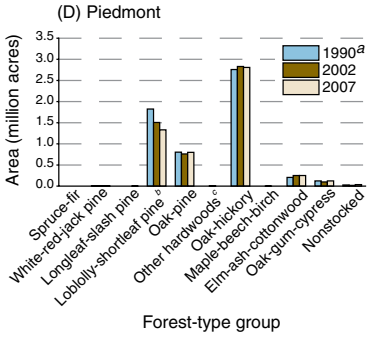

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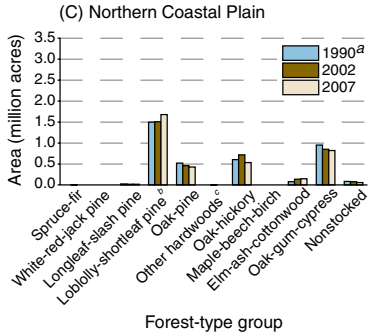

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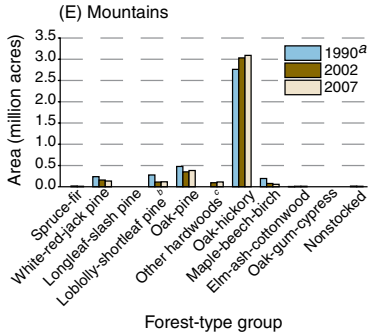


[a] 1990 survey data incorporated spruce-fir with loblolly-shortleaf pine and other hardwoods with oak-hickory.
[b] Includes other softwoods.
[c] Includes exotic hardwoods and aspen-birch.

Figure 4—Area of timberland in (A) North Carolina by forest-type group, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

Stand-Size Class

FIA classified forest stands into three major stand-size classes to provide a quick picture of the resource. Those few acres with insufficient stocking to determine forest type or stand size were allocated to the nonstocked category. The classes were sawtimber-size, poletimber-size, and sapling-seedling size.

The sawtimber-size class covered almost 9.6 million acres, or 53 percent, of North Carolina's timberland in 2007. Based on broad forest-type groupings, most of the sawtimber-size stands, 46 percent, were composed of upland hardwood forest types (fig. 5A). Softwood forest types made up 29 percent and lowland hardwood forest types made up 14 percent of the State's sawtimber-size timberland. The oak-pine forest types were fourth and accounted for 11 percent.

The poletimber-size class covered 4.2 million acres, or 23 percent, of North Carolina's timberland in 2007. Based on broad forest-type groupings, most of the poletimber-size stands, 39 percent, were composed of softwood forest types (fig. 5A). A close second, upland hardwood forest types made up 36 percent of the State's poletimber-size timberland, and oak-pine forest types made up 13 percent. The lowland hardwood forest types were fourth and accounted for 12 percent.

The sapling-seedling size class covered 4.1 million acres, or 23 percent, of North Carolina's timberland in 2007. Based on broad forest-type groupings, most of the sapling-seedling size stands, 37 percent, were composed of upland hardwood forest types (fig. 5A). Softwood forest types made up 31 percent and oak-pine types made up 18 percent of the State's sapling-seedling size timberland. The lowland hardwood forest types were fourth and accounted for 14 percent.

Just as forest types distribution by survey unit differed from those at the State level, so the stand-size class distribution across the broad forest-type categories differed by survey unit from the statewide distribution. For instance, whereas upland hardwood forest types dominated the statewide distribution of sawtimber-size stands, it was the softwood forest types that dominated sawtimber-size stands in the Southern Coastal Plain.

In fact, the sawtimber-size class covered almost 2.2 million acres, or 43 percent, of the Southern Coastal Plain's timberland in 2007. Based on broad forest-type groupings, most of the sawtimber-size stands, 55 percent, consisted of softwood forest types (fig. 5B). Lowland hardwood forest types made up 23 percent and oak-pine types made up 12 percent of the Southern Coastal Plain's sawtimber-size timberland. The upland hardwood forest types were fourth and accounted for 10 percent.

The poletimber-size class covered 1.3 million acres, or 26 percent, of the Southern Coastal Plain's timberland in 2007. Based on broad forest-type groupings, most of the poletimber-size stands, 53 percent, were made up of softwood forest types (fig. 5B). Next were lowland hardwood, upland hardwood, and oak-pine forest types, which accounted for 18, 17, and 12 percent of the Southern Coastal Plain's poletimber-size timberland, respectively.

The sapling-seedling size class covered <1.6 million acres, or 31 percent, of the Southern Coastal Plain's timberland in 2007. Based on broad forest-type groupings, most of the sapling-seedling size stands, 36 percent, were composed of softwood forest types (fig. 5B). Upland hardwood forest types made up 27 percent and lowland hardwood forest types made up 19 percent of the Southern Coastal Plain's sapling-seedling size timberland. The oak-pine forest types were fourth and accounted for 18 percent.

The sawtimber-size class covered <1.7 million acres, or 45 percent, of the Northern Coastal Plain's timberland in 2007. Based on broad forest-type groupings, most of the sawtimber-size stands, 48 percent, were composed of softwood forest types (fig. 5C). Lowland hardwood

forest types made up 32 percent and upland hardwood forest types made up 12 percent of the Northern Coastal Plain's sawtimber-size timberland. The oak-pine forest types were fourth and accounted for 8 percent.

The poletimber-size class covered almost 0.9 million acres, or 24 percent, of the Northern Coastal Plain's timberland in 2007. Based on broad forest-type groupings, most of the poletimber-size stands, 56 percent, were composed of softwood forest types (fig. 5C). Lowland hardwood forest types accounted for 21 percent, upland hardwood forest types 12 percent, and oak-pine forest types 11 percent of the Northern Coastal Plain's poletimber-size timberland.

The sapling-seedling size class covered <1.1 million acres, or 29 percent, of the Northern Coastal Plain's timberland in 2007. Based on broad forest-type groupings, most of the sapling-seedling size stands, 38 percent, were composed of softwood forest types (fig. 5C). Lowland hardwood forest types made up 23 percent and upland hardwood types made up 21 percent of the Northern Coastal Plain's sapling-seedling size timberland. The oak-pine forest types were fourth and accounted for 18 percent.

The sawtimber-size class covered <2.9 million acres, or 54 percent, of the Piedmont's timberland in 2007. Based on broad forest-type groupings, most of the sawtimber-size stands, 56 percent, were composed of upland hardwood forest types (fig. 5D). Softwood forest types made up 21 percent and oak-pine forest types made up 14 percent of the Piedmont's sawtimber-size timberland. The lowland hardwood forest types were fourth and accounted for 9 percent.

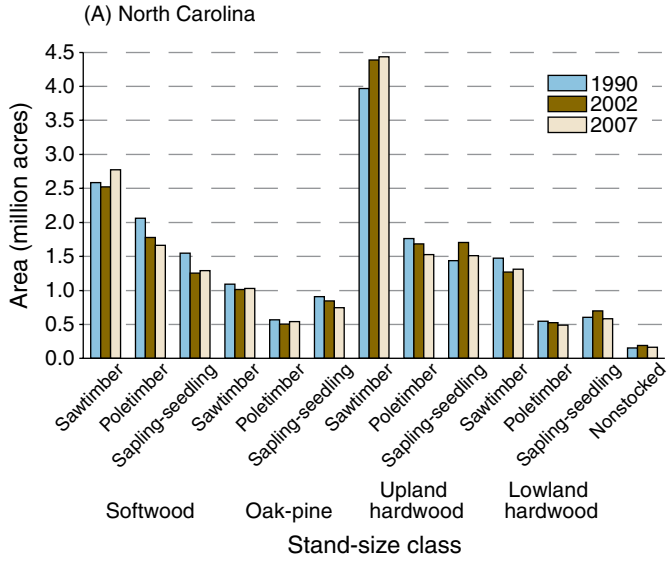
The poletimber-size class covered 1.2 million acres, or 23 percent, of the Piedmont's timberland in 2007. Based on broad forest-type groupings, most of the poletimber-size stands, 44 percent, were composed of upland hardwood forest types (fig. 5D). Softwood forest types made up 35 percent and oak-pine forest types made up 15 percent of the Piedmont's poletimber-size timberland. The lowland hardwood forest types accounted for the remaining 6 percent.

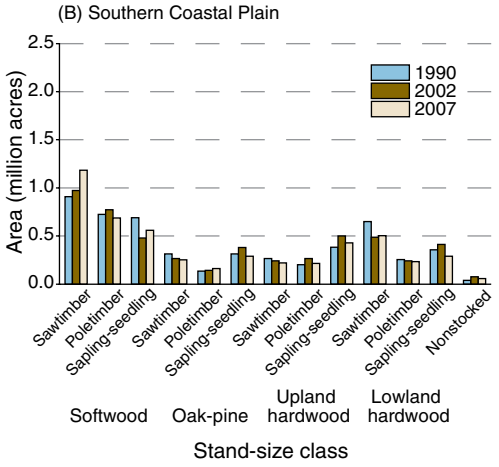
The sapling-seedling size class covered >1.2 million acres, or 23 percent, of the Piedmont's timberland in 2007. Based on broad forest-type groupings, most of the sapling-seedling size stands, 55 percent, were composed of upland hardwood forest types (fig. 5D). Softwood forest types made up 24 percent and oak-pine forest types made up 17 percent of the Piedmont's sapling-seedling size timberland. The lowland hardwood forest types were fourth and accounted for >3 percent.

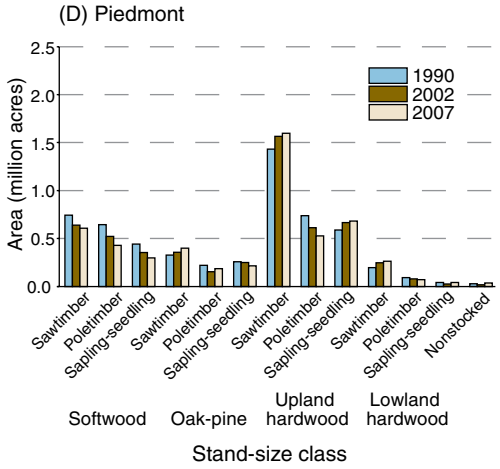
The sawtimber-size class covered >2.8 million acres, or 73 percent, of the Mountains' timberland in 2007. Based on broad forest-type groupings, a great majority of the sawtimber-size stands, 85 percent, were composed of upland hardwood forest types (fig. 5E). Oak-pine forest types made up 8 percent and the softwood forest types made up 7 percent of the Mountains' sawtimber-size timberland. The lowland hardwood forest types accounted for <1 percent.

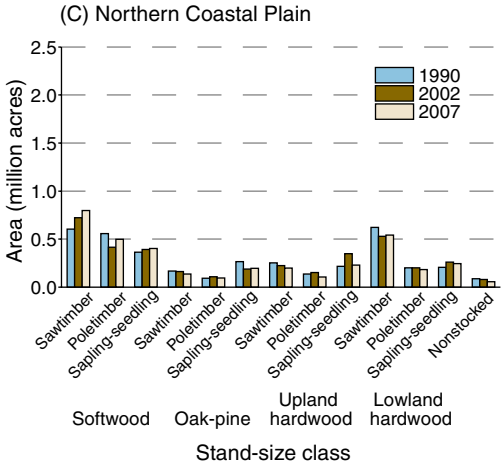
The poletimber-size class covered >0.8 million acres, or 21 percent, of the Mountains' timberland in 2007. Based on broad forest-type groupings, most of the poletimber-size stands, 82 percent, were composed of upland hardwood forest types (fig. 5E). Oak-pine forest types made up 12 percent and softwood forest types made up 6 percent of the Mountains' poletimber-size timberland. The lowland hardwood forest types accounted for <1 percent.

The sapling-seedling size class covered >0.2 million acres, or 6 percent, of the Mountains' timberland in 2007. Based on broad forest-type groupings, most of the sapling-seedling size stands, 68 percent, were composed of upland hardwood forest types (fig. 5E). Oak-pine forest types made up 18 percent and softwood forest types made up 12 percent of the Mountains' sapling-seedling size timberland. The lowland hardwood forest types were fourth and accounted for 2 percent.









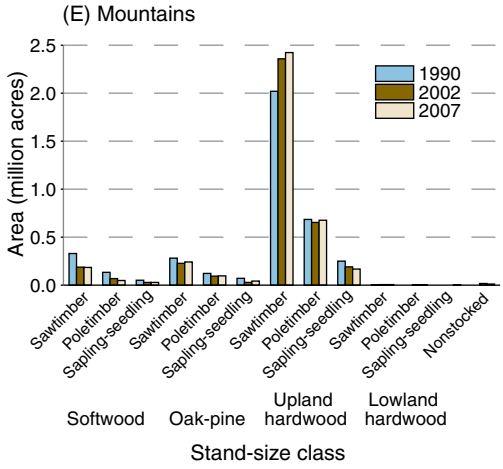


Figure 5—Area of timberland in (A) North Carolina by stand-size class, broad forest-type group, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

Stand Origin

Identifying stand origin, by determining whether a stand was established naturally or through planting, helps to describe the State's timberland resource and provides important information to certain segments of the State's wood-using industry. In 2007, almost 3.3 million acres or 18 percent, of North Carolina's timberland exhibited clear evidence of artificial regeneration (fig. 6A). For the purposes of this report, those acres are considered to be planted and the terms herein used synonymously.

More than 2.7 million acres, or 83 percent of the area with evidence of artificial regeneration, was classified in the softwood forest-type group. The remaining 17 percent was classified in the hardwood forest-type group. It is important to note that the oak-pine forest types are classified under the hardwood forest-type group. In fact, oak-pine forest types accounted for one-half of the planted hardwood forest-type group timberland. These planted oak-pine stands typically result from varying degrees of planting success or hardwood competition. Under these circumstances, forest type classifications compute to mixed species stands from the species stocking ratios present. However, some acres are intentionally planted to specific hardwood species. Of the >0.5 million planted hardwood acres, 280,000 acres were oak-pine forest types and 220,000 were oak-hickory forest types. Less than 10,000 acres each were classified as elm-ash-cottonwood and oak-gum-cypress forest types. Within the softwood forest-type group, loblolly-shortleaf pine forest type accounted for <2.6 million acres, or 79 percent, of the State's total planted timberland. Longleaf-slash pine forest type accounted for 127,000 acres, and white-red-jack pine forest type accounted for 18,000 acres.

In 1990, area of natural softwood was twice the area of planted softwood in North Carolina (fig. 6A). By the 2007 survey, however, the areas of planted softwood and natural softwood had drawn closer to the same amounts. The area of planted softwood acres increased while the area of natural softwood acres decreased.

Distribution of the State's 3.3 million acres of planted timberland was not even across the four survey units. The two easternmost units together accounted for more than three-fourths of the planted timberland in North Carolina. Most of the planted acres, or 43 percent, were located in the Southern Coastal Plain unit (fig. 6B), and another 34 percent were located in the Northern Coastal Plain unit (fig. 6C). The Piedmont unit (fig. 6D) accounted for almost 22 percent of the planted timberland. Planted timberland in the Mountains unit (fig. 6E) was limited and accounted for only 1 percent of the State total.

Area of planted timberland accounted for 1.4 million acres, or 27 percent, of the Southern Coastal Plain's timberland in 2007. Based on major forest-type groupings, most of the planted stands, 86 percent, were composed of softwood forest types (fig. 6B). Since 1990, the area of planted softwood stands has increased. As the decrease in area of natural softwood stands slowed, planted and natural softwood acres became almost equal in 2007.

Area of planted timberland accounted for >1.1 million acres, or 30 percent, of the Northern Coastal Plain's timberland in 2007. Based on major forest-type groupings, most of the planted stands, 87 percent, were composed of softwood forest types (fig. 6C). Since 1990, the area of planted softwood stands has increased and the area of natural softwood stands has decreased to the point where planted softwood stands exceeded natural softwood stands in 2007. To date, this has been the only unit of the State where this occurred.

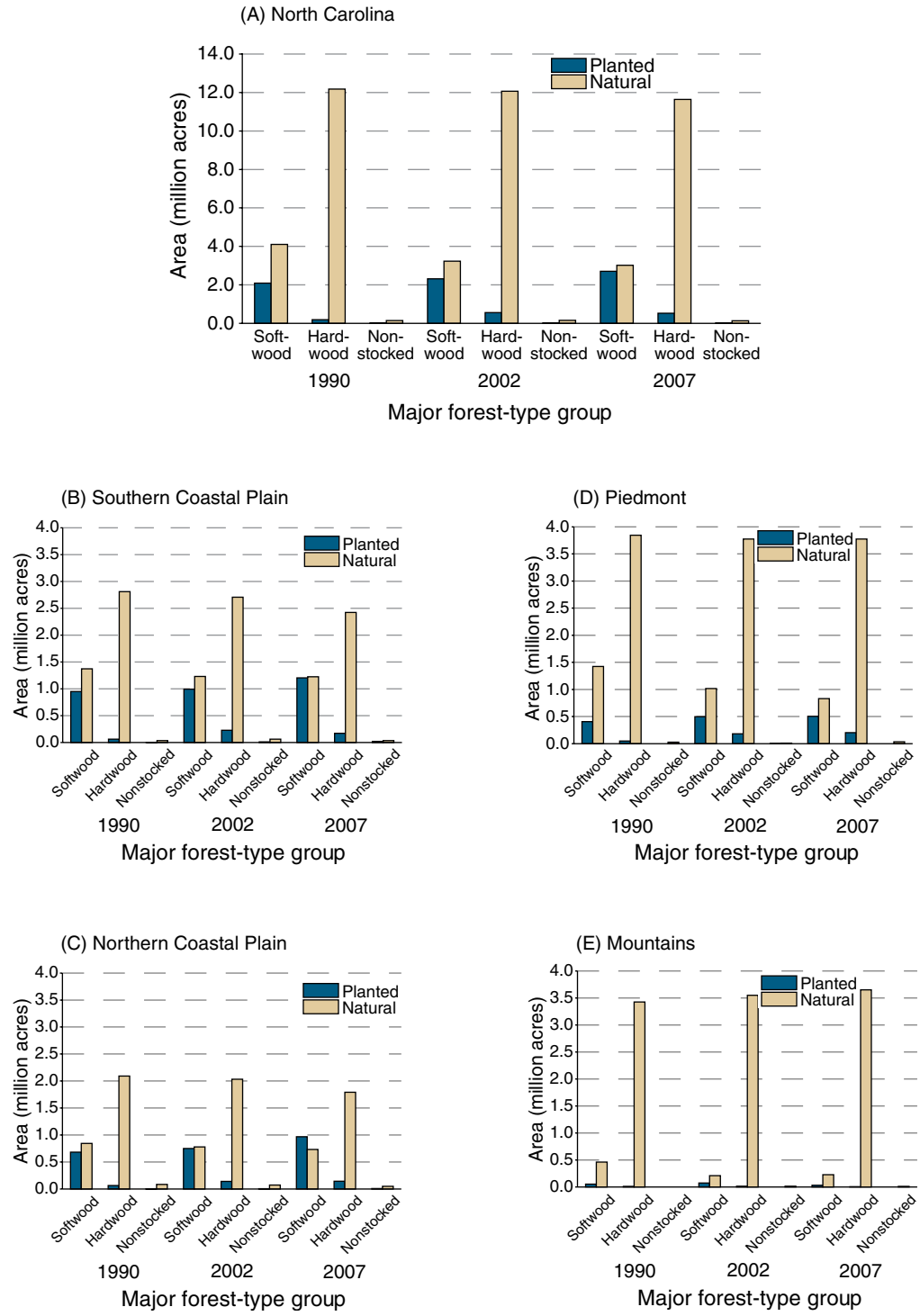


Figure 6—Area of timberland in (A) North Carolina by major forest-type group, stand origin, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

Area of planted timberland accounted for 0.7 million acres, or 13 percent, of the Piedmont's timberland in 2007. Based on major forest-type groupings, most of the planted stands, 71 percent, were composed of softwood forest types (fig. 6D). Since 1990, the area of planted softwood stands increased minimally, and remained unchanged from that in 2002. The area of natural softwood stands continued to decrease and the change in the Piedmont may be the most evident of the four units. However, because areas of planted stands have not increased, natural softwood stands still exceeded planted softwood stands in 2007.

Area of planted timberland accounted for just 40,000 acres, or 1 percent, of the Mountains' timberland in 2007. Based on major forest-type groupings, most of the planted stands, 85 percent, were composed of softwood forest types (fig. 6E). Although minimal to begin with, the area of planted softwood stands decreased. After declines from 1990 levels, the area of natural softwood stands has remained stable since 2002.

Stand-Age Class

For all species together, the planted and natural stands by stand-age class provide another method to describe North Carolina's timberland. In 2007, the statewide area of planted timberland peaked in the 0- to 10-year age class and almost disappeared after the 31- to 40-year age class (fig. 7A). There was also a slight dip in the 11- to 20-year age class, which may indicate pulpwood removal prior to stand liquidation more evident in >30-year age classes. The statewide area of natural timberland peaked sharply in the 41- to 80-year age classes.

In the Southern Coastal Plain unit (fig. 7B), the area of planted timberland remained relatively unchanged through the 21- to 30-year age class, after which the rate of liquidation accelerated. Notably, of those fewer acres of planted timberland in the 41- to 60-year age class, almost two-thirds occurred in the Southern Coastal Plain. Natural timberland in this unit peaked in the 41- to 60-year age class.

In the Northern Coastal Plain unit (fig. 7C), the area of planted timberland clearly peaked in the 0- to 10-year age class and also all but disappeared after the 31- to 40-year age class. A large part of the dip in the 11- to 20-year age class planted timberland statewide was supported by a very noticeable dip in total acreage in that age class in the Northern Coastal Plain. The natural timberland in this unit peaked in the 41- to 60-year age class as it did in the Southern Coastal Plain unit.

In the Piedmont unit (fig. 7D), the area of planted timberland started to disappear after the 21- to 30-year age class. There was a noticeable dip in the 11- to 20-year age class here as well. The natural timberland in this unit peaked in the 41- to 60-year age class as it did in the Coastal Plain units.

In the Mountains unit (fig. 7E), the 2007 survey recorded no area of planted timberland in the 0- to 10-year age class. The nominal area of planted timberland in the Mountains peaked in the 11- to 20-year age class. Sixteen percent of planted timberland in the Mountains unit was in the 41- to 60-year age class. The Mountains unit had the oldest peak of natural timberland in the State at the 61- to 80-year age class.

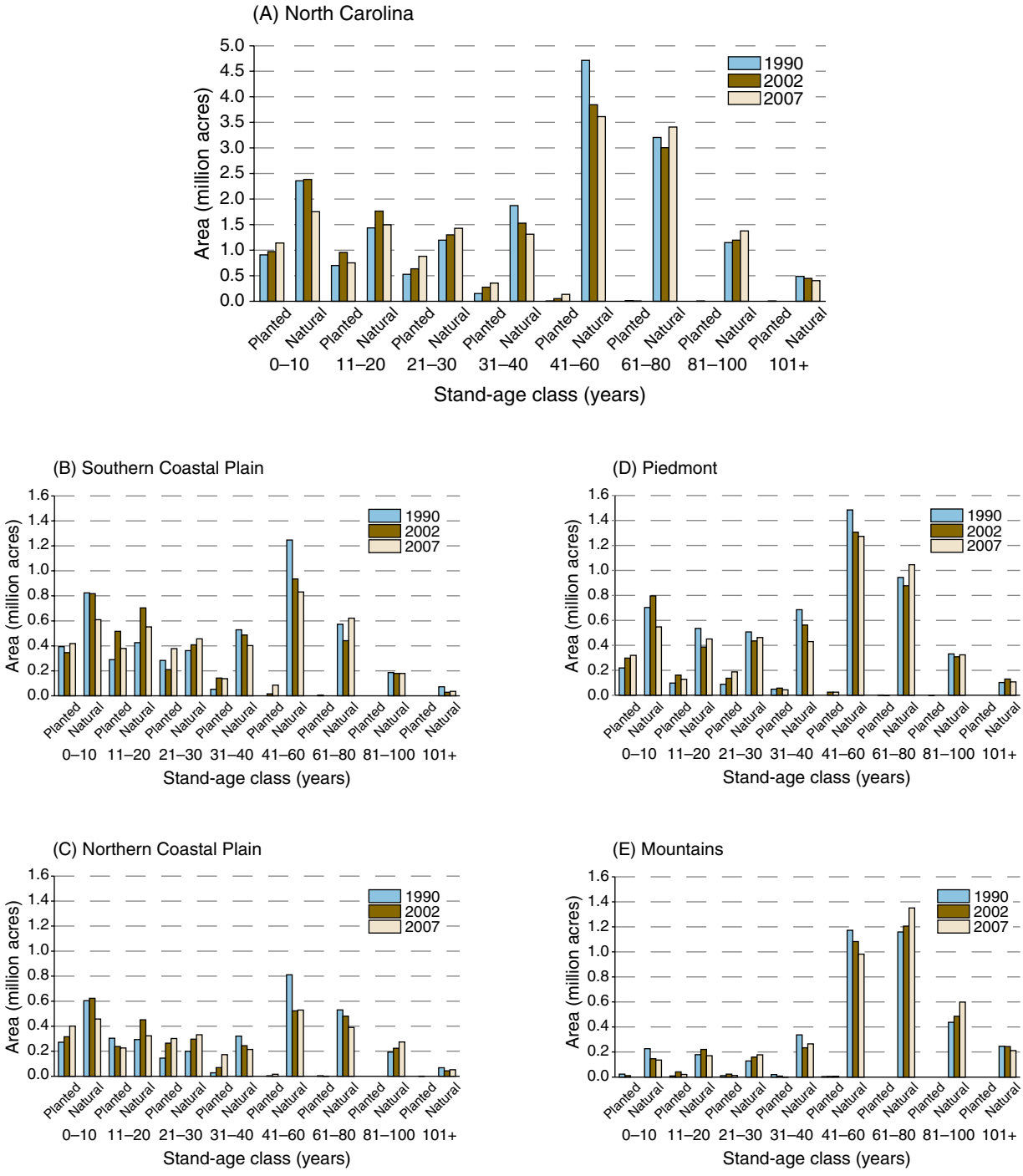


Figure 7—Area of timberland in (A) North Carolina by stand-age class, stand origin, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

Timberland Statistics: Tree Volume

The calculation of volume begins with a tally of trees. The numbers of trees by species along with their heights and diameters form the foundation for all the algorithmic processes to follow.

Figure 8A shows the top 10 timberland tree species by number that are at least 1 inch diameter at breast height (d.b.h.). Loblolly, red maple, and sweetgum accounted for the highest numbers of trees. There were similarities and differences in the order of prevalence and species present by survey unit. For instance, the statewide top three remained in the top three until the Mountains unit. Only in the Southern Coastal Plain unit (fig. 8B) did longleaf pine make the top 10 list. Sweetbay, redbay, and swamp tupelo were included in both the Southern and Northern Coastal Plain unit (fig. 8C) lists. These 3 species were in the top 10 only in the Coastal Plain units. In the Piedmont unit, Virginia pine, dogwood, and black cherry appeared (fig. 8D). Only in the Piedmont did Virginia pine make the top 10. The top 10 for the Mountains unit (fig. 8E) differed from the other units most of all. Here, white pine, sweet birch, chestnut oak, hemlock, and beech made the top 10. However, with the demise of hemlock trees, it is certain to be missing from future lists.

Planted red spruce in western North Carolina. (photo courtesy of USDA Forest Service, Southern Research Station)

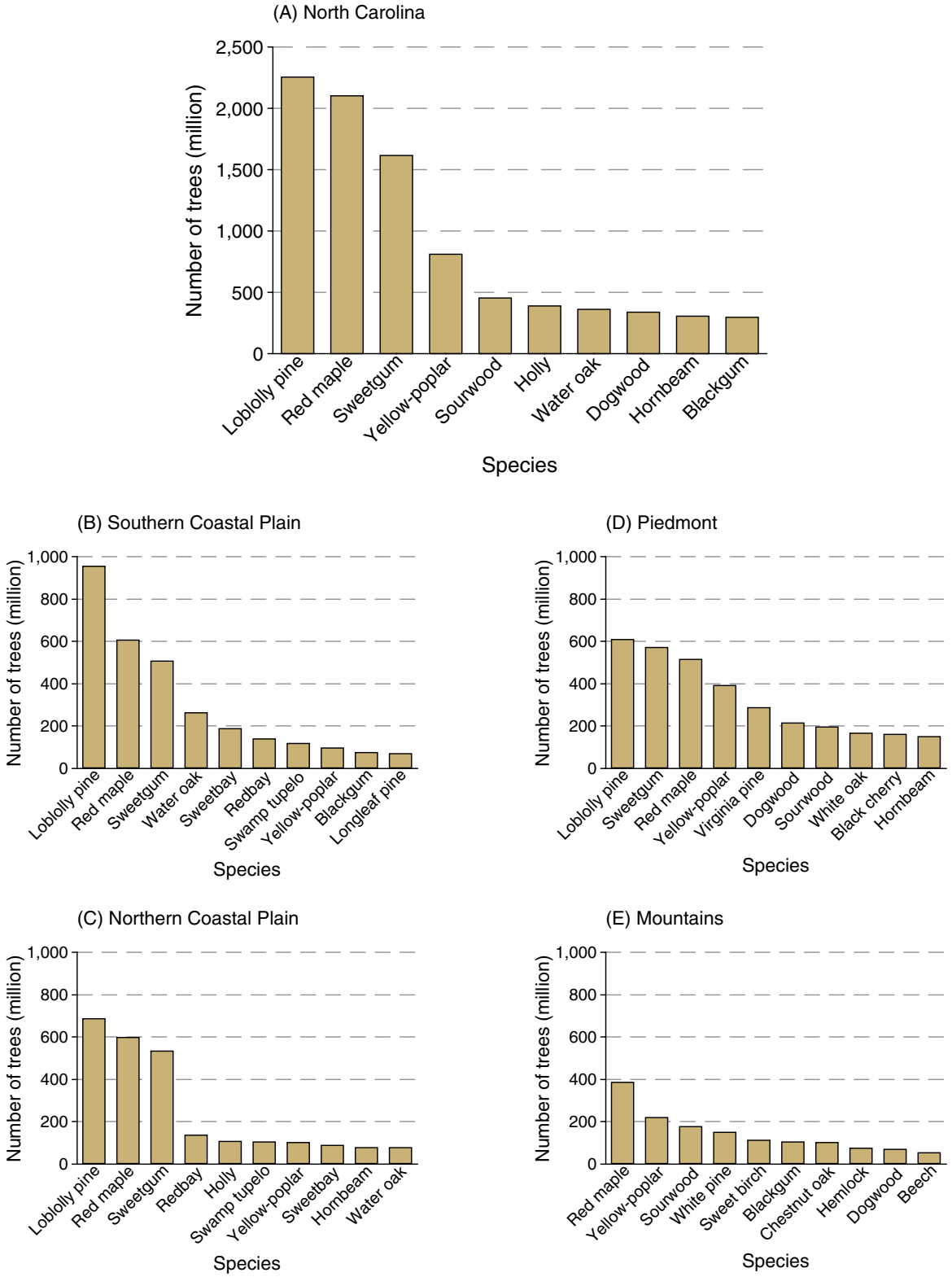


Figure 8—Top 10 species based on number of trees in (A) North Carolina and by survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains, 2007.

The top 10 trees on North Carolina timberland based on tree species volume (fig. 9A) altered the list of species order and presence from that by number of trees. These differences occurred for two primary reasons. First, it would take the volume from numerous small trees of a particular species to match the volume in one large tree of another species. Second, volume is calculated based on merchantability standards of a 1-foot stump to a 4-inch diameter top; thus only trees ≥5.0 inches d.b.h. are included in volume calculations. Statewide, yellow-poplar, which ranked fourth in tree numbers (fig. 8A), rose to second in prominence when considered by volume (fig. 9A). In fact, by volume, the list totally changed for spots 5 through 10 and incorporated more oak species. Similar changes occurred by survey unit. In the Southern Coastal Plain unit (fig. 9B), loblolly pine, sweetgum, and swamp tupelo formed the top three by volume, with pond pine and slash pine having enough volume to make the list. The top three from the Southern Coastal Plain were the same in the Northern Coastal Plain (fig. 9C), but here, baldcypress and green ash accounted for enough volume to make the list. In the Piedmont unit (fig. 9D), yellow-poplar, loblolly pine, and white oak accounted for the top three volume totals. Only in the Piedmont did shortleaf pine have enough volume to make the list. In the Mountains unit (fig. 9E), yellow-poplar, chestnut oak, and red maple occupied the top three spots for volume. Sweet birch, hemlock, and pignut hickory made the top 10 list as well, but mortality of hemlock will certainly remove it from future lists.

The Southern Coastal Plain held 41 percent of the State's total loblolly pine volume. Together, the two Coastal Plain units had 76 percent of the loblolly pine volume in the State. The Mountains unit had almost one-half, 46 percent, of the State's yellow-poplar volume. The Mountains and Piedmont units together had 84 percent of North Carolina's yellow-poplar volume. The greatest volume of red maple, 38 percent, was located in the Mountains unit, followed by 27 percent in the Piedmont unit. Forty-two percent of the sweetgum volume occurred in the Piedmont unit with the remainder roughly split between the Coastal Plain units, as the Mountains unit had little. Other survey findings showed 56 percent of the white oak volume to be located in the Piedmont unit, 95 percent of the white pine volume in the Mountains unit, and 55 percent of the State's baldcypress volume in the Northern Coastal Plain unit.

Volume as a descriptor of the timber resource is in many ways a better approach to analyzing the potential of a State's forests. Unlike area by forest type, volume can be analyzed related to tree species population estimates regardless of occurrence. For example, all yellow-poplar volume can be summed for an individual survey unit regardless of its distribution on the ground, or trends in volume of yellow-poplar can be tracked. Furthermore, volume can be summed for a species or species group by diameter class or for a particular ownership group alone. In essence, wood volume is the medium of exchange that propels the State's forest industry economy. Suffice it to say, volume is ultimately the basis for determining net change using components of growth to be discussed in the next section of this report.

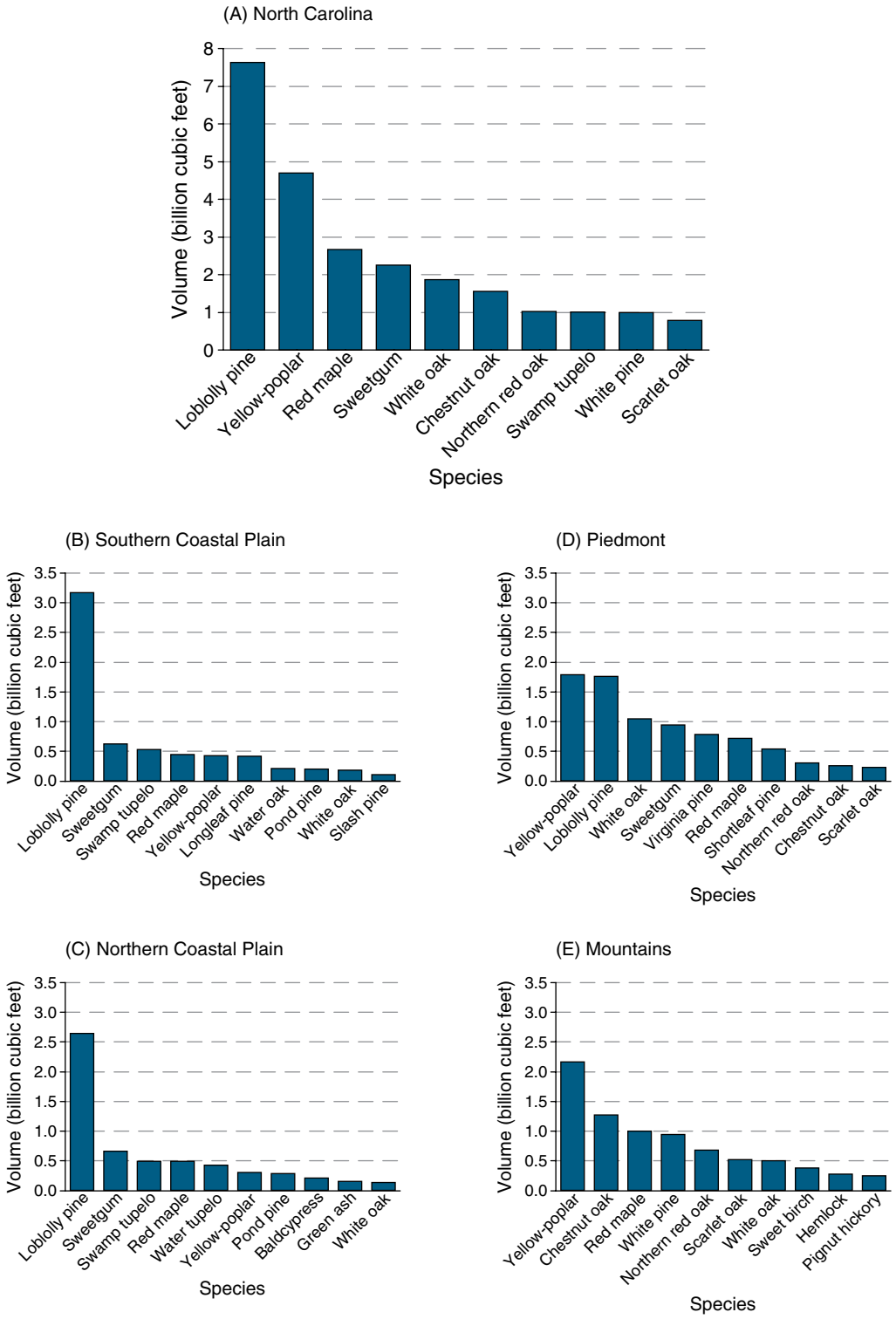


Figure 9—Top 10 species based on volume of trees in (A) North Carolina and by survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains, 2007.

Overall, all-live tree merchantable volume on timberland in North Carolina increased to 35.8 billion cubic feet in 2007 from 34.5 billion cubic feet in 2002. Merchantable volume is based on trees 5.0 inches d.b.h. and larger. The softwood species together accounted for 35 percent, or 12.4 billion cubic feet, of the total (fig. 10A). In combination, all the hardwood species made up 65 percent, or 23.4 billion cubic feet.

Eighty-eight percent, or >31.5 billion cubic feet, of North Carolina's total all-live merchantable volume is in species from stands of natural origin. Twelve percent, or almost 4.3 billion cubic feet, is in species from stands with evidence of artificial regeneration (planted). Softwood species accounted for 92 percent, or 3.9 billion cubic feet, of the State's planted volume (fig. 10A). The distribution of this planted volume differed by survey unit within the State. Together, the two Coastal Plain units accounted for 77 percent, or 3.3 billion cubic feet, of the State's planted volume. The Southern Coastal Plain accounted

Northern red oak, light/dark striped bark at mid height on double-trunked tree. Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

for 1.7 billion cubic feet of the planted volume (fig. 10B) and the Northern Coastal Plain accounted for 1.6 billion cubic feet (fig. 10C). The Piedmont unit accounted for 20 percent, or nearly 0.9 billion cubic feet, of the State's planted volume (fig. 10D). The Mountains unit accounted for <3 percent, or 0.1 billion cubic feet, of the State's planted volume (fig. 10E). Softwood species made up a slightly higher percentage of the planted volume in the Southern and Northern Coastal Plain units, 93 and 94 percent, respectively, versus 87 percent in both the Piedmont and Mountains units.

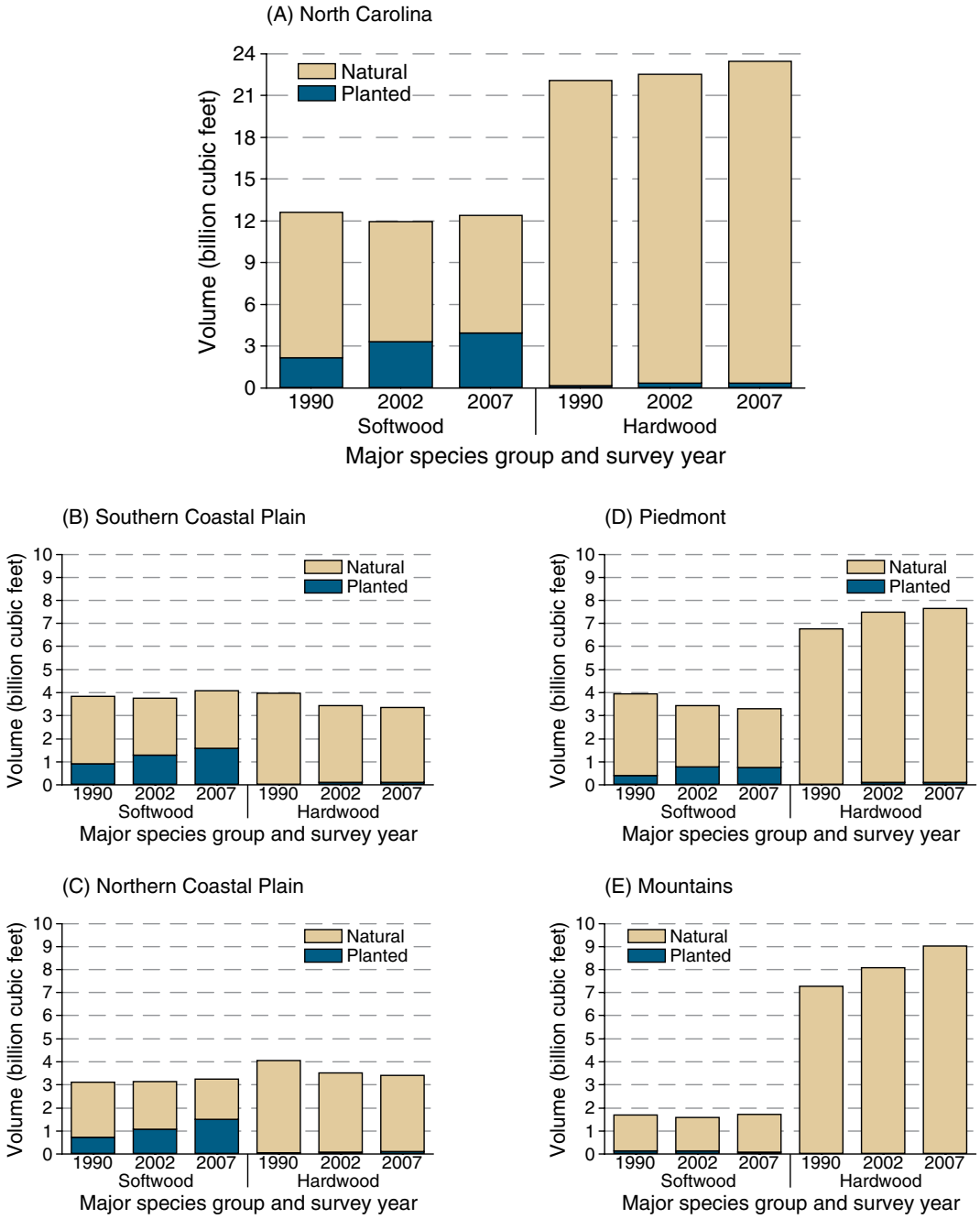
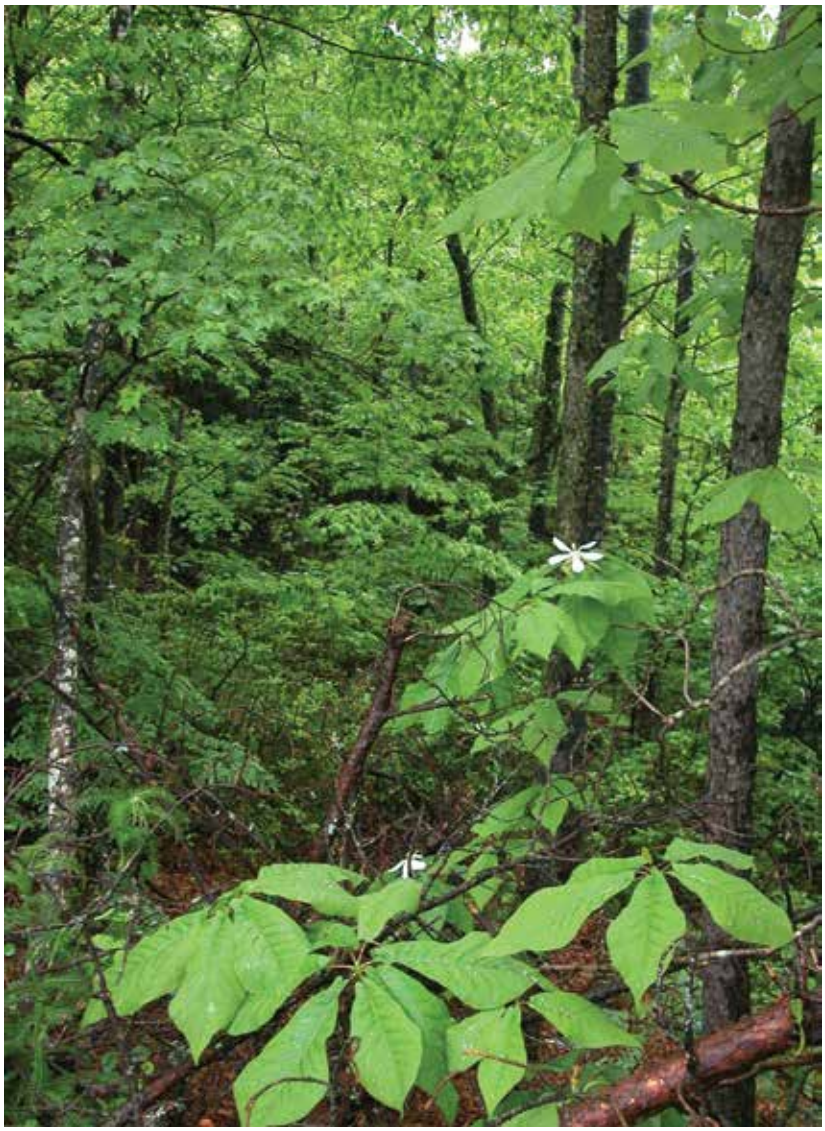


Figure 10—All-live merchantable volume in (A) North Carolina by major species group, survey year, stand origin, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

The distribution of the State's all-live merchantable volume differed by diameter class between the species groups. At the State level, volume of softwood species centered around the 8- to 12-inch diameter classes (fig. 11A). In fact, the softwood volume peaked in the 10-inch d.b.h. class. In 2007, the volume of softwood in the 6- through 10- inch diameter classes was down from that recorded in 1990. In contrast it was similar or higher in the 12-inch and larger diameter classes. For the two Coastal Plain units in general, softwood volume distribution by diameter class mirrored that at the State level primarily because they contain more of the softwood volume than the other two units. In the Southern Coastal Plain unit (fig. 11B), the change since 1990 in smaller softwood diameter classes was less severe and confined to the 6- and 8-inch diameter classes. In the Northern Coastal Plain unit (fig. 11C), it was also less severe, but did extend through the 10-inch diameter class. Differences here were that softwood volumes in the ≥20-inch diameters were down from those recorded in 1990, and softwood volume peaked in the 12-inch diameter class. In the Piedmont unit (fig. 11D), softwood volume since 1990 was noticeably down in the 6- through 12-inch diameter classes, about the same in the 14-inch class, and down as well in the 16-inch diameter class. In the Mountains unit (fig. 11E), softwood volume was also



Fraser magnolia in mountains of North Carolina. (photo by Dr. David Lindbo, North Carolina State University, Wikimedia.org)

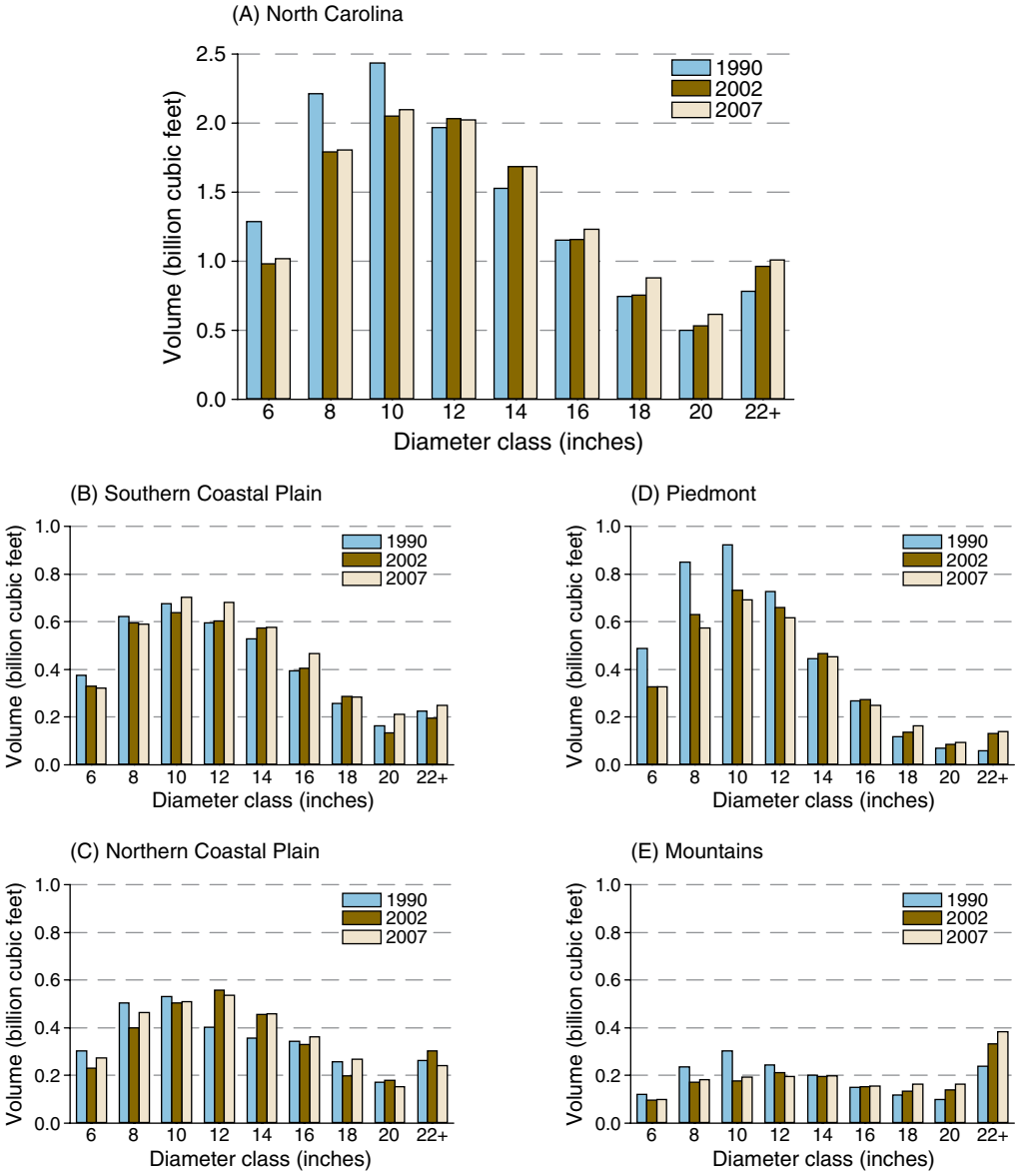


Figure 11—All-live merchantable softwood volume on timberland in (A) North Carolina by diameter class, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

noticeably down since 1990. The decrease extended from the 6- through 14-inch diameter classes. By 2007, however, softwood volume in the 18-inch and larger diameter classes of the Mountains unit apparently had increased enough to skew the diameter class distribution towards that of the larger trees, thus making the softwood diameter class distribution here unlike that of the other survey units.

In contrast to softwoods, volume of hardwood species at the State level was distributed more widely across the range of diameter classes (fig. 12A). Although hardwood volume peaks in the 14-inch diameter class, it is less discernable and most of the volume is spread across the 10- to 16-inch diameter classes. In 2007, similar to changes that occurred statewide for softwoods, hardwood volume declined in

the smaller diameter classes and increased in the larger diameter classes since that recorded in 1990. However, these changes in hardwood volume by diameter class differed by survey unit. In the Southern Coastal Plain unit (fig. 12B), hardwood volume was down in all diameter classes from that recorded in 1990, and peaked in the 10-inch diameter class. In the Northern Coastal Plain unit (fig. 12C), hardwood volume also declined in all diameter classes since 1990, but peaked in the 14-inch diameter class. The Piedmont unit (fig. 12D) most reflected State-level hardwood volume changes by diameter class. In the Piedmont, hardwood volume was down in the 6- through 12-inch diameter classes and increased in those classes 14 inches and larger. Hardwood volume in the Piedmont peaked in the 14-inch diameter class. In contrast, hardwood volume in the Mountains unit (fig. 12E) increased across all diameter classes.

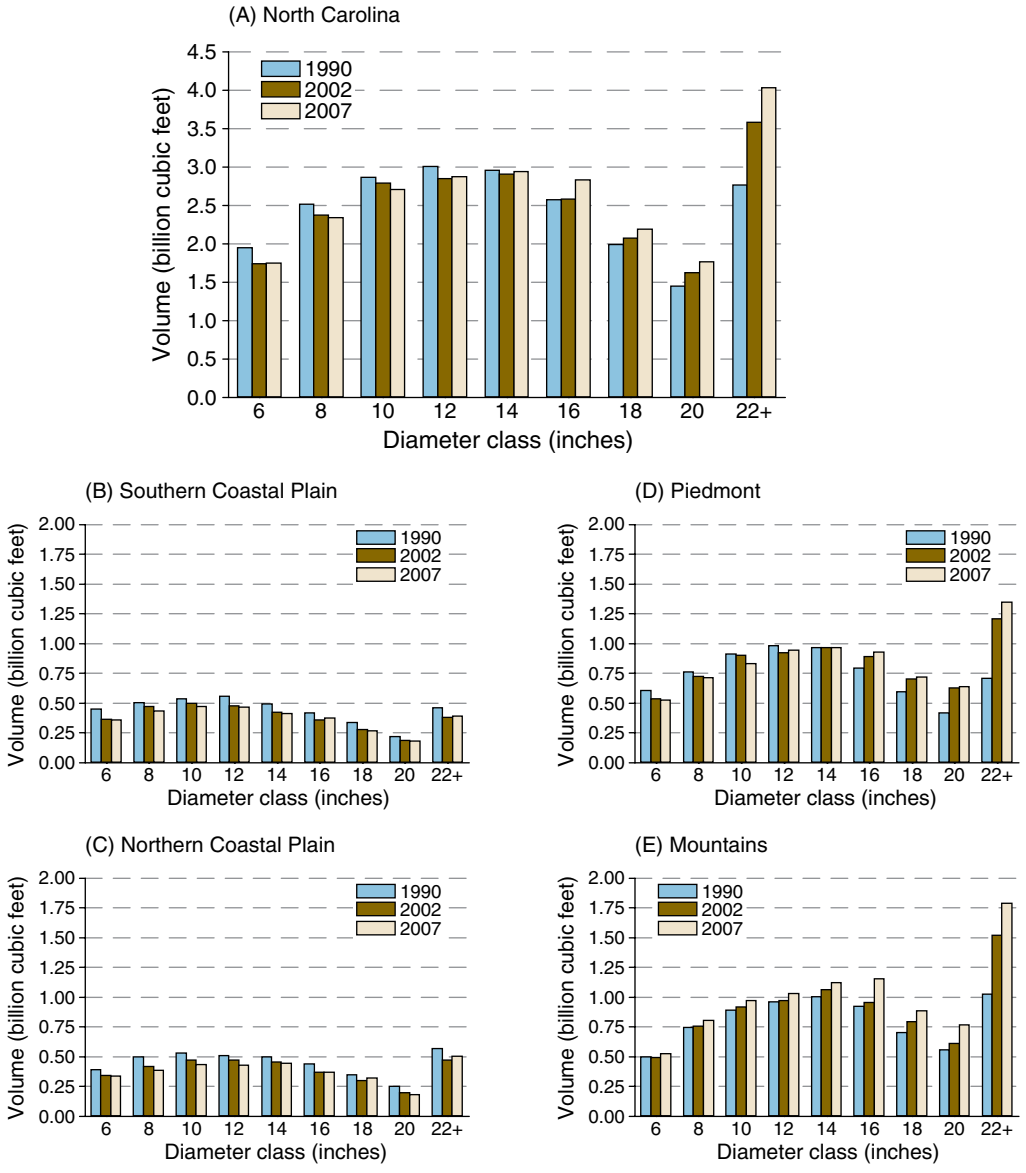


Figure 12—All-live merchantable hardwood volume on timberland in (A) North Carolina by diameter class, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

Timberland Statistics: Net Change Components

A main purpose of the forest inventory is to determine resource change and direction if any. The components of change revolve around measurements of gross growth, mortality, and removal volumes calculated in terms of average annual rates based on the remeasurement period involved. The relationship is such that gross growth is diminished by mortality, creating net growth. Then measured removals detract from net growth, resulting in net change in the inventory.

A cautionary note is injected here to alert users to inordinately high growth figures identified for the Mountains unit. Ongoing internal investigations by FIA suggest processing abnormalities between the 2002 and 2007 datasets. At the time of this publication, the issue remained unresolved. Also of note: Subsequent data recorded through 2011 for the Mountains unit has remained at these high levels.

Statewide for all species combined, net growth averaged 1,450 million cubic feet annually, and removals averaged 1,146 million cubic feet annually. Planted stands provided 23 percent, or 337 million cubic feet, of the State's total net growth. Planted stands also supplied 23 percent, or 262 million cubic feet, of total removals in the State.

The average annual components of change for softwood volume in North Carolina are shown in figure 13A. Statewide in 2007, softwood average annual net growth of 702 million cubic feet exceeded softwood average annual removals of 613 million cubic feet. The difference between these two components yielded a positive average annual net change of 89 million cubic feet for the State's softwood resource.

To put the State-level net change impact in perspective, figure 14A shows the growth and removals dynamics for softwoods compared to total inventory volume of softwoods. For the period ending in 2007, softwood net growth averaged 5.7 percent of total inventory volume and removals averaged 5.0 percent. The positive net change of 89 million cubic feet of softwood averaged 0.7 percent of total softwood inventory.

More than two-thirds of the State's softwood removals came from the two Coastal Plain units. However, in the Southern Coastal Plain (fig. 13B), average annual softwood net growth of 261 million cubic feet exceeded average annual softwood removals of 210 million cubic feet by a wider margin and resulted in a positive average annual softwood net change of 50 million cubic feet. For the period ending in 2007, the Southern Coastal Plain's softwood net growth averaged 6.4 percent of total softwood inventory volume and removals averaged 5.1 percent (fig. 14B). The net change of 50 million cubic feet averaged 1.2 percent of total softwood inventory.

In the Northern Coastal Plain (fig. 13C), average annual softwood net growth of 223 million cubic feet exceeded average annual softwood removals of 213 million cubic feet, but by a narrow margin, and resulted in a smaller positive average annual softwood net change of 10 million cubic feet. For the period ending in 2007, the Northern Coastal Plain's softwood net growth averaged 6.9 percent of total softwood inventory volume and removals averaged 6.5 percent (fig. 14C). The net change of 10 million cubic feet averaged 0.3 percent of total softwood inventory.

In the Piedmont (fig. 13D), the softwood situation differed from the State's other units. In the Piedmont, average annual softwood net growth of 139 million cubic feet was exceeded by average annual softwood removals of 163 million cubic feet, and resulted in a negative average annual softwood net change of 24 million cubic feet. For the period ending in 2007, the Piedmont's softwood net growth averaged 4.2 percent of total softwood inventory volume and removals averaged 4.9 percent (fig. 14D). The net change of negative 24 million cubic feet averaged 0.7 percent of total softwood inventory.

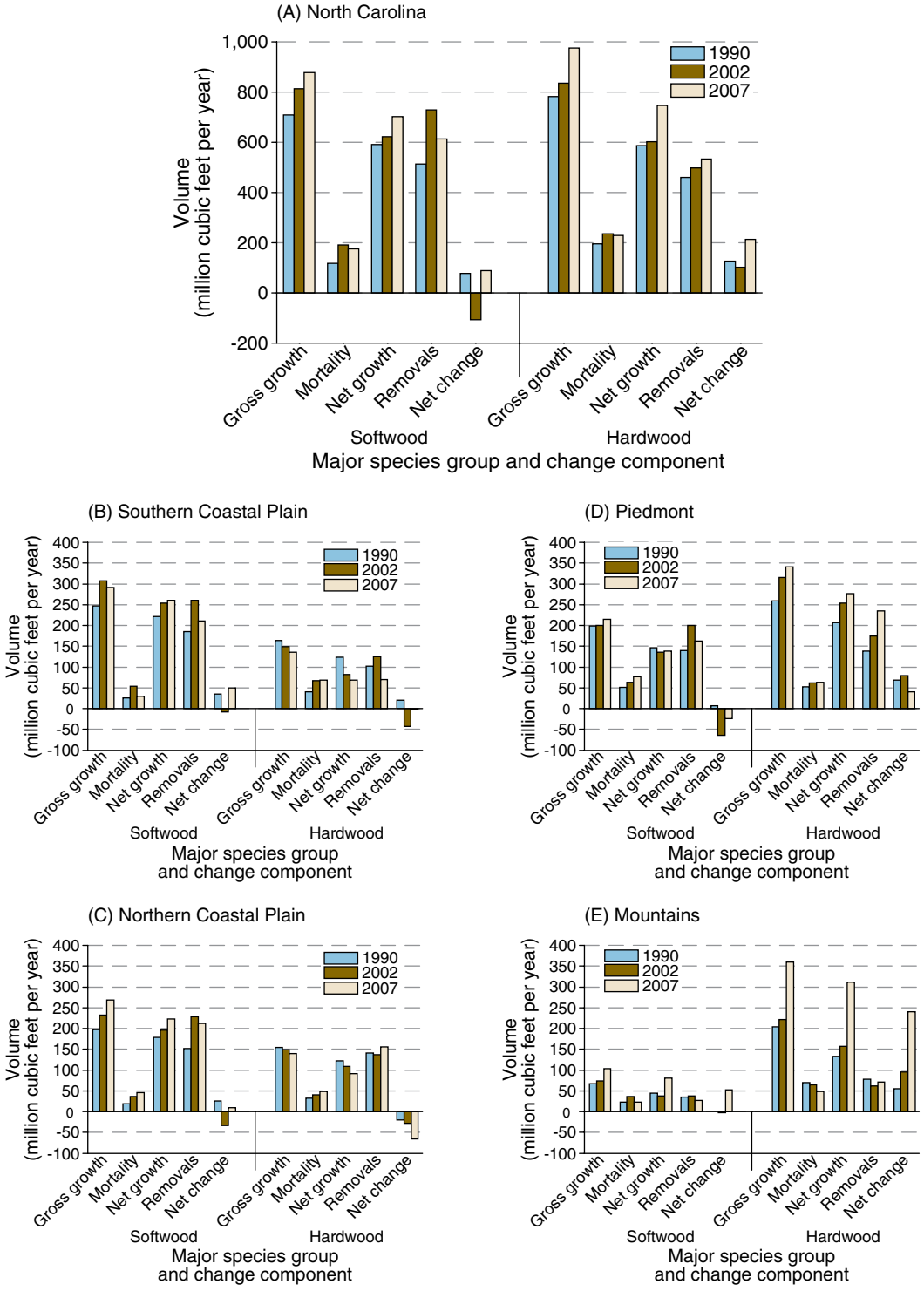


Figure 13—Net change components for all-live volume in (A) North Carolina by major species group, change component, survey year, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

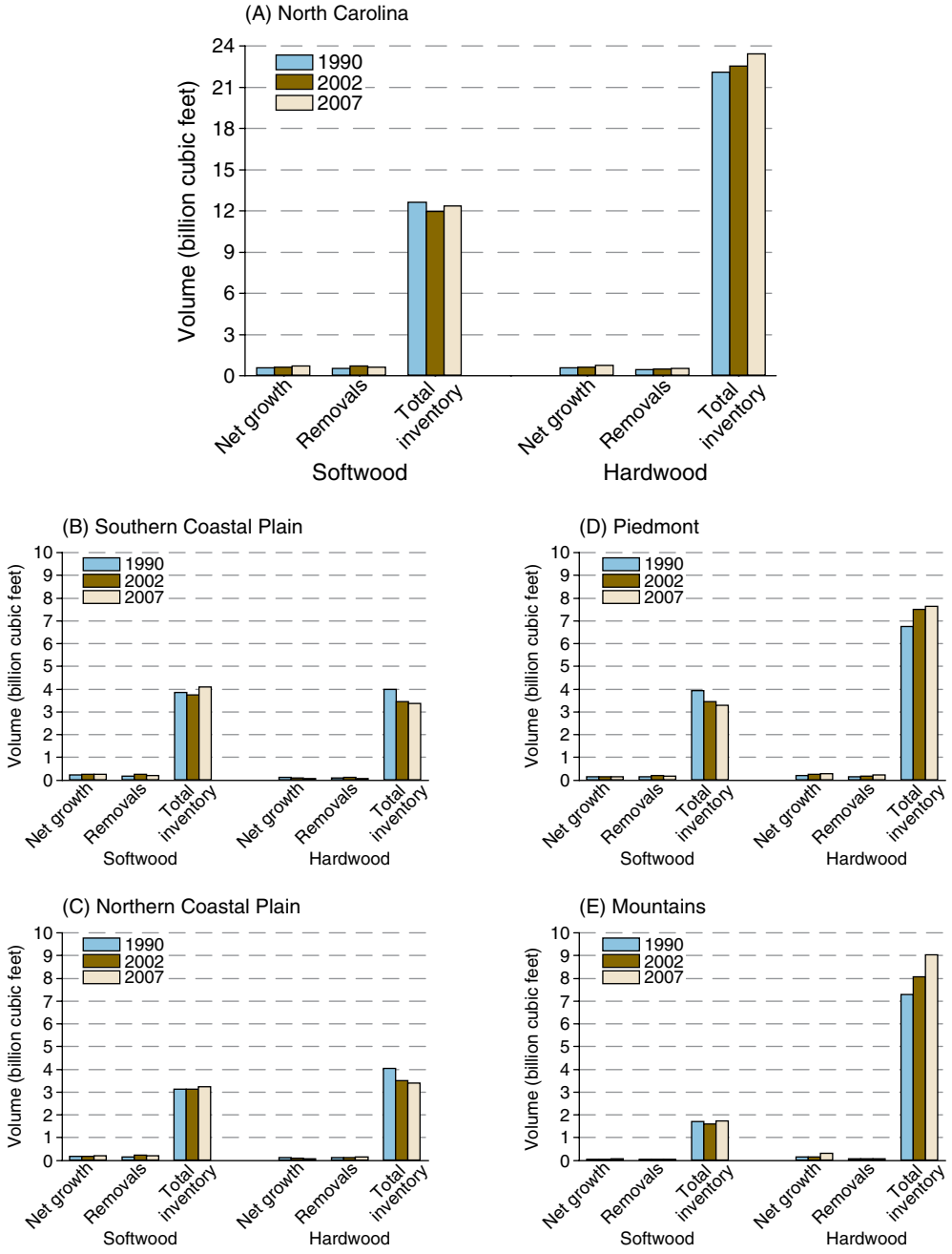


Figure 14—Comparison of net growth and removals to total inventory volume for softwood and hardwood in (A) North Carolina by survey year and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains.

In the Mountains (fig. 13E), where the softwood component is the lowest of all units in the State, average annual softwood net growth of 80 million cubic feet exceeded average annual softwood removals of 27 million cubic feet. This resulted in a positive average annual softwood net change of 52 million cubic feet. For the period ending in 2007, the Mountains unit's softwood net growth averaged 4.6 percent of total softwood inventory volume and removals averaged 1.6 percent (fig. 14E). The net change of positive 52 million cubic feet net change averaged 3.1 percent of total softwood inventory.

The average annual components of change for hardwood volume in North Carolina are shown in figure 13A. Statewide in 2007, hardwood average annual net growth of 748 million cubic feet exceeded hardwood average annual removals of 533 million cubic feet. The difference between these two components yielded a positive average annual net change of 214 million cubic feet for the State's hardwood resource.

To put the State level net change impact in perspective, figure 14A shows the growth and removals dynamics for hardwoods compared to total inventory volume of hardwoods. For the period ending in 2007, hardwood net growth averaged 3.2 percent of total inventory volume and removals averaged 2.3 percent. The positive 214 million cubic feet hardwood net change averaged 0.9 percent of total hardwood inventory.

Hardwood removals exceeded growth in the two Coastal Plain units, although only minimally in one. In the Southern Coastal Plain (fig. 13B), average annual hardwood net growth of 68 million cubic feet was exceeded by average annual hardwood removals of 70 million cubic feet by a slim margin and resulted in a negative average annual hardwood net change of 2 million cubic feet. For the period ending in 2007, the Southern Coastal Plain's hardwood net growth averaged 2.0 percent of total hardwood inventory volume and removals averaged 2.1 percent (fig. 14B). The net change of negative 2 million cubic feet averaged <0.1 percent of total hardwood inventory.

In the Northern Coastal Plain (fig. 13C), average annual hardwood net growth of 92 million cubic feet was exceeded by average annual hardwood removals of 156 million cubic feet, a wider margin that resulted in a larger negative average annual hardwood net change of 64 million cubic feet. For the period ending in 2007, the Northern Coastal Plain's hardwood net growth averaged 2.7 percent of total hardwood inventory volume and removals averaged 4.6 percent (fig. 14C). The net change of negative 64 million cubic feet averaged 1.9 percent of total hardwood inventory.

The Piedmont unit accounted for 44 percent of the State's hardwood removals, more than any other unit. In the Piedmont (fig. 13D), average annual hardwood net growth of 277 million cubic feet exceeded average annual hardwood removals of 236 million cubic feet, and resulted in a positive average annual hardwood net change of 41 million cubic feet. For the period ending in 2007, the Piedmont's hardwood net growth averaged 3.6 percent of total hardwood inventory volume and removals averaged 3.1 percent (fig. 14D). The net change of positive 41 million cubic feet averaged 0.5 percent of total hardwood inventory.

In the Mountains (fig. 13E), where the hardwood component is the highest of all units in the State, average annual hardwood net growth of 311 million cubic feet exceeded average annual hardwood removals of 71 million cubic feet. This resulted in a positive average annual hardwood net change of 240 million cubic feet. For the period ending in 2007, the Mountains unit's hardwood net growth averaged 3.4 percent of total hardwood inventory volume and removals averaged 0.8 percent (fig. 14E). The net change of positive 240 million cubic feet averaged 2.7 percent of total hardwood inventory.

Timber Industry Statistics: Timber Product Output

Timber Removals and Utilization

Average annual timber removals from timberland include the merchantable and nonmerchantable volume of trees harvested for products and whole trees or portions of trees cut and left behind as logging residue. Average annual removals volume also includes trees removed due to land clearing for agriculture or urban development and timberland set aside by statute prohibiting tree harvesting. The latter removals are considered land use change removals. Total removals include harvested products, logging residues, and land use removals and are reported by broad species group at the regional, State, FIA survey unit, or county level for ownership, forest type, diameter class, stand origin, and other variables.

Most FIA removal tables report only the merchantable portion or volume from a 1-foot stump to the 4-inch diameter top in cubic feet for trees ≥5 inches d.b.h. For sawtimber-size trees, removal volume is reported in board feet (International ¼-inch rule), as well. Removal estimates are generated for the sawtimber portion of growing-stock trees, all other growing-stock trees ≥5 inches d.b.h., and all-live trees ≥5 inches d.b.h., which include rough and rotten cull trees. It is best to think of these categories for removals as subsets; sawtimber removals are a subset of growing-stock removals, growing-stock removals are a subset of all-live tree removals, and all of these are a subset of total aboveground tree removals, which include the volume of the stumps, tops, and limbs to 1 inch in diameter. Volume of removal trees <5 inches d.b.h. has been considered noncommercial and has not been reported on a routine basis.

Reporting removals in this fashion served FIA and its users well for many decades when dealing with the traditional timber products such as saw logs, veneer logs, poles, and other solid-wood forest products. However, the traditional fiber products industries (pulpwood, composite panel, and mulch) along with the emerging bioenergy industry have increased and will continue to dramatically increase the utilization of rough and cull trees, tops and limbs, a portion of trees <5 inches d.b.h., and in some cases, understory vegetation.

Tree length logging. (photo courtesy of USDA Forest Service, Southern Research Station, Bugwood.org)

The majority of timber bought and sold commercially has been scaled by weight at the destination mills for many years. The forestry community has become familiar with weight as a unit of measure for timber products and has requested FIA to include weight as a reporting unit for removals. The cubic foot volumes have been converted to green tons throughout this section by using 68.59 pounds of wood and bark per cubic foot of solid wood for softwoods and 74.78 pounds of wood and bark per cubic foot of solid wood for hardwoods.[2] It is important to keep in mind that this is fresh green weight of wood and bark per cubic foot immediately after harvest.

This section focuses on total average annual removals for all-live tree volume for trees ≥5 inches d.b.h. expressed in cubic feet and green tons. It also includes an estimate of removals for stumps, tops, and limbs, which is expressed as average annual harvest removals from nonmerchantable sources. In addition, an estimate of removals for trees <5 inches is discussed under the section for logging residue and is not included in total annual removals. Figure 15 shows the total annual removals by the subcategories previously discussed.

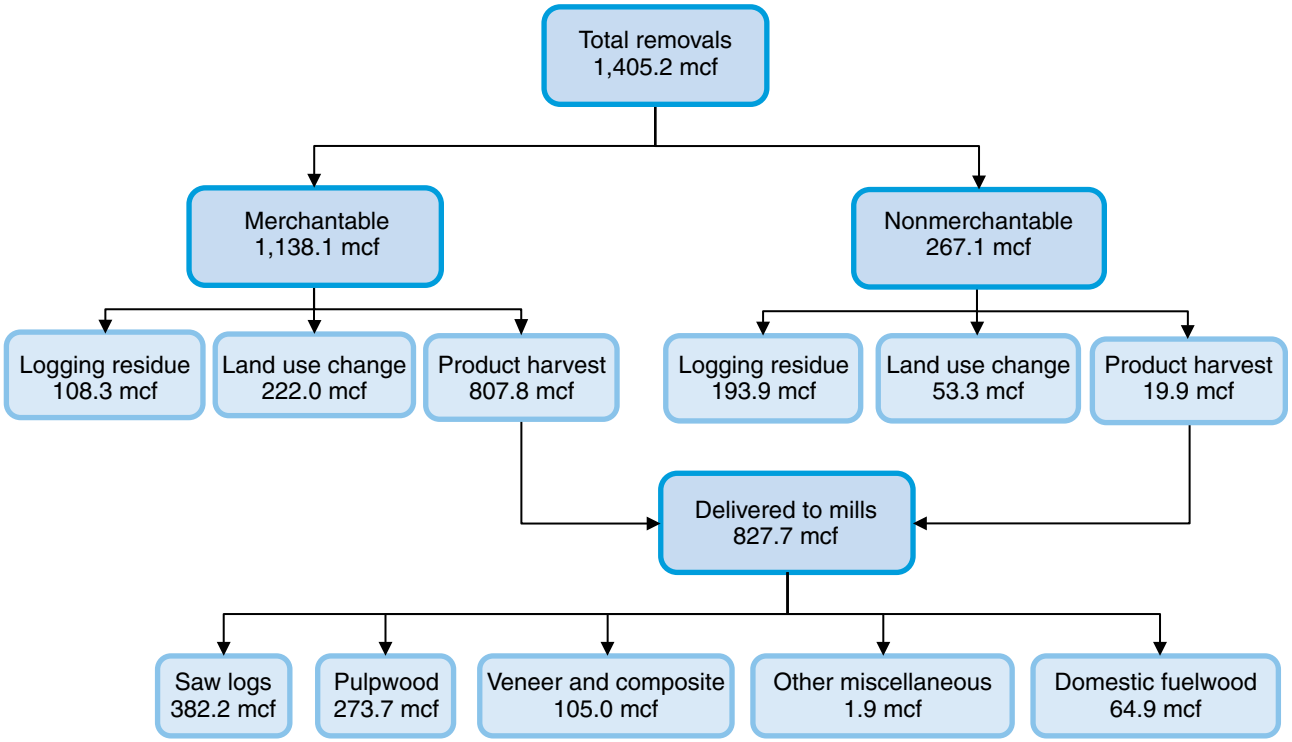


Figure 15—Total removals in million cubic feet (mcf) by merchantability and category, North Carolina, 2007.

[2] Conversion factors are based on cycle 8 live inventory (green weight) and applied to removals at time severed or harvested. As a general rule, green weight can be converted to dry weight by multiplying by 0.5.

Between 2002 and 2007, total removals from all sources in North Carolina, for both softwoods and hardwoods totaled 1,405.2 billion cubic feet, or 50.2 million green tons (tables 8 and 9). Softwoods accounted for 53 percent of total removals, or 744.2 million cubic feet (25.5 million green tons). Volume of removals attributed to the merchantable portion of all-live tree removals accounted for 1,138.1 billion cubic feet (40.7 million green tons). Nonmerchantable sources accounted for 267.1 million cubic feet (9.6 million green tons).

The following sections present an average annual estimate for the merchantable and nonmerchantable portions of annual timber product output (timber harvested and delivered to mills), land use removals, and an estimate of logging residue in North Carolina for the period 2002 through 2007.

Table 8—Average annual volume of all-live timber removals by removals class, species group, and source, North Carolina, 2002–07

Removals class and species group	All sources	Source	
		Merchantable	Non-merchantable
	thousand cubic feet		
Timber products			
Softwood	514,790	501,539	13,251
Hardwood	312,911	306,277	6,634
Total	827,701	807,816	19,885
Logging residues			
Softwood	150,284	41,554	108,730
Hardwood	151,938	66,752	85,186
Total	302,222	108,306	193,916
Land use removals			
Softwood	79,125	64,613	14,512
Hardwood	196,118	157,379	38,739
Total	275,243	221,992	53,251
Total removals			
Softwood	744,199	607,706	136,493
Hardwood	660,967	530,408	130,559
Total	1,405,166	1,138,114	267,052

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

Table 9—Average annual green weight of timber removals by removals class, species group, and source, North Carolina, 2002–07

Removals class and species group	All sources	Source	
		Merchantable	Non-merchantable
	green tons		
Timber products			
Softwood	17,655,379	17,200,919	454,460
Hardwood	11,699,918	11,451,869	248,049
Total	29,355,297	28,652,788	702,509
Logging residues			
Softwood	5,154,182	1,425,147	3,729,035
Hardwood	5,681,053	2,495,895	3,185,158
Total	10,835,235	3,921,042	6,914,193
Land use removals			
Softwood	2,713,693	2,215,985	497,708
Hardwood	7,332,965	5,884,489	1,448,476
Total	10,046,658	8,100,474	1,946,184
Total removals			
Softwood	25,523,254	20,842,051	4,681,203
Hardwood	24,713,936	19,832,253	4,881,683
Total	50,237,190	40,674,304	9,562,886

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

Timber Products

The diverse forest products industry in North Carolina is made up of a variety of mills, ranging from small to medium-sized softwood and hardwood sawmills, pole mills, and post mills to the very large softwood sawmills, pulpmills, and plywood mills. The forest products industry contributes an estimated $28 billion annually to the State's economy and provides jobs for more than 80,000 people.[3] In 2007, there were about 163 sawmills, pulpwood mills, and other primary wood-processing plants distributed across the State (fig. 16). This section presents estimates of average annual timber product harvest volume for the period 2002 through 2007.

Estimates of timber product output (TPO) and plant residues were obtained from canvasses (questionnaires) sent to all major primary wood-using mills in the State. The canvasses are used to determine the types and amount of roundwood or timber (such as saw logs, pulpwood, plywood and veneer, and poles) received by each mill, the county of origin, the species used, and how the mills disposed of the bark and wood residues produced. The canvasses were conducted every 2 years by personnel from Southern Research Station and the North Carolina Forest Service. These data are used to augment the FIA annual inventory of all-live timber removals by providing the proportions that are used for timber products. Individual TPO studies, or industry surveys, are necessary to track trends and capture changes in product output levels.

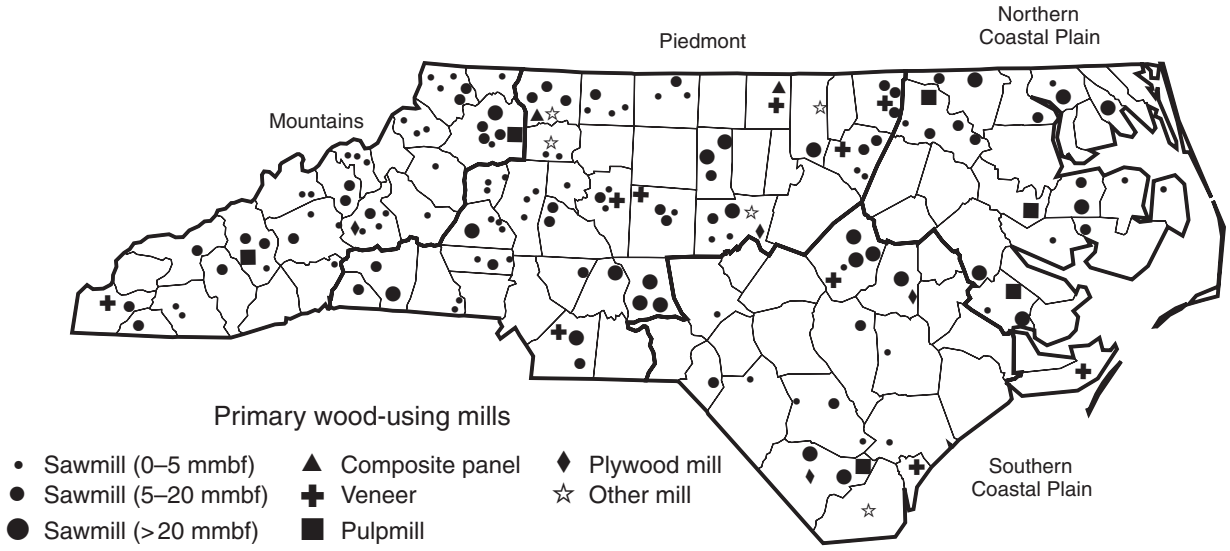


Figure 16—Primary wood-using mills by region, North Carolina, 2007.

[3] Personal communication. 2009. D. Ashcraft, Office of the Executive Director of Development and College Relations, North Carolina State University, College of Natural Resources, Raleigh, NC 27699.

Industry surveys conducted in 2003, 2005, and 2007 were used to determine average annual output for timber products and plant byproducts for the latest FIA cycle (Cooper and Mann 2009, Howell and others 2006, Johnson and Mann 2007). Therefore, the average volumes reported in this section for individual products will not match specific year values reported in TPO publications or online query tools.

Volume harvested and delivered for products (including residential fuelwood) from all sources totaled 827.7 million cubic feet (29.4 million green tons), or 59 percent, of total removals. The merchantable portion of all-live removals accounted for 807.8 million cubic feet (28.7 million green tons), or 98 percent of timber product harvest volume. Nonmerchantable sources from all-live removals accounted for 19.9 million cubic feet (702,509 green tons), or 2 percent of product output levels. Average annual volume harvested for softwood products totaled 514.8 million cubic feet (17.7 million green tons) and accounted for 62 percent of the total product volume. Average annual volume harvested for hardwood products totaled 312.9 million cubic feet (11.7 million green tons).

Figure 17 shows trends in average annual harvest volume by product type for the survey periods from 1956 through 2007. Harvest volume for nearly every major industrial product type was down from the previous survey period with the exception of volume harvested for composite panel products.

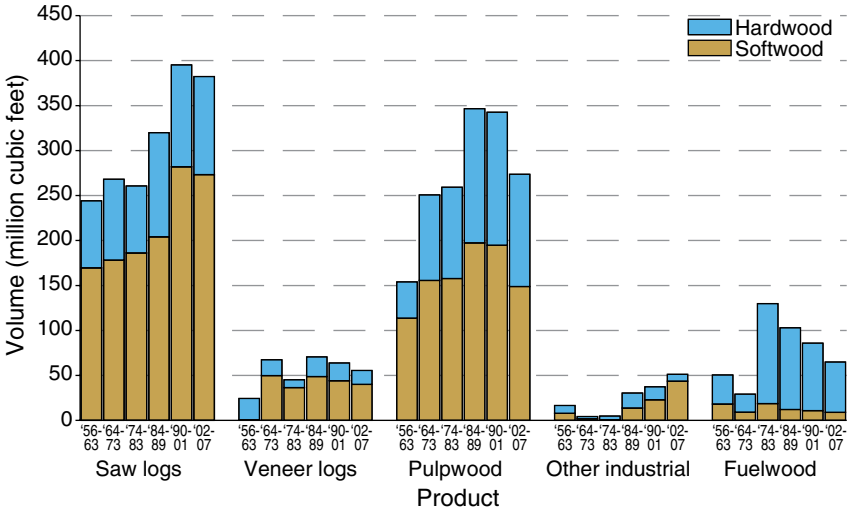


Figure 17—Average annual harvest volume of timber products by product type and species group, North Carolina, 1956–2007.

Table 10 depicts the average annual output of timber products by survey years or the survey period, species group, the softwood proportion for each category, and the proportion that category made up of total products. Volume harvested for saw-log products, used mainly for dimension lumber, was the leading product in North Carolina, averaging >382.2 million cubic feet (13.4 million green tons), and accounted for 46 percent of total product output. This volume was down 3 percent from the 395.2 million cubic feet for the previous survey period (table 10). The total number of sawmills varied between 204 in 2003 and the current number of 136 in 2007. At 273.3 million cubic feet (9.4 million green tons) softwoods accounted for 71 percent of saw-log harvest volume (tables 11 and 12).

The 14 pulpmills operating in North Carolina over the time period made pulpwood the second leading wood product produced during the latest survey period. Pulpwood output as a proportion of total product output declined from 40 percent during the 1984–89 survey period, to 37 percent during the 1990–2001 survey period. Pulpwood output during the latest

Table 10—Average annual volume of timber products by product type, survey years, and species group, North Carolina

Product type and survey years	Softwood	Hardwood	Total	Proportion of total
	- - - - thousand cubic feet - - - -			
Saw logs				
1956–63	169,632	74,472	244,104	0.50
1964–73	178,126	89,940	268,066	0.43
1974–83	186,206	74,439	260,645	0.37
1984–89	204,121	115,774	319,895	0.37
1990–2001	282,002	113,177	395,179	0.43
2002–07	273,305	108,940	382,245	0.46
Veneer logs				
1956–63	710	23,604	24,314	0.05
1964–73	49,799	17,629	67,428	0.11
1974–83	36,533	8,615	45,148	0.06
1984–89	48,769	21,913	70,682	0.08
1990–2001	44,184	19,697	63,881	0.07
2002–07	40,076	15,505	55,581	0.07
Pulpwood				
1956–63	113,665	40,411	154,076	0.31
1964–73	155,547	95,248	250,795	0.40
1974–83	157,689	101,590	259,279	0.37
1984–89	197,420	149,118	346,538	0.40
1990–2001	194,640	147,975	342,615	0.37
2002–07	148,882	124,780	273,662	0.33
Other industrial				
1956–63	7,799	8,820	16,619	0.03
1964–73	1,899	2,491	4,390	0.01
1974–83	675	4,214	4,889	0.01
1984–89	13,697	16,669	30,366	0.03
1990–2001	22,947	14,365	37,312	0.04
2002–07	43,564	7,730	51,294	0.06
Domestic fuelwood				
1956–63	18,254	32,263	50,517	0.10
1964–73	9,171	20,055	29,226	0.05
1974–83	18,674	111,190	129,864	0.19
1984–89	12,045	91,009	103,054	0.12
1990–2001	10,817	75,044	85,861	0.09
2002–07	8,963	55,956	64,919	0.08
All products				
1956–63	310,060	179,570	489,630	NA
1964–73	394,542	225,363	619,905	NA
1974–83	399,777	300,048	699,825	NA
1984–89	476,052	394,483	870,535	NA
1990–2001	554,590	370,258	924,848	NA
2002–07	514,790	312,911	827,701	NA

NA = not applicable.

Table 11—Average annual timber removals from all sources on timberland by item, softwood, and hardwood, North Carolina, 2002–07

Item	All species	Softwood	Hardwood
	thousand cubic feet		
Timber products			
Saw logs	382,245	273,305	108,940
Veneer logs and bolts	55,581	40,076	15,505
Pulpwood	273,662	148,882	124,780
Composite panels	49,373	41,991	7,382
Other	1,921	1,573	348
Residential fuelwood	64,919	8,963	55,956
All products	827,701	514,790	312,911
Logging residues	302,222	150,284	151,938
Land use removals	275,243	79,125	196,118
Total removals	1,405,166	744,199	660,967

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

Table 12—Average annual green weight of timber removals from all sources on timberland by item, softwood, and hardwood, North Carolina, 2002–07

Item	All species	Softwood	Hardwood
		green tons	
Timber products			
Saw logs	13,446,672	9,373,349	4,073,323
Veneer logs and bolts	1,954,210	1,374,457	579,753
Pulpwood	9,771,660	5,106,083	4,665,577
Composite panels	1,716,150	1,440,133	276,017
Other	66,972	53,960	13,012
Residential fuelwood	2,399,633	307,397	2,092,236
All products	29,355,297	17,655,379	11,699,918
Logging residues	10,835,235	5,154,182	5,681,053
Land use removals	10,046,658	2,713,693	7,332,965
Total removals	50,237,190	25,523,254	24,713,936

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

remeasurement period accounted for 33 percent of total product output for the State, down 20 percent from the previous survey period. Average annual harvest for pulpwood (softwood and hardwood combined) totaled 273.7 million cubic feet (9.8 million green tons). Although softwood pulpwood production was down 24 percent from the previous survey period, it still totaled 148.9 million cubic feet (5.1 million green tons) and accounted for 54 percent of total pulpwood harvest volume. Hardwood pulpwood production was down 16 percent to 124.8 million cubic feet (4.7 million green tons).

Volume harvested for veneer and composite panel products totaled 55.6 and 49.4 million cubic feet, respectively (2.0 and 1.7 million green tons). These two products combined accounted for 13 percent of total timber product output. Veneer volume was down 13 percent from the previous survey period while composite panel volume increased 42 percent.

Volume harvested for other miscellaneous products such as poles, posts, and mulch, totaled 1.9 million cubic feet (67,000 green tons). Volume used for residential fuelwood totaled 64.9 million cubic feet (2.4 million green tons) and accounted for 8 percent of total product output. At 56.0 million cubic feet (2.1 million green tons), hardwoods accounted for 86 percent of the residential fuelwood harvest.

Mill Residue

Mill or plant residues are defined as wood material generated in the production of timber products from roundwood at primary manufacturing plants. This material falls into three main categories:

1. Coarse residues, or material, such as slabs, edgings, trim, and veneer cores and ends, which is suitable for chipping,
2. Fine residues, or material, such as sawdust, shavings, and veneer residue, which is not suitable for chipping, and
3. Bark, which is used mainly for industrial fuel.

For many years, most mill residue produced in North Carolina has been utilized either for primary products such as pulp or in secondary products such as mulch and animal bedding, or as fuel at wood product mills.

Table 13 depicts the average annual disposal of mill residue or how it was utilized. Data on mill residue production and disposal generated from the averaged forest industry surveys over the time period indicated 305.1 million cubic feet of wood and bark residue was generated from primary processors. Sawmills and veneer mills generated the majority of the mill residue produced. Bark accounted for 69.2 million cubic feet (23 percent), coarse residues accounted for 131.3 million cubic feet (43 percent), and sawdust and shavings accounted for 104.6 million cubic feet (34 percent) of mill residue produced.

More than 107.5 million cubic feet, or 35 percent, of mill residue produced was used for industrial fuel either at pulpmills for boiler fuel or at sawmills for dry kiln operations. Bark and sawdust, at 40.9 and 61.9 million cubic feet, respectively, accounted for 96 percent of mill residue utilized for industrial fuel. Fifty-nine percent of bark residue produced was utilized for fuel, with the remainder going for mulch or miscellaneous products. Industrial fuel and fiber products were by far the largest uses of mill residue produced in North Carolina. Eighty-six percent of the coarse residue produced, 112.8 million tons, was utilized for pulp or fiber products.

Land Use Removals

Land use removals (land clearing or set-aside forest land), or removal volume attributed to land use change, accounted for 20 percent of total removals with 275.2 million cubic feet (10.0 million green tons) (table 8). The merchantable portion of live trees accounted for 222.0 million cubic feet (8.1 million green tons), while non-merchantable sources accounted for 53.2 million cubic feet (1.9 million green tons). The hardwood species group accounted for 71 percent of the land use change removals.

Table 13—Disposal of average annual volume of residue at primary wood-using plants by product, species group, and type of residue, North Carolina, 2002–07

Product and species group	All types	Type of residue			
		Bark	Coarse	Sawdust	Shavings
	thousand cubic feet				
Fiber products					
Softwood	82,348	0	81,828	521	0
Hardwood	31,059	74	30,927	57	0
Total	113,407	74	112,755	578	0
Particleboard					
Softwood	15,891	19	4,025	3,955	7,892
Hardwood	3,105	78	2,452	461	114
Total	18,996	96	6,477	4,416	8,006
Charcoal/ chemical wood					
Softwood	3,045	0	0	3,045	0
Hardwood	0	0	0	0	0
Total	3,045	0	0	3,045	0
Sawn products					
Softwood	2,720	0	2,719	0	0
Hardwood	4,307	1	4,305	0	0
Total	7,026	2	7,025	0	0
Industrial fuel					
Softwood	68,298	25,567	407	40,689	1,636
Hardwood	39,245	15,330	2,471	21,180	264
Total	107,543	40,896	2,878	61,869	1,900
Miscellaneous					
Softwood	40,023	17,534	998	6,894	14,597
Hardwood	14,295	10,541	1,098	2,441	216
Total	54,319	28,075	2,096	9,335	14,813
Not used					
Softwood	341	22	50	270	0
Hardwood	434	39	66	329	0
Total	775	61	116	598	0
All products					
Softwood	212,667	43,141	90,027	55,373	24,125
Hardwood	92,444	26,063	41,319	24,468	594
Total	305,111	69,204	131,346	79,841	24,719

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

Logging Residue

The merchantable portions of trees cut and left onsite are underutilized removals by FIA merchantability standards, while the nonmerchantable portions of trees (part of the 1-foot stump or volume in tops <4 inches in diameter) used for products are considered overutilized removals by FIA merchantability standards. With this in mind, underutilization and overutilization factors used to estimate average annual logging residue for this section were derived from the 2007 North Carolina Harvest and Utilization study (Bentley and Johnson 2010). Logging residue has been considered a possible source for bioenergy and other timber products during recent years. It is important to keep in mind that logging residue, traditionally, has not had a marketable value. Retrieval of logging residue is a matter of economics and markets. If markets are available and a willingness to pay a reasonable price exists, then more total tree volume (including what has been left as logging residues) is utilized for products.

Most loggers are set up to merchandise the main bole of the tree or the merchantable portion of the tree (from a 1-foot stump to a 4-inch diameter top). The current conventional logging system in North Carolina is a feller buncher, working with one or two rubber-tired grapple skidders, a delimbing gate or pull-through delimber at the deck, a knuckleboom loader, and the appropriate number of tractor trailers to haul the volume harvested. The improved mechanization and equipment capabilities have dramatically increased productivity and utilization across the South. These systems are typically capable of producing on average about 10 loads of tree-length wood per day (Bentley and Johnson 2010).

Woody material typically left on a logging site includes:

1. Whole trees, ≥5 inches d.b.h., or portions of the merchantable boles of severed trees broken and left during the felling operation (merchantable),

2. Small trees, <5 inches d.b.h., damaged or killed during harvesting operations (nonmerchantable), and

3. Residual stump portions, tops, and limbs or forks not utilized because of insufficient size or quality to fit on the trailers (nonmerchantable).

This wood material left on the site is known as merchantable and nonmerchantable logging residues.

FIA calculates the merchantable portion of logging residue in a two-stage process. First, for those plots that were classified as timberland during the previous inventory and stayed in timberland for the current inventory cycle, the volume of whole trees cut and not utilized is identified by FIA field crews during the remeasurement phase of the inventory. A removal volume is derived for trees that are classified in this category.

Second, underutilization factors derived from felled-tree utilization studies are applied to the volume classified as utilized by field crews for the remainder of the merchantable portion of logging residue. For instance, felled-tree utilization studies conducted for North Carolina showed that only 5.17 percent of the merchantable softwood bole was not utilized for products, whereas 10.88 percent of the merchantable hardwood bole was not utilized.

The reader must remember that total removal volume is made up of volume from the merchantable and nonmerchantable portions of removal trees. Overutilization factors from the utilization studies were

used to determine how much of the nonmerchantable portion of removals was used for timber products. The nonmerchantable volume is calculated for the land use change removal estimate and added to the merchantable volume for a total land use change removal volume. With the nonmerchantable portion of timber products and land use change values calculated and subtracted from total nonmerchantable removals volume, the remainder is the volume of nonmerchantable logging residues.

With this in mind, the annual logging residue volume in North Carolina from 2002 to 2007 averaged 302.2 million cubic feet per year, or 10.8 million green tons. This volume accounted for 22 percent of total timber removals. Nearly 150.3 million cubic feet (5.2 million green tons), or 50 percent, of the logging residues generated came from softwoods, while 151.9 million cubic feet (5.7 million green tons) came from hardwood species. Logging residue from the merchantable portion of all-live removals totaled 108.3 million cubic feet per year (3.9 million green tons), or 36 percent of total logging residue. It is interesting to note that while total logging residue accounted for 22 percent of total removals, the merchantable portion of logging residue for both softwood and hardwood combined accounted for about 10 percent of total live removals. For softwoods, the merchantable portion of logging residue accounted for 7 percent of the total softwood all-live tree removals, which totaled 607.7 million cubic feet. The merchantable portion of hardwood logging residue accounted for 13 percent of all-live hardwood removals, which amounted to 530.4 million cubic foot. Nonmerchantable sources (such as the residual stump, forks, tops, and limbs) accounted for 193.9 million cubic feet (6.9 million green tons), or 64 percent of total logging residue. Trees <5 inches d.b.h. contributed another 2.4 million green tons of possible logging residue (table 14).

Table 14—Average annual green weight of logging residue by recovery rate and tons per acre, North Carolina, 2002–07

Logging residue in harvested trees by size class (d.b.h.)	Total		Non-recoverable		Base total volume	Base total	Potentially recoverable at 60% recovery rate[a]		
			Discounted stump volume	Discounted <5" volume			Discounted ≥5" volume	Total volume	Total
	green tons	*tons/ acre*	*green tons*		*green tons*	*tons/ acre*	*green tons*		*tons/ acre*
Merchantable volume ≥5"	3,921,042	9.2	0	0	3,921,042	9.2	1,497,159	2,423,883	5.7
Nonmerchantable volume ≥5"	6,914,193	16.3	1,409,252	0	5,504,941	13.0	2,477,223	3,027,718	7.2
Total	10,835,235	25.5	0	0	9,425,983	22.2	3,974,382	5,451,601	12.9
Nonmerchantable volume <5"	2,390,109	5.6	0	1,912,087	478,022	1.1	0	478,022	1.1
All classes	13,225,344	31.1	1,409,252	1,912,087	9,904,005	23.3	3,974,382	5,929,623	14.0

d.b.h. = diameter at breast height.
Numbers in rows and columns may not sum to totals due to rounding.
[a] This value is calculated from the base total volume of 9,904,005 tons.

Over the same time period, the area of timber harvested annually in North Carolina amounted to nearly 424,200 acres. Of this area, 229,300 acres (54 percent) underwent a final harvest, while 81,000 acres (19 percent) had a partial harvest and 103,100 acres (24 percent) had commercial thinning. The removals volume attributed to timber products and logging residues is directly related to these treated acres. Based on these estimates, nearly 95 tons per acre in the merchantable and nonmerchantable portion of trees ≥5 inches d.b.h. was removed annually from North Carolina timberland. Of this, >69 tons per acre were utilized for products, while 22.2 tons per acre were left as logging residue after discounting the residual stump volume. Adding in 5.6 tons per acre for trees <5 inches d.b.h., the total logging residue amounts to 27.8 tons per acre. This volume would be the equivalent of a tree-length trailer load of wood for every acre treated in North Carolina.

Potential Recoverable Logging Residue

Conventional logging operations are designed to haul tree-length wood that fits between the stanchions of the trailer. A more effective way to handle the nonmerchantable portion of removals trees—rough trees with crooked boles, tops, and limbs—is to chip this material at the site and transport the material in chip vans. Some North Carolina loggers have begun to add whole-tree chippers and chip vans to their inventory of equipment. Current markets for chipped wood captured from logging residue are limited to facilities with wood-fired boiler systems or production of mulch. Where bioenergy or mulch markets are available, chipping this material onsite is a cost-efficient way of handling and transporting rough and rotten trees, the nonmerchantable portions of cut trees, as well as small trees <5 inches d.b.h.

What is a realistic recovery rate of logging residue in North Carolina? Current literature and personal communications with loggers and others in the forestry field suggest that conventional logging operations described earlier could capture 60 percent of what is currently being left behind as logging residue. This recovery rate excludes residual stump volume and would seem to be a realistic goal for possible extraction of formerly unutilized material (Perlack and others 2005).

For this assessment the nonmerchantable portion of logging residue has been reduced by 64 percent to 2.5 million green tons to account for residual stump (1.4 million green tons) and tops and limb volume (3.0 million green tons) that are not immediately recoverable (table 14). This amount combined with the merchantable logging residue of 1.5 million green tons leaves a total of 4.0 million green tons available from trees ≥5 inches d.b.h., or 12.9 tons per acre. Residual volume following harvest operations for trees <5 inches d.b.h. accounted for another 2.4 million green tons. This report assumes only 20 percent could realistically be extracted, or 478,000 green tons.[4] This volume adds another 1.1 tons per acre. Combined, the average annual recovery of logging residue at a 60-percent recovery rate from all sources could have amounted to an additional 14.0 tons per acre added to the product stream.

[4] Personal communication. 2008. Lupold, H.M. (Mac). Lupold Consulting, Inc., 228 Chestnut Ferry Road, Camden, SC 29020.

Timber Products Summary

Traditional markets for paper and construction materials remain the dominant wood products industry. However, timber removals and utilization continue to change as increased demand for wood as a source for energy create new market opportunities.

FIA and TPO data indicate substantial sources of fiber that are currently underutilized and could be used for bioenergy or other timber products if effectively captured. New facilities that utilize wood for energy may provide opportunities to capture logging residue and minimize the increase to current harvest levels. This will require further study.

New markets, such as bioenergy facilities that plan to use logging residues as a primary source for fuel, must carefully assess average annual volume available in a procurement area, and consider incentives to attract loggers to invest in operations that harvest wood residues at minimum costs.

With proper assessment, investment, and operation, industries utilizing logging residue could possibly offer opportunities for a renewable energy source while creating "green" jobs. Loggers would realize additional markets for fiber and additional sources of income from each logging site. Landowners may also receive additional income with increased utilization from harvested acres and lower site preparation costs to establishing new forests.

Log pile on a harvest in eastern North Carolina. (photo courtesy of Bugwood.org)

Nontimber Forest Products

Historical Perspective

North Carolina has one of the most dynamic, significant, and established nontimber forest products (NTFPs) industries in the country. Well before it became a State, its forests were supplying food, medicine, ornaments, and utilitarian devices to domestic and well-established international markets. People have been harvesting fungi, moss, lichen, herbs, vines, shrubs, and even parts of trees for the NTFPs industries since before European settlers came to the region. With the European settlers and associated international trade of NTFPs, demand on the forest resources increased. Before the early 1700s, when Europeans began settling what is now North Carolina, demand on nontimber forest resources was primarily based on subsistence needs. Since then, NTFPs have added significantly to the North Carolina economy.

European settlers found vast forest resources. Nearly all of North Carolina's Coastal Plain and much of the Piedmont were covered with longleaf pine forests (Walbert 2008). Naval stores rapidly became the colony's most important industry. By the 1770s, North Carolina was producing >70 percent of the pine tar exported from North America, and one-half of the turpentine. From 1768 through 1772, North Carolina exported almost a half million barrels of pine tar. With the advent of iron-clad ships and the decline in longleaf pine forests, the naval stores industry quickly disappeared.

Current Overview

Today, North Carolina is a major source of nontimber forest products, and a significant contributor to the NTFP industry. It is one of the top five suppliers of wild-harvested American ginseng root. North Carolina is the major producer of galax leaves for the international floral industry. And until just a few years ago, it was the major supplier of wild-harvested Fraser fir bare-root stock for the Christmas tree segment. Like many segments of the NTFP industry, the dynamics affecting demand for wild-harvested Fraser fir planting stock resulted in a precipitous decline in this economic activity once nurseries began producing seed and other growing stock.

American ginseng. (photo courtesy of Wikimedia.org)

This dynamic industry, which provides tremendous value to North Carolina's people, is based on a diversity of products and markets. The products are not included in the typical definition of the forest products industry, but are important components to other industries, including herbal medicines and crafts, that add value to the forest products economy. The products range from edible (for example, fruits, nuts, mushrooms, and most notably ramps), to medicinal or dietary supplements (such as ginseng, bloodroot, black cohosh, and many more herbs), to floral (especially galax, pine tips for garlands, and vines for wreaths), landscaping (native plants), and even specialty woods (for example, burl and crotch wood for fine crafts).

A 2003 survey of county extension agents was the first attempt to estimate the number and distribution of NTFP enterprises in the Southern United States[5] (Chamberlain and Predny 2004). The agents perceived a dynamic and widespread nontimber forest products industry. This initial assessment of the NTFP showed a clear concentration of enterprises in western North Carolina and nearby States.

Table 15 summarizes the concentration of NTFP enterprises, as perceived by the county extension agents. North Carolina was estimated to have the most NTFP enterprises of all Southern States. It surpassed second-ranked Kentucky by >1,400 enterprises. According to estimates from county agents, North Carolina accounted for 25 percent of the southern industry. It was the leading State in the South for firms that specialize in floral and decorative, culinary, and landscape products, accounting for 48 percent, 14 percent, and 23 percent of the total enterprises in each category,

Table 15—Distribution of nontimber forest products enterprises in Southern United States, as perceived by county extension agents

State	Edible	Specialty wood	Floral and decorative	Landscape	Medicinal	Total	Percent of total
			number				
Alabama	221	377	378	377	58	1,411	6
Arkansas	224	257	208	120	251	1,060	4
Florida	216	127	182	837	50	1,412	6
Georgia	250	186	384	1,086	68	1,974	8
Kentucky	490	826	562	373	2,670	4,921	19
Louisiana	249	119	94	81	8	551	2
Mississippi	234	252	207	192	15	900	4
North Carolina	526	452	3,283	1,326	770	6,357	25
Oklahoma	275	148	75	65	14	577	2
South Carolina	89	81	145	216	25	556	2
Tennessee	390	794	481	593	314	2,572	10
Texas	438	210	200	196	27	1,071	4
Virginia	239	370	698	376	262	1,945	8
Total all States	3,841	4,199	6,897	5,838	4,532	25,307	
Percent of total	15	17	27	23	18		

[5] James Chamberlain. 2005. Nontimber forest products assessment. PowerPoint presentation. Project summary on file with: Forest Inventory and Analysis Section, Southern Research Station, 4700 Old Kingston Pike, Knoxville, TN 37919.

respectively. It ranked third for specialty wood products firms (452 enterprises, or 11 percent), and second for firms that specialize in medicinal plants (North Carolina Cooperative Extension Service 2010).

According to county extension agents, North Carolina has a vast diversity of enterprises that use nontimber forest resources to manufacture products. Approximately 52 percent of the 6,357 NTFP enterprises in North Carolina dealt with floral and decorative products. Seven percent of the total NTFP firms in the State manufactured specialty wood products, and 8 percent manufactured edible items from forest harvested resources. Enterprises that used medicinal plants accounted for 12 percent of North Carolina's NTFP industry, and landscaping firms that used native plants or plants collected from the wild, accounted for about 21 percent of the industry in the State.

A county-level assessment provided further insight into the distribution of NTFP enterprises. Data were collected for 85 of 100 counties for this study. Twelve counties reported having no NTFP enterprises. Twenty counties reported >90 percent of the total NTFP enterprises. Of the 85 counties that reported having NTFP enterprises, Avery County reported having the most enterprises (1,765, or about 28 percent). Yancey County ranked second overall with 1,030 firms (16 percent of the total). Graham County, ranked third, reported having 745 firms (12 percent). Ashe (694 firms, or 11 percent), Mitchell (495 firms or 8 percent), and Jackson (244 firms or 4 percent of total) Counties ranked fourth, fifth, and sixth overall, respectively. All are located in the West or West Central region, as defined by the North Carolina Cooperative Extension Service.

Thirty-eight counties reported having NTFP enterprises that used edible forest products. North Carolina had an estimated 526 firms that used edible forest products, and >85 percent were located in 13 counties. Graham County was ranked number one with 200 firms, which was about 38 percent of all firms using edible forest products. Yancey County reported having 70 firms (13 percent) that used edible forest products, and ranked number two, overall. Mitchell and Madison Counties reported having 40 and 22 firms, respectively, which together accounted for another 12 percent of the edible forest products enterprises. Stanly County, in the South Central region, and Chatham County in the North Central region, each ranked fifth in the State for firms using edible forest products. Each reported having 20 firms or just 3.8 percent of the total for the State. Forty-seven counties reported having no edible forest products enterprises.

Forty-six counties reported having NTFP enterprises that made products out of woody materials collected from the forest that are not timber-based. County extension agents estimated that North Carolina had a total of about 452 firms that used products collected from the forests to produce crafts. Graham County ranked first and reported having 150 such firms. Mitchell County ranked second, with 40 enterprises. Stanly County, in South Central region, was ranked third with about 25 enterprises. Yancey, Ashe, and Wake Counties each reported having 20 such firms. These six counties reportedly had 61 percent of the specialty NTFP enterprises.

Fifty-six counties reported having a total of 3,283 NTFP enterprises that produced floral decorative items. These types of firms used or produced such products as galax, grapevine, Christmas trees, wreaths, moss, greenery, or vines. Ninety-three percent of all these enterprises were located in 10 counties. According to county extension agents, Avery County had 31 percent of all

floral decorative NTFP enterprises (about 1,025). Yancey County, also in the Western region, had about 21 percent of the enterprises in this category. Ashe County ranked third, reporting to have 600 (18 percent) NTFP enterprises that produced floral decorative items. Other counties, reportedly with large number of NTFP enterprises that produced for the floral industry included Mitchell (300), Jackson (180), and Madison (100). The top 10 counties reportedly had >90 percent of the floral decorative NTFP enterprises.

As reported, there were approximately 1,326 firms, in 57 counties classified as landscaping with native plants. Twenty-eight counties reported having no landscaping NTFP enterprises. The extension agent reporting for Avery County, estimated that there were 700 landscaping NTFP enterprises, accounting for 53 percent of the total. The combined total of the next top 12 counties accounted for about 30 percent of the total. Graham County, the second ranked county, was estimated to have 75 NTFP landscape enterprises.

County extension agents estimated that there were about 770 NTFP enterprises that used medicinal forest plants spread across 23 counties. Graham County reported the most with 250 firms or about 32 percent of all such enterprises. Yancey and Mitchell Counties ranked second and third, respectively. Together they were estimated to have about 39 percent (300) of all NTFP medicinal plant enterprises. The next five counties (Madison, Avery, Clay, Swain, and Ashe) reportedly accounted for about 16 percent (162) of medicinal plant enterprises.

National Forests

The U.S. Department of Agriculture Forest Service, National Forests of North Carolina (NFNC) is a supplier of many nontimber forest products. Between 2002 and 2009, the NFNC sold >$660,000 worth of nontimber products (table 16). Almost 40 percent of sales came from plant materials valued for foliage, most of which was probably galax. Live plants (i.e., transplants) made up almost 35 percent of the total value. This category included seedlings of flame azalea (*Rhododendron calendulaceum*), rhododendron (*R. catawbiense*/*R. maximum*), and mountain laurel (*Kalmia latifolia*). At one time, the NFNC was a major supplier of Fraser fir seedlings, but now that private nurseries are able to produce their own stock, demand for seedlings from

Table 16—Sold value of nontimber forest products from the National Forests of North Carolina

Product description	2002	2003	2004	2005	2006	2007	2008	2009	Total	Total
	dollars									*percent*
Foliage	$27,448	$18,646	$21,746	$22,536	$32,078	$26,516	$49,103	$52,525	$250,599	38
Transplants	29,081	51,463	42,627	38,101	23,561	17,168	13,495	10,765	226,259	34
Roots	15,418	11,010	8,610	7,170	5,902	14,873	29,530	27,330	119,842	18
Herbs	495	905	600	780	1,120	1,340	1,240	1,120	7,600	1
Vines	505	258	180	170	155	50	75	20	1,413	<1
Mosses	2,993	2,693	1,709	1,748	380	NA	NA	NA	9,521	1
Cones, dry	480	30,100	N/A	300	6,525	NA	1,100	600	39,105	6
Other plants	949	275	NA	NA	NA	NA	NA	3,419	4,643	1
Green biomass cubic volume	NA	NA	NA	NA	NA	1,324	NA	NA	1,324	<1
Total	77,368	115,349	75,471	70,804	69,721	61,271	94,543	95,779	660,306	

Source: Timber Cut and Sold on National Forests Reports [http://www.fs.fed.us/forestmanagement/reports/sold-harvest/cut-sold.shtml].
NA = not applicable.

the national forests has declined. Roots (particularly those used for medicinal purposes) generated about 18 percent of the total value of NTFP from the national forests during this period. The annual value of roots collected from the NFNC ranged from $5,900 in 2006 to $29,500 in 2008. On average the NFNC generated almost $15,000 each year from the sale of roots. Other products, including herbs, vines, mosses, and cones, generated >$62,000 over the 8 years.

Market Segments

The NTFP industry in North Carolina can be classified into four major segments, encompassing many products. The floral decorative segment of the industry includes pine straw, galax leaves, and moss. The medicinal and dietary supplement segment may include a couple of dozen plant species, but is most well known for American ginseng, black cohosh, and goldenseal. Ramps, a wild onion, are the most prominent edible forest product, though other products in this market segment include truffles, Muscadine grapes, and various berries. Plants also are harvested from North Carolina's forests for the landscape industry. Though the NTFP industry has been adding to the State's economy for several hundred years, very little of its value has been documented. The few examples highlight a diverse and prosperous industry.

Floral decoratives—The floral market uses a vast array of plant materials, many of which are forest species, and harvested from natural or planted forests. North Carolina was, at one time, a major supplier of moss and lichen for the floral industry. Pine straw from planted forests is a major commodity for the State and in 1996 was valued at >$25 million (North Carolina Cooperative Extension Service 1997, North Carolina Forest Service 2011). Specialty niche markets exist for pine cones and pine needles, as well as for ground pine (*Lycopodium obscurum*), harvested from North Carolina's forests.

The leaves of galax (*Galax urceolata*) have been harvested from western North Carolina forests for more than 100 years for the global floral market. In the early 1990s there was a major shift in labor for harvesting from mountain residents of predominantly Caucasian heritage to recent Hispanic immigrants. In 2002, 11 galax dealers were identified in North Carolina (Predny and Chamberlain 2005). Most dealers were located in Yancey and Avery Counties, and according to the dealers, most of the harvesting occurred in Ashe, Avery, Buncombe, Madison, McDowell, Mitchell, Transylvania, Watauga, and Yancey Counties. According to Greenfield and Davis (2003), annual sales of galax leaves could range from $10 to $18 million.

Medicinal and dietary supplements—The Southern Appalachian hardwood forests have a great diversity of plant species that are harvested to supply the herbal medicinal market. By some estimates several dozen species are regularly harvested from these forests for herbal medicines. American ginseng is, by far, the most popular and well known. But, of the 22 medicinal plants tracked by the American Herbal Products Association (2007), 12 grow naturally in eastern hardwood forests, including the forests of North Carolina. Many, such as black cohosh (*Actaea racemosa*), bloodroot (*Sanguinaria canadensis*), bethroot (*Trillium erectum*), and goldenseal (*Hydrastis canadensis*), share the same forest habitat as ginseng. Large quantities of these and other native forest plants are harvested annually from natural populations for the herbal market.

The harvest of American ginseng from North Carolina's forests has contributed significantly to the State's economy since the mid-1700s. From 1990 through 2008, >157,000 pounds (dry weight) of wild American ginseng root were harvested from North Carolina's forests, generating sales of >$56 million for harvesters. Further, from 2000 through 2007, North Carolina provided about 60,000 pounds of American ginseng root, valued at >$20.6 million, to the global market. The average annual income for North Carolina harvesters of American ginseng, from 1990 through 2008, was about $3.6 million.

Some 40 counties reported ginseng harvest between 1990 and 2008. Fifteen counties reported approximately 92 percent of the total harvest for this period. Six counties (Buncombe, Jackson, Madison, Haywood, Macon, and Yancey) reported >50 percent of the total harvest for the same period. All of the major producing counties are in western North Carolina. The State has 4 (Buncombe, Haywood, Jackson, and Madison) of the top 10 counties in the United States providing wild American ginseng root to the global market.

Edible forest products—Very little is known about the volume or value of plants harvested from North Carolina's forests that supply culinary markets. As the local food movement expands, interest in producing edible forest products such as shiitake mushrooms, truffles, Muscadine grapes, and ramps is increasing as well. Ramps (*Allium tricoccum*) are, perhaps, the most prominent and well known of the edible forest products. These forest onions are available for a short period each spring and people flock to the forests for a "mess" of ramps. Recreational foragers harvest for personal use, and probably do not have a significant impact on natural populations. Civic organizations, such as churches, fire and rescue departments, and community groups organize annual ramp festivals to raise money for local causes. In western North Carolina, approximately 10 ramp festivals have been identified that collectively use >4,000 pounds of ramps each year. Entrepreneurs have capitalized on the recent sky-rocketing popularity of ramps and harvest large, unreported quantities for local and national markets.

Landscaping forest products—Native plants are harvested from North Carolina's forests for use in landscaping. Live shrubs such as flame azalea, rhododendron, and mountain laurel are commonly dug from the forests and sold in the landscape industry. A variety of herbaceous plants also are collected from the wild for landscaping, but no formal accounts are available. From 2002 through 2009, the NFNC generated >$225,000 in revenues from the sale of permits for collection of "transplants." In 2005, the sale of permits for flame azalea plants was discontinued, resulting in a decline in revenues for "transplants."

North Carolina has a vibrant and dynamic NTFP industry, yet it has not been fully documented. The evidence presented provides a partial representation of the industry in the State. From available data, the NTFP industry is a significant contributor to the State's economy. Collection and sale of NTFPs directly impact tens of thousands of residents. State and Federal agencies have been supporting research and development of this industry for many years, yet much more needs to be done. To get a more comprehensive, accurate, and reliable portrayal of this industry will require substantial investment. Such assessment would provide a more complete valuation of these important resources, as well as of the forest overall.

Timberland Statistics: Forest Health

FIA collected several data items during sample plot measurement that can be used or interpreted to assess forest health in North Carolina. Some of these items are degree of tree mortality, number of standing dead trees and identifiable causes of death, amount of down woody material present, and the invasion of nonnative plants. Some of these data were collected after the 2007 survey, but are included to improve assessment of timberland condition.

Tree Mortality

In 2007, average annual mortality volume of all-live trees ≥5 inches d.b.h. on North Carolina's timberland totaled 404 million cubic feet. Softwood species accounted for 175 million cubic feet, or 43 percent. Hardwood species accounted for 228 million cubic feet, or 56 percent. The <1 percent that remained was attributed to trees not measured. Statewide, for all species combined, mortality peaked in the 41- to 60-year age class (fig. 18A), where 31 percent of total mortality occurred. For softwood species alone, mortality peaked in the 41- to 60-year age class, where 37 percent of the total softwood mortality occurred. For hardwood species alone, mortality peaked in the 61- to 80-year age class, where 32 percent of the total hardwood mortality occurred.

Each of the Coastal Plain units sustained about one-fourth of the State's total mortality. However, in the Southern Coastal Plain (fig. 18B), softwood mortality peaked in the 21- to 40-year age class and was relatively low beyond the 41- to 60-year age class. The Southern Coastal Plain also held the highest percentage of the State's hardwood mortality with 30 percent.

Wildfire on Great Dismal Swamp National Wildlife Refuge of North Carolina and Virginia. (photo by Mike Petruncio, North Carolina Forest Service, Wikimedia.org)

In contrast with the Southern Coastal Plain, softwood mortality in the Northern Coastal Plain (fig. 18C) peaked in the 41- to 60-year age class and continued to be fairly high through the older age classes. The Northern Coastal Plain also had a lower percentage of the State's hardwood mortality with 21 percent.

The Piedmont unit had the highest percentage of the State's total mortality with 35 percent. The Piedmont also had the highest percentage of the State's total softwood mortality with 43 percent. Softwood mortality in the Piedmont (fig. 18D) peaked in the 41- to 60-year age class. The second highest percentage of the State's hardwood mortality, 28 percent, occurred in the Piedmont unit as well.

The Mountains unit (fig. 18E) had the lowest percentage of the State's total mortality with <18 percent. In the Mountains unit, softwood mortality peaked in the 61- to 80-year age class, the oldest peak of softwood mortality of the

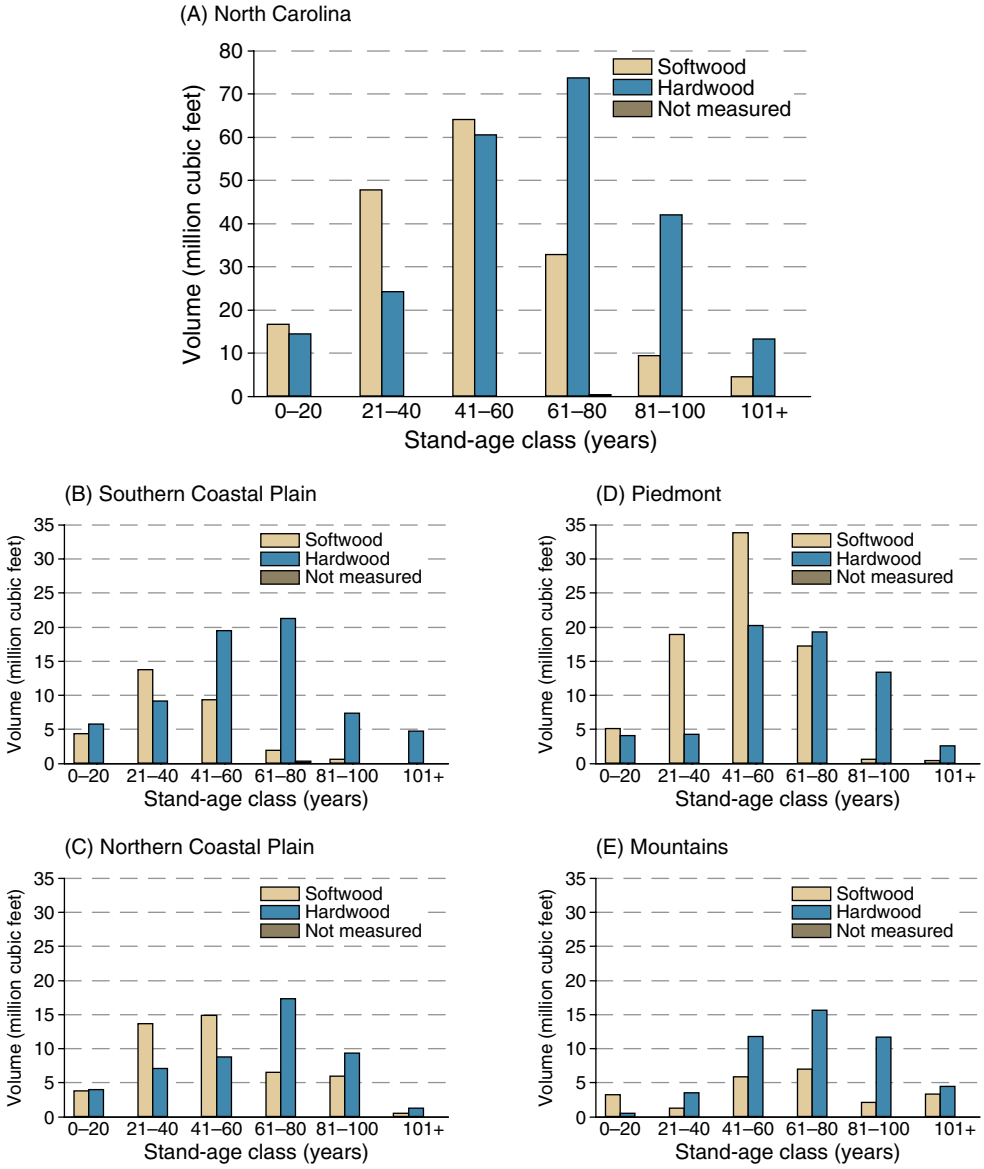


Figure 18—Average annual mortality of trees in (A) North Carolina by stand-age class, major species group, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains, 2007.

four survey units. Hardwood mortality in the Mountains unit peaked in the 61- to 80-year age class as well. The Mountains unit accounted for 21 percent of the State's total hardwood mortality.

Standing Dead Trees

The number of standing dead trees by cause of death across the State provided some insight into the health of North Carolina's timberland. Figure 19A shows the number of standing dead trees, 176 million trees ≥5 inches d.b.h., present on timberland and lists major agents involved, both identifiable and unknown. More than one-half of the standing dead trees were snags still standing from prior surveys, in which cause of death was attributed at that time. To ascertain current impacts, only data for new snags are broken out by cause of death. Statewide, for all species combined, the leading identifiable causes of death in descending order of prevalence were vegetation, weather, disease, insects, and fire. However, the order differed between softwoods and hardwoods.

For both major species groups, vegetation remained the leading identifiable cause of death statewide (fig. 19A). For softwood species, the impact of insects ranked second, and changed the order to vegetation, insects, weather, disease, and fire. For hardwood species, the impact of disease ranked second, and changed the order to vegetation, disease, weather, fire, and animals. The order of the impact for these leading identifiable causes of death further differed between the different survey units of the State.

In the Southern Coastal Plain (fig. 19B), insects were the leading identifiable cause of death for softwoods and accounted for 24 percent of the State's total softwood trees lost to insects. For hardwoods in the Southern Coastal Plain, weather was the leading identifiable cause of death and accounted for 37 percent of the State's total hardwood trees lost to weather. In contrast, in the Northern Coastal Plain (fig. 19C), weather was the leading identifiable cause of death for both softwoods and hardwoods. In the Northern Coastal Plain, weather accounted for 45 percent and 42 percent of the State's total softwoods and total hardwoods lost to weather, respectively.

In the Piedmont unit (fig. 19D), vegetation was the leading identifiable cause of death for softwoods and accounted for 39 percent of the State's total softwood trees lost to vegetation. For hardwoods in the Piedmont, disease edged out vegetation as the leading identifiable cause of death and accounted for 39 percent of the State's total hardwood trees lost to disease. About 68 percent of the State's total softwood trees identified as having died from disease came from the Piedmont unit. The Piedmont also accounted for 37 percent of the State's total softwood trees lost to insects.

In the Mountains unit (fig. 19E), insects were the leading identifiable cause of death for softwoods and accounted for 25 percent of the State's total softwood trees lost to insects. The Mountains portion of the State's total softwood trees lost to insects was notable for a unit dominated by hardwoods. For hardwoods in the Mountains unit, vegetation was the leading identifiable cause of death and accounted for 33 percent of the State's total hardwood trees lost to vegetation. The Mountains unit also accounted for 35 percent of the State's total hardwood trees lost to disease.

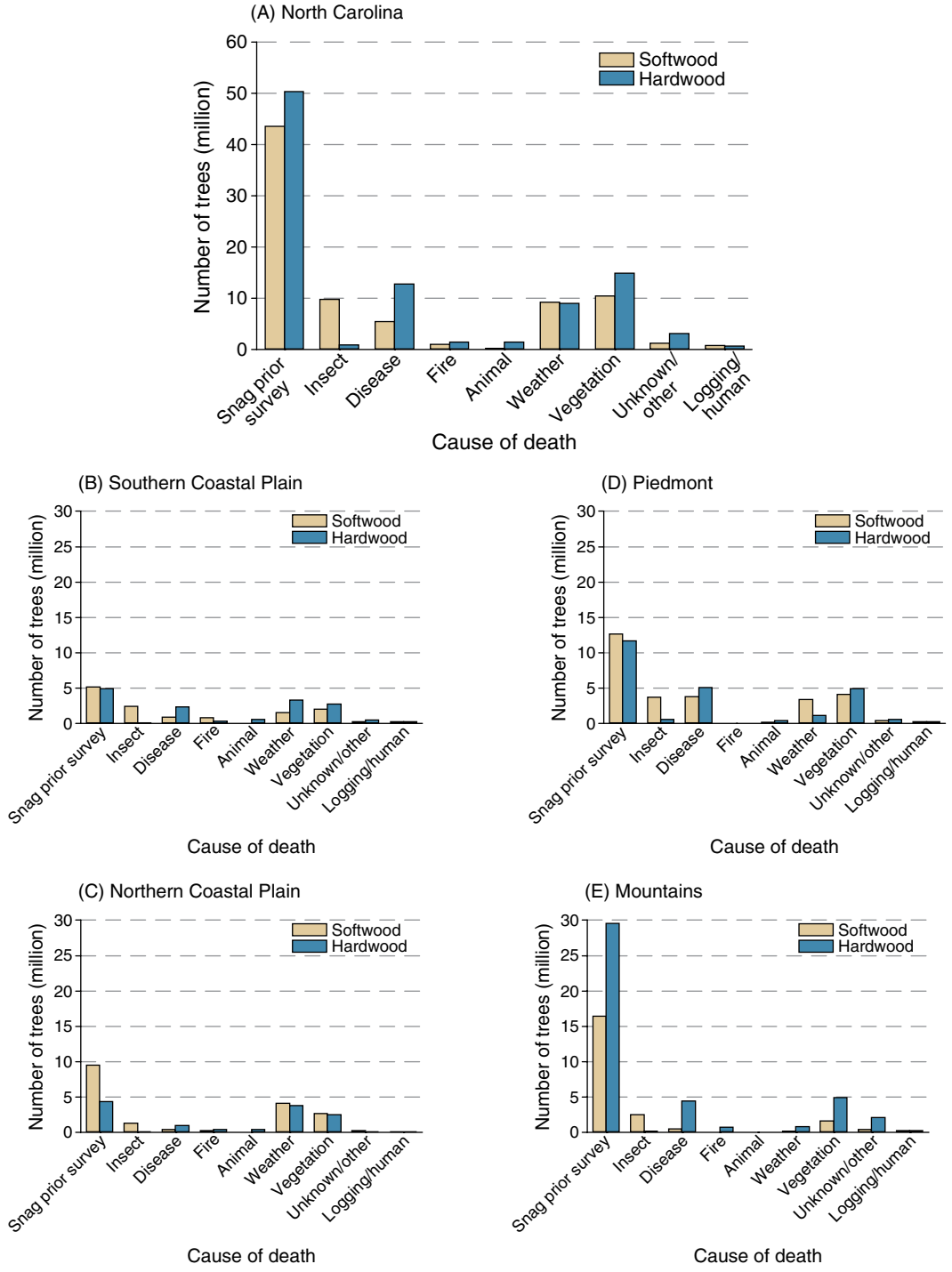


Figure 19—Number of standing-dead trees ≥5 inches d.b.h. on timberland in (A) North Carolina by cause of death, broad species group, and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains, 2007.

Down Woody Material

The total amount of down woody material (DWM), both coarse and fine, accumulating on the forest floor can have implications for forest health. This debris, whether caused by various damage agents such as weather, disease, or human activity, or even by stand senescence, can provide fuels for future fire events. Some determination or gauge of the amounts and locations of its occurrence can be a desirable byproduct of forest survey measurements. FIA began compiling this information in cubic feet on forest land and included it in the FIA database for North Carolina subsequent to the date of this report. Although it is circa 2010 data and involves all forest land, it is included in this report for additional perspective on the condition and health of North Carolina's forests.

In 2010, FIA forest survey measurements estimated nearly 10.8 billion cubic feet of DWM existed on North Carolina's 18.6 million acres of forest land. Statewide, DWM averaged 581 cubic feet per acre of forest land. This average varied by survey unit from a low of 386 cubic feet per acre in the Southern Coastal Plain, 635 cubic feet per acre in the Northern Coastal Plain, and 461 cubic feet per acre in the Piedmont, to a high of 911 cubic feet per acre in the Mountains unit.

The Southern Coastal Plain accounted for nearly 19 percent, or 2.0 billion cubic feet, of the State's total DWM. The Northern Coastal Plain accounted for 22 percent, or 2.4 billion cubic feet, and the Piedmont accounted for 23 percent, or 2.5 billion cubic feet. The Mountains unit accounted for the most, with 3.9 billion cubic feet, or 36 percent of the State's total DWM.

The physical geography of forest land plays a role in DWM occurrence. FIA classifies the terrain of all plot areas by physiographic class (U.S. Department of Agriculture Forest Service 2004). Land form, topographic position, and soil generally determine physiographic class. Based on these classes, more of the State's DWM was located on rolling uplands than on any other physiographic class (fig. 20A). Statewide, rolling uplands accounted for

Large down woody material in North Carolina. (photo courtesy of USDA, Forest Service, Southern Research Station, Bugwood.org)

33 percent of the total DWM. Moist slopes and coves were second, and accounted for 18 percent. Flatwoods were third with 17 percent of the State's total DWM.

The survey units generally subdivided the State based on approximate physiographic regions, so differences in DWM location by survey unit were evident. In the Southern Coastal Plain (fig. 20B), most of the unit's DWM was located in the flatwoods physiographic class. Flatwoods accounted for 46 percent of the unit's DWM. The second highest portion, 23 percent, of the unit's DWM was located in the narrow floodplains/bottomlands physiographic class.

In the Northern Coastal Plain (fig. 20C), more of the unit's DWM was also located in the flatwoods physiographic class than any

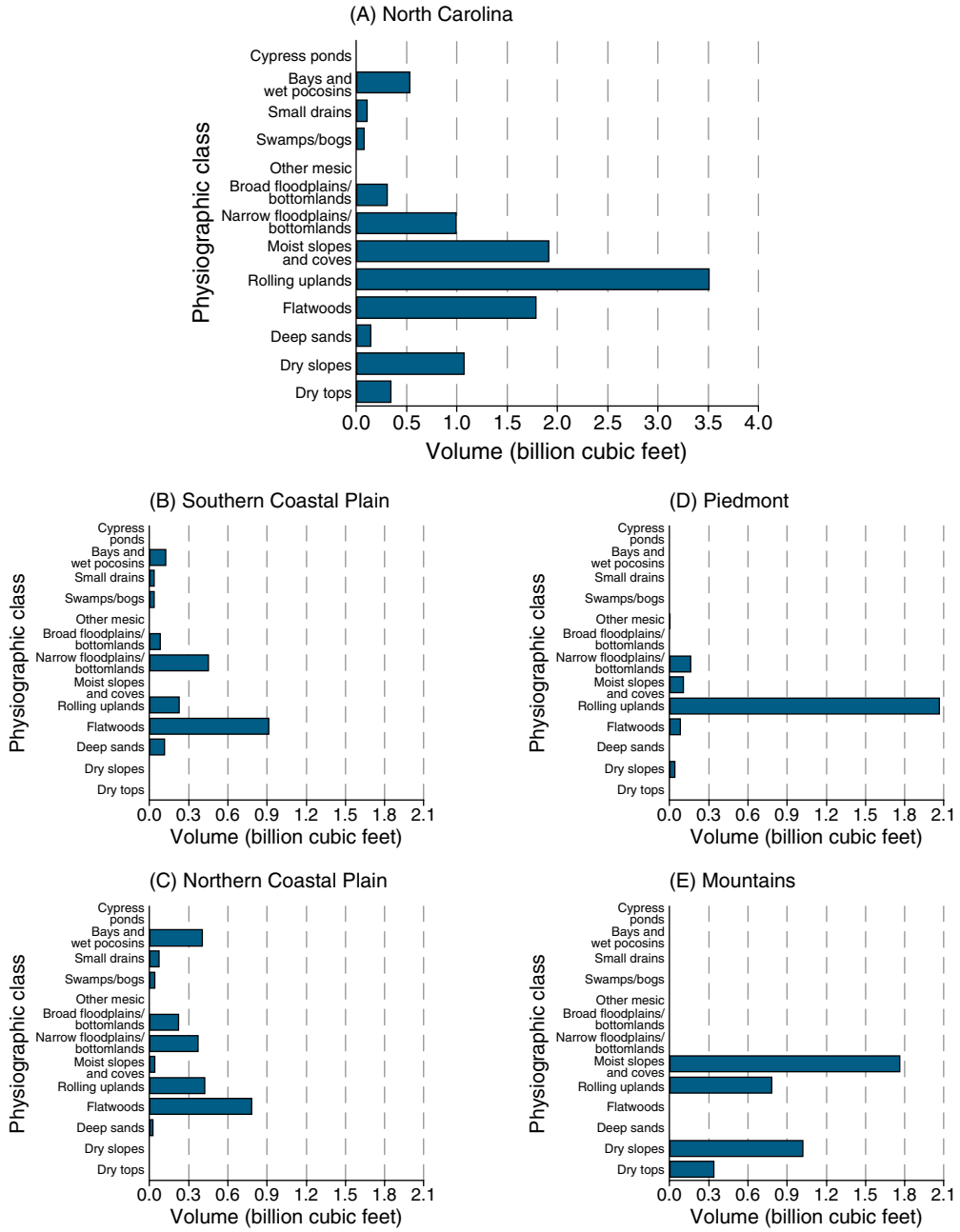


Figure 20—Volume of down woody material on forest land in (A) North Carolina by physiographic class and survey unit (B) Southern Coastal Plain, (C) Northern Coastal Plain, (D) Piedmont, and (E) Mountains, 2010.

other. Flatwoods accounted for 33 percent of the unit's DWM. The rolling uplands physiographic class was second with 18 percent of the unit's DWM. The bays and wet pocosins physiographic class was third, accounting for 17 percent.

In the Piedmont unit (fig. 20D), nearly all of the unit's DWM was located in one physiographic class. Here, the rolling uplands class accounted for 84 percent of the unit's DWM.

In the Mountains unit (fig. 20E), most of the unit's DWM was located in the moist slopes and coves physiographic class. Moist slopes and coves accounted for 45 percent of the unit's DWM. The dry slopes physiographic class was second with 26 percent of the unit's DWM.

Nonnative Invasive Plants

For much the same reason that 2010 DWM data were included in this report, 2010 data on nonnative invasive plants have been included. A brief summary of those plants recognized as problematic because they compete with or even threaten to displace native species is an important gauge of their potential impact. Table 17 lists by frequency those invasive species of trees, shrubs, vines, grasses, and herbs encountered on survey plots in North Carolina in 2010.

The most frequently encountered invasive tree was tree-of-heaven, which was encountered on 108 plots. The mimosa tree was second in occurrence and encountered on 33 plots. Third was royal paulownia, which was encountered on 22 plots. The Piedmont unit individually accounted for 65 percent of the invasive tree encounters in the State (Oswalt and Oswalt 2014). Overall, invasive trees were found on 5 percent of all forested plots in North Carolina in 2010.

The most frequently encountered invasive shrubs were the Chinese/European privets, which were encountered on 733 plots. As a group, the nonnative roses were second in occurrence for the shrubs and encountered on 371 plots. Japanese/glossy privet was the third most frequent of the shrubs, and encountered on 61 plots across the State. Overall, invasive shrubs were found on 35 percent of all forested plots in North Carolina in 2010.

The most frequently encountered invasive vine was Japanese honeysuckle, which was also the most frequently encountered invasive life form altogether. Japanese honeysuckle was encountered on 1,501 plots. Overall, invasive vines were found on 45 percent of all forested plots in North Carolina in 2010.

The most frequently encountered invasive grass was Nepalese browntop, which was encountered on 324 plots. Tall fescue was second, encountered on 124 plots across the State. Overall, invasive grasses were found on 13 percent of all forested plots in North Carolina in 2010.

The most frequently encountered herb/forb was Chinese lespedeza, which was encountered on 211 plots. Overall, invasive herbs/forbs were found on 7 percent of all forested plots in the State in 2010.

Table 17—Regionally recognized nonnative invasive plants identified on survey plots in North Carolina forests, 2010[a]

Common name	Scientific name	Plots[b]
		number
Trees		
Tree-of-heaven	*Ailanthus altissima*	108
Mimosa, silktree	*Albizia julibrissin*	33
Royal paulownia, princesstree	*Paulownia tomentosa*	22
Chinaberry	*Melia azederach*	10
Russian olive	*Elaeagnus angustifolia*	7
Tallowtree	*Triadica sebifera, Sapium sebiferum*	1
Shrubs		
Chinese/European privet	*Ligustrum sinense/L. vulgare*	733
Nonnative roses	*Rosa* spp.	371
Japanese/glossy privet	*Ligustrum japonicum/L. lucidum*	61
Autumn olive	*Elaeagnus umbellate*	44
Bush honeysuckle	*Lonicera* spp.	32
Nandina, sacred bamboo	*Nandina domestica*	8
Silverthorn	*Elaeagnus pungens*	7
Winged burning bush	*Euonymus alatus*	2
Vines		
Japanese honeysuckle	*Lonicera japonica*	1,501
Nonnative vincas, periwinkles	*Vinca minor/V. major*	41
Oriental bittersweet	*Celastrus orbiculatus*	23
Kudzu	*Pueraria montana* var. *lobata*	20
English ivy	*Hedera helix*	18
Nonnative climbing yams	*Dioscorea bulbifera/D. oppositifolia*	17
Chinese/Japanese wisteria	*Wisteria sinensis/W. floribunda*	13
Grasses		
Nepalese browntop	*Microstegium vimineum*	324
Tall fescue	*Lolium arundinaceum*	124
Nonnative bamboos	*Phyllostachys* spp./*Bambusa* spp.	7
Chinese silvergrass	*Miscanthus sinensis*	2
Herbs		
Chinese lespedeza	*Lespedeza cuneata*	211
Shrubby lespedeza	*Lespedeza bicolor*	55
Garlic mustard	*Alliaria petiolata*	4

[a] Oswalt and Oswalt (2014).
[b] Count of survey plots with at least one invasive plant present.

Summary

The 2007 FIA survey recorded 18.6 million acres of forest land in North Carolina, of which 18.1 million acres were classified as timberland. Hardwood forest types covered 12.2 million acres (67 percent) of timberland, and softwood forest types covered 5.7 million acres (32 percent). Nonstocked timberland accounted for the remaining 1 percent. Oak-hickory was the predominant forest-type group and occupied 7.3 million acres. Nonindustrial private forest landowners controlled 14.1 million acres (78 percent) of the State's timberland. Forest industry held 1.4 million acres (8 percent) and public ownerships held 2.5 million acres (14 percent). The volume of all-live trees on timberland totaled 35.8 billion cubic feet. Hardwoods accounted for 23.4 billion cubic feet (65 percent) of the State's total volume, and softwoods accounted for 12.4 billion cubic feet. Net annual growth of all-live trees averaged 1.5 billion cubic feet, and annual removals averaged 1.1 billion cubic feet. Softwood net growth averaged 702 million cubic feet per year and exceeded softwood removals, which averaged 613 million cubic feet per year. In comparison, hardwood net growth averaged 748 million cubic feet per year and greatly exceeded hardwood removals, which averaged 533 million cubic feet per year.

With the exception of the emerging insect-caused damage to hemlock trees, all indications are that these forested acres are relatively healthy (low mortality), and as productive as in any previous survey. Growth rates are high (with the earlier note of caution about accuracy for the Mountains unit) and net growth exceeds latest reported removals estimates at the State level (with the exception as noted for hardwood in the Northern Coastal Plain unit and softwood in the Piedmont unit). By these accounts, the 2007 North Carolina survey data suggest a surplus of hardwood volume in the Mountains and Piedmont units available to meet future increases in demand for wood products.

Clemmons Educational State Forest. (photo courtesy of Wikimedia.org)

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Cherohala skyway in Graham County, NC.
(photo courtesy of Wikimedia.org)

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Glossary

Terms used in this report are defined in the Forest Inventory and Analysis (FIA) glossary available on the FIA Web site at http://www.fia.fs.fed.us/tools-data/docs/. For a hardcopy of the glossary please call 865-862-2000 or write to the following address:

Southern Research Station
Forest Inventory & Analysis
4700 Old Kingston Pike
Knoxville, TN 37919

Dry falls near Highlands, NC. (photo courtesy of Wikimedia.org)

Inventory Methods

Inventory Methods

The inventory design and methodology used to collect and process the information needed to derive the current forest resource estimates for the 2007 survey of North Carolina are similar to those used for the closeout periodic survey in 2002 (Brown and others 2006). However, the 2002 survey methods changed substantially from those used in the previous survey conducted in 1990 (Brown 1993).

The current inventory is a three-phase, fixed-plot design conducted on an annualized basis. Annualized means that a portion (a panel) of the entire sample population (a cycle) is collected each year until all plots have been measured. For the 2007 survey, the inventory was done over a 5-year period. Phase 1 (P1) provides the area estimates for the inventory. Phase 2 (P2) involves on-the-ground measurements of sample plots by field personnel. Phase 3 (P3) is a subset of the P2 plot system where additional measurements are made by personnel to assess unique forest health indicators, many of which are not measured on the P2 plots.

The data that were used to derive the estimates in this report came from panels 1, 2, 3, 4, and 5 of cycle 8. Collectively, these five panels represent the full complement of sample plots in the cycle. The data were processed with the national inventory and monitoring system (NIMS) version 4.0 software.

Sample Design Overview

Under the annual inventory system, 20 percent (one panel) of the total number of plots in a State are measured every year over a 5-year period (one cycle). Each panel of plots is selected on a subgrid which is slightly offset from the previous panel, so that each panel covers essentially the same sample area (both spatially and in intensity) as the prior panel. In the sixth year, the plots that were measured in the first panel are remeasured. This marks the beginning of the next cycle of data collection. After field measurements are completed, a cycle of data is available for the 5-year report. Because of logistics, economics, and sample implementation protocols, the dataset consists of data that are <1 year old (the most recently collected data) as well as data up to 5 years old (the data collected at the beginning of the cycle).

Sample Design Phases

The three phases (P1, P2, P3) of the current sampling method are based upon a hexagonal-grid design for sample placement on the ground; successive phases are sampled with less intensity. In general, the P1 phase involves area estimation. The P2 and P3 phases involve placement of sample plots on the ground, where measurement of variable attributes are made. The grid ensures a systematic placement of P2 and P3 plots on the ground. There are 16 P2 hexagons for every P3 hexagon. The P2 and P3 hexagons represent about 6,000 and 96,000 acres, respectively. To ensure systematic coverage of the sample domain (State), the goal is to place one P2 plot in every hexagonal grid cell. The grid covering North Carolina contains 5,796 hex cells with plots essentially centrally located.

Area

The determination of forest area applies a stratification technique to improve the precision of the estimate; that is, it reduces the variance of the estimate. With this method, the placement (on the ground) and subsequent classification (by land use) of the P2 plot carry much of the weight in determining forest area. The area of control was the survey unit. Forest Inventory and Analysis (FIA) used National Land Cover Data (NLCD) for the stratification platform. The NLCD data are derived from Landsat Thematic Mapper data and incorporate the U.S. Geological Survey's land cover classification scheme. Using these data, FIA identified four strata to improve

the variance of the area estimate. These strata are identified by a pixel classification according to four types of placement: (1) pixels in forest, (2) pixels in nonforest, (3) pixels in nonforest but within a 2-pixel width of a forest edge, and (4) pixels in a forest area but within a 2-pixel width of a forest edge. The estimation of forest area is then the sum across all strata from respective pixel counts (based on placement within the above strata) and the mean area from the P2 plots. This type of approach places more weight on the P2 plot in area determination than with previous aerial-photo dot count methods.

Ownership

Under the annual inventory system, area estimation of all lands and ownerships was based on the probability of selection of P2 plot locations. There was no enumeration of any ownership (no use of known areas of ownership to determine area and plot expansion factors). As a result, the known forest land area (for specific ownerships) does not always agree with area estimates based on probability of selection. For example, the acreage of national forests, published by the National Forest System, will not agree exactly with the statistical estimate of national forest land derived by FIA. These numbers may differ substantially for very small areas.

Plot Design

Bechtold and Patterson (2005) describe the current P2 and P3 ground plots and explain their use. These plots are clusters of four points arranged so that one point is central and the other three lie 120 feet from it at azimuths of 0, 120, and 240 degrees (fig. A.1). Each point is the center of a circular subplot with a fixed 24-foot radius. Trees ≥5.0 inches in diameter at breast height (d.b.h.) are measured in these subplots. Each subplot in turn contains a circular 1/300th-acre microplot with a

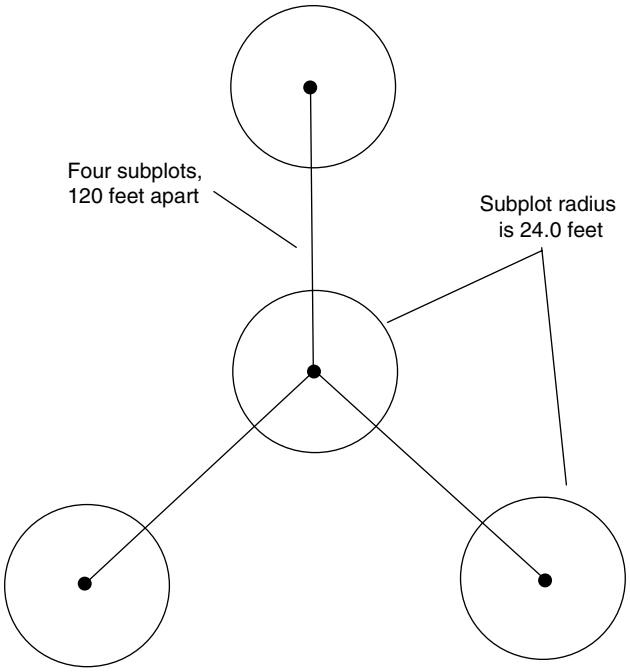

Figure A.1—Annual inventory fixed-plot design (the P2 plot).

fixed 6.8-foot radius (fig. A.2). Trees 1.0 to 4.9 inches d.b.h. and seedlings (<1.0 inch d.b.h.) are measured on these microplots.

Sometimes a plot cluster straddles two or more land use or forest condition classes (Bechtold and Patterson 2005). There are seven condition-class variables that require mapping of a unique condition on a plot: land use, forest type, stand size, ownership, stand density, regeneration status, and reserved status. A new condition is defined and mapped each time the aerial extent of one of these variables is encountered during plot measurement. The process of mapping any of these conditions on a plot, changes the plot size for a respective condition. In other words, the condition size will be smaller than a full plot complement, so the variance of the estimate may increase.

Data on forest health variables (P3) are collected on about 1/16th of the P2 sample plots (U.S. Department of Agriculture Forest Service 2004). P3 data are coarse descriptions, and are meant to be used as general indicators of overall forest health over large geographic areas. P3 data collection includes variables pertaining to tree crown health, down woody material (DWM), foliar ozone injury, lichen diversity, and soil composition. Tree crown health, DWM, and soil composition measurements are collected using the same plot design used during P2 data collection (fig. A.3).

Biomonitoring sites for ozone data collection are located independently of the FIA grid. Sites must be 1-acre fields or similar open areas adjacent to or surrounded by forest land, and must contain a minimum number of plants of at least two identified bioindicator species (U.S. Department of Agriculture Forest Service 2006). Plants are evaluated for ozone injury, and voucher specimens are submitted to a regional expert for verification of ozone-induced foliar injury.

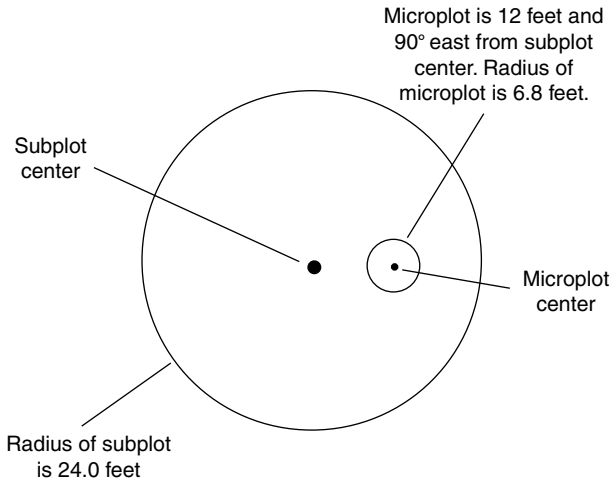

Figure A.2—Subplot and microplot layout.

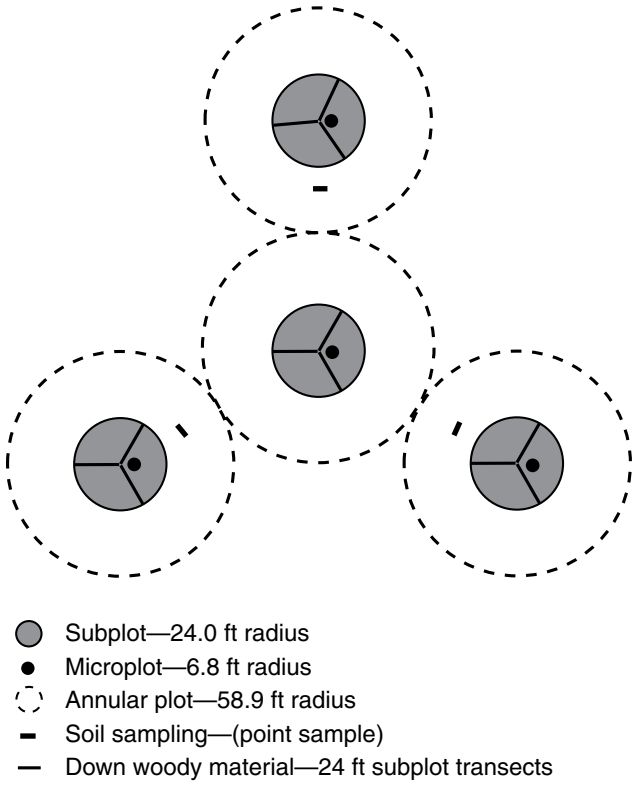

Figure A.3—Layout of the fixed-radius plot design illustrating where the P3 variables (soil and down woody material) were collected.

Volume

Tree volumes for each individual tally tree were derived by a linear regression model. The general form of the model involves two measurements from sample trees: d.b.h. and total height. This equation estimated gross cubic foot volume from a 1-foot stump to a 4-inch diameter top for each sample tree. Separate equation coefficients for 77 species or species groupings were used. The volume in forks in the central bole and the volume in limbs outside of the main bole were excluded. Net cubic foot volume was derived by subtracting the estimate of rotten or missing wood for each sample tree. Volume of the saw-log portion (expressed in International ¼-inch board feet) of sample trees was derived by using board foot-to-cubic foot ratio equations. All equations and coefficients were developed from standing and felled tree volume studies conducted by FIA across several Southern States. For more detailed and specific information regarding volume models and coefficients, contact the Southern Research Station (SRS), FIA work unit.

Biomass

Tree biomass for each individual tally tree was derived by applying models and coefficients derived by McClure and Biesterfeldt (1981) and McClure and Knight (1984). The general form of the model used two measurements from sample trees: d.b.h. and total height. The coefficients derived green weight by means of a volume conversion method. The dry weight was then derived by multiplying the green weight by 0.5. The tree biomass model gives the weight of the total tree, including wood and bark, from ground level; foliage is not included. The model for the merchantable stem, including wood and bark, gives the weight of the stem from a 1-foot stump to a 4-inch diameter top. For more detailed and specific information regarding biomass models and coefficients, contact the SRS FIA work unit.

Growth, Removals, and Mortality

Growth, removals, and mortality estimates were determined from the remeasurement of the 5,796 hexes with sample plots measured in the 2002 inventory. North Carolina's 2007 survey remeasured 4,990 of these plots. The 806-plot difference predominantly consisted of new plots (sample kind 1) as well as a nominal number of plots not sampled due to adverse conditions or denied access. Sixty-two percent, or 3,118, of the remeasured plots were forested and 1,872 were nonforested. The remeasurement information was then used in the calculation of seven components of change: survivor growth, ingrowth, growth on ingrowth, growth on mortality, mortality, growth on removals, and removals. The mathematical exchanges between these components of change were used to determine average annual rates of net growth and removals. The interaction of net growth to removals ultimately provided estimates of net change for the resource.

Summary

Users wishing to make rigorous comparisons of data between surveys should be aware of the significant differences in plot designs and variable assessments, particularly between the 1990 and 2002 surveys (Brown 1993, Brown and others 2006). The 2002 survey methods laid the foundation for the 2007 survey to follow, but the transition has resulted in subsequent continued adjustments and improvements to the processing methods and algorithms used so as to enhance accuracy of the data. Assuming there is no bias in plot selection or maintenance of plot integrity, the most valuable and powerful trend information comes from the same plots being revisited from one survey to the next and measured in the same way. This is also the only method that yields reliable components of change estimation for growth, removals, and mortality.

Data Reliability

Sampling Error

A measure of reliability of inventory statistics is provided by sampling errors. Sampling error is associated with the natural and expected deviation of the sample from the true population mean. This deviation is susceptible to a mathematical evaluation of the probability of error. Sampling errors for State totals are based on one standard deviation, meaning that the chances are two out of three that the true population value is within the limits indicated by a confidence interval.

FIA inventories supported by the full complement of sample plots are designed to achieve reliable statistics at the survey unit and State levels. However, users should note that sampling error increases as the area considered decreases in size. Sampling errors and associated confidence intervals are often unacceptably high for small components of the total resource.

Sampling errors (in percent) and associated confidence intervals around the sample estimates for timberland area, inventory volumes, and components of change are presented in the following tabulation:

Statistical confidence may be computed for any subdivision of the State totals using the following formula. Sampling errors obtained from this method are only approximations of reliability because this process assumes constant variance across all subdivisions of totals.

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

where

SE_s = sampling error for subdivision of State total

SE_t = sampling error for State total

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

X_t = total area or volume for State

For example, the estimate of sampling error for softwood live-tree volume on public timberland is computed as:

$$SE_s = 1.40 \frac{\sqrt{35{,}801.3}}{\sqrt{1{,}844.1}} = 6.17$$

Thus, the sampling error is 6.17 percent, and the resulting confidence interval (two times out of three) for softwood live-tree inventory on public timberland is 1,844.1 ± 113.8 million cubic feet.

Item	Sample estimate and confidence interval			Sampling error
				percent
Timberland (*1,000 acres*)	18,055.4	±	124.6	0.69
All live (million cubic feet)				
Inventory	35,801.3	±	501.2	1.40
Net annual growth	1,450.1	±	43.4	2.99
Annual removals	1,146.6	±	70.7	6.17
Annual mortality	403.7	±	18.5	4.59
Growing stock (*million cubic feet*)				
Inventory	32,713.5	±	480.9	1.47
Net annual growth	1,401.5	±	40.6	2.90
Annual removals	1,076.5	±	67.6	6.28
Annual mortality	337.6	±	17.0	5.03
Sawtimber (*million board feet*)				
Inventory	118,249.3	±	2270.4	1.92
Net annual growth	5,918.6	±	190.6	3.22
Annual removals	4,017.4	±	289.7	7.21
Annual mortality	1,139.5	±	78.2	6.86

Table C.1—Species[a] list by common and scientific name, North Carolina, 2007

Common name	Scientific name[b]	Common name	Scientific name[b]
Softwoods		Hardwoods (continued)	
Fraser fir	*Abies fraseri* (Pursh) Poir.	Catalpa	*Catalpa* spp. Scop.
Atlantic white-cedar	*Chamaecyparis thyoides* (L.) B.S.P.	Sugarberry	*Celtis laevigata* Willd.
Southern redcedar	*Juniperus silicicola* (Small) Bailey	Hackberry	*C. occidentalis* L.
Eastern redcedar	*J. virginiana* L.	Eastern redbud	*Cercis canadensis* L.
Red spruce	*Picea rubens* Sarg.	Flowering dogwood	*Cornus florida* L.
Shortleaf pine	*Pinus echinata* Mill.	Hawthorn	*Crataegus* spp. L.
Longleaf pine	*P. palustris* Mill.	Common persimmon	*Diospyros virginiana* L.
Table Mountain pine	*P. pungens* Lamb.	American beech	*Fagus grandifolia* Ehrh.
Pitch pine	*P. rigida* Mill.	White ash	*Fraxinus americana* L.
Pond pine	*P. serotina* Michx.	Carolina ash	*F. caroliniana* Mill.
Eastern white pine	*P. strobus* L.	Green ash	*F. pennsylvanica* Marsh.
Loblolly pine	*P. taeda* L.	Pumpkin ash	*F. profunda* (Bush) Bush
Virginia pine	*P. virginiana* Mill.	Waterlocust	*Gleditsia aquatica* Marsh.
Baldcypress	*Taxodium distichum* (L.) Rich.	Honeylocust	*G. triacanthos* L.
Eastern hemlock	*Tsuga canadensis* (L.) Carr.	Kentucky coffeetree	*Gymnocladus dioicus* (L.) K. Koch
Hardwoods		Carolina silverbell	*Halesia carolina* L.
Florida maple	*Acer barbatum* Michx.	American holly	*Ilex opaca* Ait.
Boxelder	*A. negundo* L.	Black walnut	*Juglans nigra* L.
Red maple	*A. rubrum* L.	Sweetgum	*Liquidambar styraciflua* L.
Silver maple	*A. saccharinum* L.	Yellow-poplar	*Liriodendron tulipifera* L.
Sugar maple	*A. saccharum* Marsh.	Cucumbertree	*Magnolia acuminata* L.
Buckeye	*Aesculus* spp. L.	Fraser magnolia	*M. fraseri* Walt.
Yellow buckeye	*A. octandra* Marsh.	Southern magnolia	*M. grandiflora* L.
Ailanthus	*Ailanthus altissima* (Mill.) Swingle	Bigleaf magnolia	*M. macrophylla* Michx.
Serviceberry	*Amelanchier* spp. Medic.	Sweetbay	*M. virginiana* L.
Yellow birch	*Betula alleghaniensis* Britt.	Apple	*Malus* spp. Mill.
River birch	*B. nigra* L.	Chinaberry	*Melia azedarach* L.
American hornbeam	*Carpinus caroliniana* Walt.	White mulberry	*Morus alba* L.
Hickory	*Carya* spp. Nutt.	Red mulberry	*M. rubra* L.
Water hickory	*C. aquatica* (Michx. f.) Nutt.	Water tupelo	*Nyssa aquatica* L.
Bitternut hickory	*C. cordiformis* (Wangenh.) K. Koch	Blackgum	*N. sylvatica* Marsh.
Pignut hickory	*C. glabra* (Mill.) Sweet	Swamp tupelo	*N. sylvatica* var. *biflora* (Walt.) Sarg.
Pecan	*C. illinoensis* (Wangenh.) K. Koch	Eastern hophornbeam	*Ostrya virginiana* (Mill.) K. Koch
Shellbark hickory	*C. laciniosa* (Michx. f.) Loud.	Sourwood	*Oxydendrum arboreum* (L.) DC.
Shagbark hickory	*C. ovata* (Mill.) K. Koch	Redbay	*Persea borbonia* (L.) Spreng.
Mockernut hickory	*C. tomentosa* (Poir.) Nutt.	American sycamore	*Platanus occidentalis* L.
American chestnut	*Castanea dentata* (Marsh.) Borkh.	Bigtooth aspen	*Populus grandidentata* Michx.
Allegheny chinkapin	*C. pumila* Mill.	Cottonwood	*P.* spp. L.
Chinkapin	*Castanopsis* (D. Don) Spach	Pin cherry	*Prunus pensylvanica* L.f.

continued

Table C.1—Species[a] list by common and scientific name, North Carolina, 2007 (continued)

Common name	Scientific name[b]	Common name	Scientific name[b]
Hardwoods (continued)		Hardwoods (continued)	
Black cherry	*Prunus serotina* Ehrh.	Northern red oak	*Quercus rubra* L.
White oak	*Quercus alba* L.	Shumard oak	*Q. shumardii* Buckl.
Scarlet oak	*Q. coccinea* Muenchh.	Post oak	*Q. stellata* Wangenh.
Southern red oak	*Q. falcata* Michx.	Black oak	*Q. velutina* Lam.
Cherrybark oak	*Q. falcata* var. *pagodifolia* Ell.	Live oak	*Q. virginiana* Mill.
Bluejack oak	*Q. incana* Bartr.	Black locust	*Robinia pseudoacacia* L.
Turkey oak	*Q. laevis* Walt.	Willow	*Salix* spp. L.
Laurel oak	*Q. laurifolia* Michx.	Sassafras	*Sassafras albidum* (Nutt.) Nees
Overcup oak	*Q. lyrata* Walt.	American basswood	*Tilia americana* L.
Swamp chestnut oak	*Q. michauxii* Nutt.	White basswood	*T. heterophylla* Vent.
Chinkapin oak	*Q. muehlenbergii* Engelm.	Winged elm	*Ulmus alata* Michx.
Water oak	*Q. nigra* L.	American elm	*U. americana* L.
Pin oak	*Q. palustris* Muenchh.	Slippery elm	*U. rubra* Muhl.
Willow oak	*Q. phellos* L.	Rock elm	*U. thomasii* Sarg.
Chestnut oak	*Q. prinus* L.		

[a] Common and scientific names of tree species ≥1.0 inch diameter at breast height occurring in the FIA sample.
[b] Little (1979).

Table D.1—Area by survey unit and land status, North Carolina, 2007

Survey unit	Total area	All forest	Land status						Nonforest land	Census water
			Unreserved			Reserved				
			Total	Timber land	Unproductive	Total	Productive	Unproductive		
	thousand acres									
Southern Coastal Plain	8,760.6	5,125.6	5,125.6	5,083.7	41.8	0.0	0.0	0.0	3,224.9	410.2
Northern Coastal Plain	9,345.1	3,804.7	3,786.4	3,689.8	96.6	18.4	12.2	6.1	2,865.6	2,674.8
Piedmont	10,630.4	5,357.6	5,351.7	5,349.6	2.1	5.9	5.9	0.0	5,090.1	182.7
Mountains	5,707.6	4,294.2	3,938.4	3,932.3	6.0	355.8	355.8	0.0	1,370.8	42.6
Total	34,443.7	18,582.2	18,202.0	18,055.4	146.6	380.1	374.0	6.1	12,551.4	3,310.2

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.2—Area of forest land by ownership class and land status, North Carolina, 2007

Ownership class	All forest land	Land status					
		Unreserved			Reserved		
		Total	Timber land	Unproductive	Total	Productive	Unproductive
	thousand acres						
U.S. Forest Service							
National forest	1,300.9	1,214.6	1,195.4	19.2	86.2	80.1	6.1
Total	1,300.9	1,214.6	1,195.4	19.2	86.2	80.1	6.1
Other Federal							
National Park Service	287.5	0.0	0.0	0.0	287.5	287.5	0.0
U.S. Fish and Wildlife Service	233.4	233.4	190.5	42.9	0.0	0.0	0.0
Dept. of Defense/Dept. of Energy	305.9	305.9	299.8	6.1	0.0	0.0	0.0
Total	826.8	539.3	490.3	49.0	287.5	287.5	0.0
State and local government							
State	612.3	605.9	592.3	13.6	6.4	6.4	0.0
Local	242.1	242.1	242.1	0.0	0.0	0.0	0.0
Total	854.4	848.0	834.4	13.6	6.4	6.4	0.0
Forest industry							
Corporate	1,397.6	1,397.6	1,391.9	5.7	0.0	0.0	0.0
Individual	16.8	16.8	16.8	0.0	0.0	0.0	0.0
Total	1,414.4	1,414.4	1,408.7	5.7	0.0	0.0	0.0
Nonindustrial private							
Corporate	2,630.4	2,630.4	2,624.9	5.4	0.0	0.0	0.0
Conservation/natural resources organization	127.3	127.3	115.5	11.9	0.0	0.0	0.0
Unincorporated local partnership/association/club	229.9	229.9	223.8	6.1	0.0	0.0	0.0
Native American	39.8	39.8	39.8	0.0	0.0	0.0	0.0
Individual	11,158.3	11,158.3	11,122.6	35.7	0.0	0.0	0.0
Total	14,185.7	14,185.7	14,126.7	59.1	0.0	0.0	0.0
All classes	18,582.2	18,202.0	18,055.4	146.6	380.1	374.0	6.1

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.3—Area of timberland by forest-type group and site productivity class, North Carolina, 2007

Forest-type group	All classes	Site productivity class (*cubic feet/acre/year*) 0–19	20–49	50–84	85–119	120–164	165–224	225+
		thousand acres						
Softwood								
White-red-jack pine	135.1	0.0	1.5	27.3	25.7	79.6	1.0	0.0
Spruce-fir	12.1	0.0	0.0	12.1	0.0	0.0	0.0	0.0
Longleaf-slash pine	290.1	0.0	105.1	124.9	49.7	10.4	0.0	0.0
Loblolly-shortleaf pine	5,260.7	0.0	531.3	1,819.0	1,641.2	871.0	387.6	10.6
Other eastern softwoods	29.7	0.0	3.0	17.5	6.1	3.1	0.0	0.0
Total softwoods	5,727.7	0.0	640.9	2,000.7	1,722.7	964.1	388.6	10.6
Hardwood								
Oak-pine	2,313.8	0.0	297.1	1,061.2	571.4	326.1	53.5	4.6
Oak-hickory	7,291.2	0.0	1,351.6	3,416.5	1,755.1	668.7	99.2	0.0
Oak-gum-cypress	1,874.1	0.0	386.9	963.4	371.0	118.8	24.7	9.2
Elm-ash-cottonwood	510.5	0.0	52.7	247.4	147.9	54.6	2.6	5.3
Maple-beech-birch	56.9	0.0	18.1	20.6	12.1	6.0	0.0	0.0
Aspen-birch	1.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0
Other hardwoods	115.1	0.0	30.0	74.7	10.4	0.0	0.0	0.0
Exotic hardwoods	2.9	0.0	2.9	0.0	0.0	0.0	0.0	0.0
Total hardwoods	12,166.1	0.0	2,139.4	5,785.4	2,868.0	1,174.2	180.0	19.0
Nonstocked	161.6	0.0	30.9	65.1	50.1	14.1	1.5	0.0
All groups	18,055.4	0.0	2,811.2	7,851.2	4,640.8	2,152.4	570.1	29.7

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.4—Area of timberland by forest-type group and ownership group, North Carolina, 2007

Forest-type group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	thousand acres					
Softwood						
White-red-jack pine	135.1	18.1	0.0	6.0	3.6	107.3
Spruce-fir	12.1	6.0	0.0	0.0	0.0	6.0
Longleaf-slash pine	290.1	7.7	68.4	50.8	16.8	146.4
Loblolly-shortleaf pine	5,260.7	107.7	157.0	218.5	976.6	3,800.9
Other eastern softwoods	29.7	0.0	0.0	1.5	0.0	28.2
Total softwoods	5,727.7	139.5	225.4	276.9	997.0	4,088.9
Hardwood						
Oak-pine	2,313.8	88.1	45.2	108.3	124.8	1,947.4
Oak-hickory	7,291.2	897.9	37.1	264.3	111.2	5,980.7
Oak-gum-cypress	1,874.1	19.5	152.7	129.4	116.8	1,455.6
Elm-ash-cottonwood	510.5	0.0	18.0	37.4	45.0	410.2
Maple-beech-birch	56.9	23.2	0.0	0.0	0.0	33.7
Aspen-birch	1.5	0.0	0.0	0.0	0.0	1.5
Other hardwoods	115.1	27.1	0.0	6.0	0.0	81.9
Exotic hardwoods	2.9	0.0	0.0	0.0	2.9	0.0
Total hardwoods	12,166.1	1,055.9	253.1	545.4	400.7	9,911.0
Nonstocked	161.6	0.0	11.8	12.1	11.0	126.7
All groups	18,055.4	1,195.4	490.3	834.4	1,408.7	14,126.7

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.5—Area of timberland by forest-type group and stand-age class, North Carolina, 2007

Forest-type group	All classes	Stand-age class (*years*) 1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100	101+	Non-stocked
						thousand acres							
Softwood													
White-red-jack pine	135.1	1.8	8.6	33.9	14.8	9.6	26.5	12.2	18.1	3.6	0.0	6.0	0.0
Spruce-fir	12.1	0.0	0.0	0.0	0.0	0.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0
Longleaf-slash pine	290.1	33.8	37.9	32.7	30.1	34.4	10.8	31.5	49.2	23.8	0.0	5.8	0.0
Loblolly-shortleaf pine	5,260.7	917.4	1,215.3	1,250.1	663.3	527.7	288.6	239.4	76.6	57.4	13.8	11.1	0.0
Other eastern softwoods	29.7	17.0	4.6	4.3	1.5	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0
Total softwoods	5,727.7	970.0	1,266.5	1,321.0	709.6	571.7	332.0	291.4	143.9	84.8	13.8	22.9	0.0
Hardwood													
Oak-pine	2,313.8	470.6	279.3	333.0	235.7	250.3	266.9	247.0	120.0	50.8	38.7	20.0	1.5
Oak-hickory	7,291.2	945.7	555.7	433.3	481.4	742.6	1,030.3	1,085.6	866.3	589.2	265.6	283.4	12.1
Oak-gum-cypress	1,874.1	208.9	118.5	167.5	187.1	196.4	225.8	251.0	195.1	196.1	70.3	57.5	0.0
Elm-ash-cottonwood	510.5	109.0	23.8	39.4	41.2	62.4	49.0	68.2	73.8	24.4	3.5	15.8	0.0
Maple-beech-birch	56.9	0.0	0.0	0.0	4.5	0.0	10.1	0.0	18.1	18.2	0.0	6.0	0.0
Aspen-birch	1.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	115.1	10.6	3.5	13.6	9.1	6.4	4.9	48.0	1.5	17.5	0.0	0.0	0.0
Exotic hardwoods	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0
Total hardwoods	12,166.1	1,744.8	982.3	986.9	959.0	1,258.0	1,587.1	1,699.8	1,274.8	899.1	378.1	382.7	13.7
Nonstocked	161.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	161.6
All groups	18,055.4	2,714.8	2,248.8	2,307.9	1,668.6	1,829.7	1,919.1	1,991.2	1,418.7	983.9	391.9	405.6	175.3

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.6—Area of timberland by forest-type group and stand origin, North Carolina, 2007

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	thousand acres		
Softwood			
White-red-jack pine	135.1	116.8	18.3
Spruce-fir	12.1	12.1	0.0
Longleaf-slash pine	290.1	162.9	127.2
Loblolly-shortleaf pine	5,260.7	2,696.9	2,563.8
Other eastern softwoods	29.7	29.7	0.0
Total softwoods	5,727.7	3,018.5	2,709.2
Hardwood			
Oak-pine	2,313.8	2,031.5	282.3
Oak-hickory	7,291.2	7,067.3	223.9
Oak-gum-cypress	1,874.1	1,865.3	8.8
Elm-ash-cottonwood	510.5	501.6	8.9
Maple-beech-birch	56.9	56.9	0.0
Aspen-birch	1.5	1.5	0.0
Other hardwoods	115.1	115.1	0.0
Exotic hardwoods	2.9	2.9	0.0
Total hardwoods	12,166.1	11,642.2	523.9
Nonstocked	161.6	132.5	29.2
All groups	18,055.4	14,793.1	3,262.3

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.7—Area of timberland disturbed annually by forest-type group and disturbance class, North Carolina, 2007

Forest-type group	Disturbance class							
	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Humans	Other natural
	thousand acres							
Softwood								
White-red-jack pine	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Spruce-fir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longleaf-slash pine	0.0	0.0	0.0	13.1	0.0	0.0	1.0	0.0
Loblolly-shortleaf pine	13.8	1.9	81.7	44.2	0.0	3.3	37.7	0.5
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	13.8	1.9	81.7	57.3	0.0	3.3	39.0	0.5
Hardwood								
Oak-pine	0.3	0.0	20.8	6.4	0.0	2.8	16.7	1.1
Oak-hickory	14.4	0.0	47.8	20.6	4.0	3.4	34.2	2.3
Oak-gum-cypress	0.0	3.6	77.2	1.5	1.3	25.0	12.9	0.5
Elm-ash-cottonwood	0.3	0.0	21.8	0.8	0.0	7.0	1.9	1.7
Maple-beech-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0
Exotic hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	15.0	3.6	167.7	31.7	5.3	38.3	65.7	5.6
Nonstocked	0.0	0.0	3.7	0.7	0.0	0.3	3.5	1.5
All groups	28.8	5.5	253.0	89.7	5.3	41.8	108.2	7.6

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.8—Area of timberland treated annually by forest-type group and treatment class, North Carolina, 2007

Forest-type group	Total treated	Treatment class: Cutting: Final harvest	Cutting: Partial harvest	Cutting: Seed-tree/ shelter-wood harvest	Cutting: Commercial thinning	Cutting: Timber stand improvement	Cutting: Salvage cutting	Site preparation	Artificial regeneration	Natural regeneration	Other silvicultural
	thousand acres										
Softwood											
White-red-jack pine	2.2	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.1	0.0	0.0
Spruce-fir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longleaf-slash pine	4.1	0.0	1.0	0.0	3.1	0.0	0.0	1.4	2.4	0.0	2.6
Loblolly-shortleaf pine	174.2	55.2	24.7	0.0	86.1	8.2	0.0	49.0	61.1	6.7	25.9
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	180.5	55.2	25.7	0.0	91.4	8.2	0.0	50.4	63.5	6.7	28.5
Hardwood											
Oak-pine	54.5	39.7	8.3	0.0	6.5	0.0	0.0	20.8	30.2	6.3	2.8
Oak-hickory	136.5	88.4	39.1	2.1	4.4	2.6	0.0	17.3	29.7	13.0	5.7
Oak-gum-cypress	29.7	20.9	7.5	0.0	1.2	0.0	0.0	0.5	0.2	2.4	0.6
Elm-ash-cotton-wood	7.6	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Maple-beech-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hard-woods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hard-woods	228.3	156.6	54.9	2.1	12.1	2.6	0.0	38.6	60.2	23.0	9.1
Nonstocked	18.6	17.5	0.8	0.0	0.3	0.0	0.0	4.2	2.5	0.2	1.2
All groups	427.4	229.3	81.3	2.1	103.8	10.8	0.0	93.3	126.2	29.9	38.8

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.9—Area of timberland by forest-type group and stand-size class, North Carolina, 2007

Forest-type group	All size classes	Stand-size class			Non-stocked
		Saw-timber	Pole-timber	Sapling-seedling	
	thousand acres				
Softwood					
White-red-jack pine	135.1	108.3	11.4	15.4	0.0
Spruce-fir	12.1	0.0	12.1	0.0	0.0
Longleaf-slash pine	290.1	188.9	47.8	53.4	0.0
Loblolly-shortleaf pine	5,260.7	2,469.6	1,587.6	1,203.5	0.0
Other eastern softwoods	29.7	8.1	3.1	18.5	0.0
Total softwoods	5,727.7	2,774.9	1,662.0	1,290.8	0.0
Hardwood					
Oak-pine	2,313.8	1,030.4	539.2	744.3	0.0
Oak-hickory	7,291.2	4,310.5	1,492.6	1,488.1	0.0
Oak-gum-cypress	1,874.1	1,025.4	420.1	428.6	0.0
Elm-ash-cottonwood	510.5	288.3	68.2	154.0	0.0
Maple-beech-birch	56.9	48.3	8.6	0.0	0.0
Aspen-birch	1.5	0.0	0.0	1.5	0.0
Other hardwoods	115.1	74.4	20.7	20.0	0.0
Exotic hardwoods	2.9	0.0	2.9	0.0	0.0
Total hardwoods	12,166.1	6,777.2	2,552.4	2,836.6	0.0
Nonstocked	161.6	0.0	0.0	0.0	161.6
All groups	18,055.4	9,552.1	4,214.4	4,127.4	161.6

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.10—Number of live trees on timberland by species group and diameter class, North Carolina, 2007

Species group	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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
								million trees								
Softwood																
Cypress	31.8	10.8	6.3	2.6	2.4	2.1	1.8	1.5	1.9	0.6	0.5	1.0	0.1	0.1	0.0	0.0
Eastern hemlock	81.4	42.1	15.7	9.7	5.8	2.5	1.9	1.6	0.7	0.5	0.4	0.3	0.2	0.1	0.0	0.0
Eastern white and red pines	165.2	84.3	28.9	16.8	11.9	7.4	4.5	2.8	2.3	2.3	1.7	1.3	0.7	0.3	0.0	0.0
Loblolly and shortleaf pines	2,328.4	1,020.9	511.4	309.7	216.6	125.1	68.8	37.2	19.4	10.3	4.9	3.1	0.6	0.1	0.1	0.0
Longleaf and slash pines	88.8	35.4	12.5	10.5	8.7	8.2	6.1	3.6	2.3	1.0	0.4	0.1	0.0	0.0	0.0	0.0
Other eastern softwoods	203.5	148.9	31.5	11.8	5.6	3.0	1.5	0.6	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Other yellow pines	467.9	222.1	94.0	52.5	40.3	27.2	17.9	9.1	2.9	1.0	0.5	0.3	0.0	0.0	0.0	0.0
Spruce and balsam fir	5.3	0.9	0.9	1.2	1.0	0.5	0.5	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	3,372.4	1,565.5	701.1	414.8	292.4	176.0	103.0	56.6	29.9	15.8	8.5	6.2	1.7	0.6	0.2	0.1
Hardwood																
Ash	248.1	153.8	50.4	16.2	10.1	6.3	3.7	2.7	2.2	1.0	0.8	0.8	0.1	0.0	0.0	0.0
Basswood	13.8	7.2	1.3	1.4	1.1	0.5	0.4	0.8	0.6	0.3	0.1	0.2	0.0	0.0	0.0	0.0
Beech	139.8	95.0	23.3	6.9	4.3	3.5	2.1	1.8	1.3	0.6	0.4	0.4	0.2	0.0	0.0	0.0
Black walnut	13.5	5.0	2.2	1.7	1.2	1.1	0.8	0.5	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0
Cottonwood and aspen	7.5	4.8	1.4	0.4	0.3	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	1,354.0	995.0	223.0	82.7	34.3	11.4	4.6	1.8	0.4	0.3	0.2	0.1	0.0	0.1	0.0	0.0
Hard maple	63.7	43.0	9.9	4.1	2.1	1.7	0.9	0.6	0.6	0.1	0.2	0.3	0.1	0.0	0.0	0.0
Hickory	287.7	180.0	39.5	22.0	14.8	10.9	7.4	5.4	3.9	2.2	0.7	0.7	0.1	0.0	0.0	0.0
Other eastern hard hardwoods	931.0	704.7	141.1	41.6	19.5	10.7	6.5	3.2	1.7	0.9	0.5	0.4	0.1	0.0	0.0	0.0
Other eastern soft hardwoods	1,056.5	761.8	170.3	60.9	28.1	14.4	8.7	4.6	3.0	1.9	1.1	1.3	0.2	0.1	0.0	0.0
Other red oaks	765.7	479.1	128.9	49.7	33.4	25.3	17.0	12.3	8.5	4.1	3.0	2.8	0.8	0.4	0.2	0.1
Other white oaks	224.4	89.0	38.5	22.8	19.3	16.7	12.0	8.1	6.5	4.3	2.8	2.8	0.9	0.3	0.4	0.0
Select red oaks	118.9	56.4	17.5	10.5	7.8	6.0	4.7	4.6	3.4	2.3	1.7	2.5	0.7	0.4	0.1	0.1
Select white oaks	306.9	151.7	56.2	26.6	19.2	14.8	11.3	8.5	7.0	4.9	2.7	2.9	0.7	0.1	0.1	0.1
Soft maple	2,104.5	1,503.6	321.5	121.7	66.3	37.8	22.0	13.5	7.9	4.3	2.8	1.9	0.9	0.0	0.1	0.0
Sweetgum	1,617.5	1,131.2	285.3	89.6	45.0	26.0	15.4	11.0	6.7	3.1	2.1	1.5	0.4	0.1	0.1	0.0
Tupelo and blackgum	557.1	336.3	90.5	41.8	29.0	19.0	14.9	10.2	7.1	4.2	1.7	1.7	0.4	0.2	0.0	0.1
Yellow birch	22.8	10.0	5.4	3.1	2.1	0.9	0.7	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	811.7	498.4	106.4	55.2	40.9	29.1	24.0	18.1	13.9	9.2	6.9	6.4	2.2	0.7	0.3	0.1
Total hardwoods	10,644.9	7,205.8	1,712.9	658.8	378.8	236.3	157.3	108.1	75.2	44.3	27.9	27.2	7.8	2.6	1.3	0.7
All species	14,017.3	8,771.4	2,414.0	1,073.6	671.3	412.3	260.3	164.7	105.1	60.1	36.4	33.3	9.5	3.2	1.5	0.8

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.11—Number of growing-stock trees on timberland by species group and diameter class, North Carolina, 2007

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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							million trees							
Softwood														
Cypress	13.5	2.0	2.2	1.8	1.8	1.5	1.8	0.6	0.5	0.9	0.1	0.1	0.0	0.0
Eastern hemlock	22.2	8.9	5.6	2.2	1.8	1.5	0.7	0.5	0.4	0.3	0.2	0.1	0.0	0.0
Eastern white and red pines	50.3	15.8	11.6	7.2	4.5	2.7	2.3	2.3	1.7	1.2	0.7	0.3	0.0	0.0
Loblolly and shortleaf pines	772.2	299.0	211.8	120.7	66.6	36.2	19.2	10.1	4.7	3.0	0.6	0.1	0.1	0.0
Longleaf and slash pines	39.9	10.1	8.6	8.0	6.1	3.6	2.3	1.0	0.3	0.1	0.0	0.0	0.0	0.0
Other eastern softwoods	18.4	9.3	4.6	2.4	1.1	0.5	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0
Other yellow pines	138.2	44.9	37.3	25.5	17.3	8.8	2.8	0.9	0.5	0.3	0.0	0.0	0.0	0.0
Spruce and balsam fir	3.3	1.1	0.9	0.4	0.5	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	1,058.1	391.2	282.6	168.3	99.7	55.0	29.4	15.5	8.2	5.8	1.6	0.6	0.2	0.1
Hardwood														
Ash	32.8	10.1	7.7	5.0	3.2	2.3	1.9	1.0	0.8	0.8	0.1	0.0	0.0	0.0
Basswood	4.9	1.2	0.9	0.5	0.4	0.8	0.6	0.3	0.1	0.2	0.0	0.0	0.0	0.0
Beech	15.9	4.7	2.7	2.6	1.7	1.5	1.2	0.5	0.3	0.4	0.1	0.0	0.0	0.0
Black walnut	4.7	1.2	0.8	0.8	0.7	0.4	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Cottonwood and aspen	1.2	0.4	0.3	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Hard maple	9.0	3.3	1.7	1.4	0.7	0.5	0.5	0.1	0.2	0.3	0.1	0.0	0.0	0.0
Hickory	60.8	18.3	13.1	10.2	6.9	5.2	3.7	2.0	0.6	0.7	0.1	0.0	0.0	0.0
Other eastern hard hardwoods	53.3	20.9	13.9	8.2	5.1	2.4	1.4	0.7	0.3	0.3	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	78.7	32.9	18.0	10.9	6.6	3.8	2.4	1.5	1.0	1.2	0.2	0.1	0.0	0.0
Other red oaks	133.0	38.1	27.8	22.5	15.2	11.2	8.0	3.7	2.9	2.5	0.5	0.3	0.1	0.1
Other white oaks	81.0	17.3	16.3	14.1	10.2	7.3	5.9	3.8	2.5	2.2	0.7	0.3	0.3	0.0
Select red oaks	41.1	9.1	7.0	5.6	4.3	4.4	3.2	2.2	1.7	2.4	0.7	0.4	0.0	0.1
Select white oaks	90.1	22.5	17.2	14.0	10.6	8.1	6.7	4.8	2.6	2.6	0.6	0.1	0.1	0.1
Soft maple	196.8	80.0	47.7	28.2	16.5	10.6	6.3	3.4	2.0	1.3	0.6	0.0	0.1	0.0
Sweetgum	178.1	76.0	40.6	24.2	13.9	10.1	6.5	3.1	2.0	1.3	0.4	0.1	0.0	0.0
Tupelo and blackgum	106.5	28.6	24.9	16.8	13.2	9.6	6.4	3.7	1.4	1.5	0.3	0.1	0.0	0.0
Yellow birch	4.8	1.8	1.3	0.7	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	194.4	50.3	37.7	27.4	22.9	17.4	13.6	8.9	6.7	6.4	2.1	0.6	0.2	0.1
Total hardwoods	1,287.3	416.7	279.7	193.2	132.6	96.2	69.0	40.1	25.3	24.3	6.5	2.1	1.0	0.5
All species	2,345.3	808.0	562.3	361.5	232.3	151.2	98.4	55.5	33.4	30.1	8.2	2.7	1.2	0.6

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.12—Net[a] volume of live trees on timberland by forest-type group and stand-size class, North Carolina, 2007

Forest-type group	All size classes	Stand-size class: Saw-timber	Pole-timber	Sapling-seeding	Non-stocked
	million cubic feet				
Softwood					
White-red-jack pine	538.2	496.3	34.7	7.1	0.0
Spruce-fir	27.4	0.0	27.4	0.0	0.0
Longleaf-slash pine	495.8	445.9	41.9	8.0	0.0
Loblolly-shortleaf pine	9,064.9	6,661.1	2,241.1	162.6	0.0
Other eastern softwoods	21.5	8.9	3.2	9.4	0.0
Total softwoods	10,147.7	7,612.3	2,348.3	187.1	0.0
Hardwood					
Oak-pine	3,834.2	2,853.6	795.7	185.0	0.0
Oak-hickory	16,172.4	13,550.7	2,279.5	342.2	0.0
Oak-gum-cypress	4,185.5	3,385.1	715.7	84.7	0.0
Elm-ash-cottonwood	1,064.9	933.0	108.2	23.8	0.0
Maple-beech-birch	134.6	117.1	17.6	0.0	0.0
Aspen-birch	0.2	0.0	0.0	0.2	0.0
Other hardwoods	244.2	201.1	35.3	7.8	0.0
Exotic hardwoods	9.8	0.0	9.8	0.0	0.0
Total hardwoods	25,646.0	21,040.5	3,961.8	643.7	0.0
Nonstocked	7.6	0.0	0.0	0.0	7.6
All groups	35,801.3	28,652.8	6,310.1	830.9	7.6

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Excludes rotten, missing, and form cull defects volume.

Table D.13—Net[a] volume of live trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	378.9	9.6	34.5	32.6	30.2	271.9
Eastern hemlock	299.1	104.7	0.0	11.8	1.5	181.1
Eastern white and red pines	1,002.4	138.0	0.0	37.2	30.1	797.1
Loblolly and shortleaf pines	8,325.4	215.0	204.6	369.2	1,463.0	6,073.7
Longleaf and slash pines	572.9	22.3	150.7	84.1	33.9	281.9
Other eastern softwoods	155.3	0.9	15.3	13.5	1.8	123.8
Other yellow pines	1,603.0	139.6	94.0	150.8	20.8	1,197.8
Spruce and balsam fir	25.7	14.8	0.0	0.8	0.0	10.0
Total softwoods	12,362.6	645.0	499.0	700.0	1,581.2	8,937.3
Hardwood						
Ash	618.4	29.0	18.9	31.4	41.8	497.4
Basswood	127.2	43.4	0.0	0.0	7.2	76.7
Beech	325.3	48.9	1.0	10.2	10.3	254.9
Black walnut	89.9	0.1	0.0	1.3	1.5	87.0
Cottonwood and aspen	27.9	1.5	0.0	6.5	5.1	14.8
Eastern noncommercial hardwoods	616.1	103.3	12.1	25.0	13.4	462.4
Hard maple	166.6	51.9	0.0	4.2	0.1	110.4
Hickory	975.3	108.0	9.5	38.0	9.6	810.2
Other eastern hard hardwoods	719.4	144.6	5.3	20.9	6.8	541.8
Other eastern soft hardwoods	1,140.7	121.8	52.8	68.5	39.8	857.8
Other red oaks	2,332.9	241.6	34.5	94.1	49.2	1,913.5
Other white oaks	1,750.3	483.4	10.5	90.8	5.0	1,160.6
Select red oaks	1,130.7	282.2	7.7	69.6	13.5	757.7
Select white oaks	1,934.6	167.0	11.2	88.4	14.4	1,653.6
Soft maple	2,667.5	321.1	61.1	157.8	114.3	2,013.2
Sweetgum	2,250.4	19.5	103.6	125.7	84.5	1,917.0
Tupelo and blackgum	1,798.5	70.4	162.2	120.8	170.9	1,274.2
Yellow birch	70.4	38.6	0.0	0.3	0.0	31.6
Yellow-poplar	4,696.7	463.4	21.1	146.0	65.9	4,000.2
Total hardwoods	23,438.7	2,739.6	511.4	1,099.4	653.3	18,435.0
All species	35,801.3	3,384.6	1,010.5	1,799.4	2,234.5	27,372.3

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Excludes rotten, missing, and form cull defects volume.

Table D.14—Net[a] volume of live trees on timberland by species group and diameter class, North Carolina, 2007

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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							million cubic feet							
Softwood														
Cypress	378.9	9.0	17.0	25.6	34.9	44.2	69.9	27.3	34.2	76.0	9.8	15.6	5.7	9.6
Eastern hemlock	299.1	20.7	28.9	22.4	29.9	37.3	26.0	23.8	28.6	23.0	25.5	13.7	0.0	19.3
Eastern white and red pines	1,002.4	47.8	77.3	81.9	85.8	78.2	85.9	120.3	124.8	124.8	108.0	67.5	0.0	0.0
Loblolly and shortleaf pines	8,325.4	731.9	1,319.9	1,493.3	1,367.1	1,144.0	836.7	602.0	369.0	316.5	93.2	19.1	32.5	0.0
Longleaf and slash pines	572.9	25.2	54.9	95.4	120.0	101.9	92.0	48.6	21.6	13.4	0.0	0.0	0.0	0.0
Other eastern softwoods	155.3	30.2	30.7	27.4	23.5	15.3	7.6	6.7	4.1	4.9	4.9	0.0	0.0	0.0
Other yellow pines	1,603.0	149.6	272.2	346.9	356.6	258.9	108.1	50.0	34.2	26.5	0.0	0.0	0.0	0.0
Spruce and balsam fir	25.7	2.3	4.7	3.9	6.9	3.2	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	12,362.6	1,016.7	1,805.6	2,096.8	2,024.7	1,683.1	1,230.9	878.7	616.4	585.1	241.4	115.9	38.2	29.0
Hardwood														
Ash	618.4	45.9	64.6	74.2	73.5	69.4	79.5	52.1	59.7	79.1	8.8	0.0	2.1	9.6
Basswood	127.2	5.2	8.6	8.2	9.4	27.1	25.5	14.5	6.7	22.1	0.0	0.0	0.0	0.0
Beech	325.3	18.4	25.7	37.8	37.3	46.4	45.0	26.7	21.1	32.1	20.9	5.1	8.7	0.0
Black walnut	89.9	4.7	6.5	10.6	14.3	12.1	18.4	10.4	7.0	5.8	0.0	0.0	0.0	0.0
Cottonwood and aspen	27.9	0.9	1.8	1.8	0.7	4.8	4.9	5.9	0.0	7.0	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	616.1	186.6	169.9	101.8	68.7	38.5	11.2	12.3	9.0	7.9	4.4	5.9	0.0	0.0
Hard maple	166.6	13.1	14.9	20.0	16.5	14.9	22.4	7.5	13.6	25.7	9.2	2.9	0.0	5.8
Hickory	975.3	55.0	93.6	129.8	139.6	155.8	156.0	116.4	42.3	58.8	21.3	6.7	0.0	0.0
Other eastern hard hardwoods	719.4	110.7	125.3	120.6	118.2	76.4	55.6	43.5	25.5	31.0	8.6	4.0	0.0	0.0
Other eastern soft hardwoods	1,140.7	152.5	160.5	157.0	147.5	115.2	100.3	85.9	67.1	101.5	20.1	22.6	6.1	4.5
Other red oaks	2,332.9	131.0	196.2	271.6	298.1	313.4	304.3	189.5	189.5	218.8	86.8	51.6	36.7	45.3
Other white oaks	1,750.3	60.0	119.7	183.9	208.7	204.0	225.2	195.7	155.5	208.2	90.1	36.6	55.6	7.1
Select red oaks	1,130.7	33.2	52.3	73.7	88.6	124.0	124.9	117.3	108.1	225.3	72.7	67.7	11.8	31.1
Select white oaks	1,934.6	72.0	120.7	177.0	212.6	242.7	272.5	249.7	177.7	250.4	89.4	20.9	13.7	35.2
Soft maple	2,667.5	356.6	408.6	403.6	356.0	324.7	254.4	177.8	139.2	133.0	82.9	4.5	26.2	0.0
Sweetgum	2,250.4	212.3	281.3	316.3	306.1	328.0	277.2	168.8	142.5	138.3	55.9	13.9	9.8	0.0
Tupelo and blackgum	1,798.5	114.8	185.8	229.0	273.4	270.5	247.2	193.5	91.4	119.7	36.3	22.4	0.0	14.4
Yellow birch	70.4	11.8	13.6	10.5	12.4	10.4	0.0	3.4	1.0	2.7	0.0	4.4	0.0	0.0
Yellow-poplar	4,696.7	166.6	292.5	378.2	493.9	563.5	607.7	521.6	512.2	642.5	303.7	124.9	62.5	26.8
Total hardwoods	23,438.7	1,751.3	2,342.3	2,705.7	2,875.5	2,941.8	2,832.2	2,192.7	1,769.2	2,309.9	910.9	394.1	233.3	179.7
All species	35,801.3	2,768.0	4,147.9	4,802.5	4,900.2	4,625.0	4,063.1	3,071.4	2,385.6	2,895.0	1,152.3	510.0	271.5	208.7

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.
[a] Excludes rotten, missing, and form cull defects volume.

Table D.15—Net[a] volume of live trees on timberland by forest-type group and stand origin, North Carolina, 2007

Forest-type group	Total	Stand origin: Natural stands	Stand origin: Artificial regeneration
	million cubic feet		
Softwood			
White-red-jack pine	538.2	490.9	47.3
Spruce-fir	27.4	27.4	0.0
Longleaf-slash pine	495.8	327.5	168.3
Loblolly-shortleaf pine	9,064.9	5,125.1	3,939.7
Other eastern softwoods	21.5	21.5	0.0
Total softwoods	10,147.7	5,992.4	4,155.3
Hardwood			
Oak-pine	3,834.2	3,773.5	60.7
Oak-hickory	16,172.4	16,121.6	50.8
Oak-gum-cypress	4,185.5	4,185.5	0.1
Elm-ash-cottonwood	1,064.9	1,064.8	0.1
Maple-beech-birch	134.6	134.6	0.0
Aspen-birch	0.2	0.2	0.0
Other hardwoods	244.2	244.2	0.0
Exotic hardwoods	9.8	9.8	0.0
Total hardwoods	25,646.0	25,534.2	111.8
Nonstocked	7.6	6.6	1.0
All groups	35,801.3	31,533.3	4,268.0

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.
[a] Excludes rotten, missing, and form cull defects volume.

Table D.16—Net[a] volume of growing-stock trees on timberland by species group and diameter class, North Carolina, 2007

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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							million cubic feet							
Softwood														
Cypress	369.9	7.4	16.1	22.9	34.9	44.2	69.1	27.3	32.5	74.8	9.8	15.6	5.7	9.6
Eastern hemlock	292.0	19.4	28.0	20.5	29.2	35.1	26.0	23.8	28.6	23.0	25.5	13.7	0.0	19.3
Eastern white and red pines	983.7	45.6	75.6	80.0	85.2	76.9	85.9	120.3	124.8	113.9	108.0	67.5	0.0	0.0
Loblolly and shortleaf pines	8,158.8	714.9	1,296.7	1,454.2	1,337.7	1,122.0	831.3	593.8	361.2	306.9	93.2	14.5	32.5	0.0
Longleaf and slash pines	555.8	24.5	54.5	93.3	118.5	101.5	92.0	48.6	16.0	6.9	0.0	0.0	0.0	0.0
Other eastern softwoods	122.0	24.7	25.5	23.3	18.3	13.3	2.9	6.7	2.3	4.9	0.0	0.0	0.0	0.0
Other yellow pines	1,523.6	134.6	256.7	328.0	347.8	251.0	106.3	46.3	29.8	23.1	0.0	0.0	0.0	0.0
Spruce and balsam fir	24.5	2.0	4.4	3.3	6.9	3.2	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	12,030.3	973.1	1,757.5	2,025.5	1,978.4	1,647.1	1,218.2	866.8	595.2	553.5	236.6	111.3	38.2	29.0
Hardwood														
Ash	551.4	31.4	52.3	63.0	66.7	64.0	73.2	48.4	57.7	79.1	6.2	0.0	0.0	9.6
Basswood	124.8	4.6	7.6	8.2	8.6	27.1	25.5	14.5	6.7	22.1	0.0	0.0	0.0	0.0
Beech	279.7	13.5	18.0	30.8	29.8	41.3	42.7	24.3	16.3	29.7	19.4	5.1	8.7	0.0
Black walnut	74.0	3.6	4.7	7.7	13.1	10.0	16.6	7.8	4.7	5.8	0.0	0.0	0.0	0.0
Cottonwood and aspen	24.0	0.8	1.8	1.0	0.7	4.8	4.9	5.9	0.0	4.0	0.0	0.0	0.0	0.0
Hard maple	143.5	11.2	12.4	17.7	13.1	14.2	20.2	7.5	13.6	24.4	9.2	0.0	0.0	0.0
Hickory	926.1	48.3	85.3	122.8	132.5	151.2	150.9	110.3	39.3	57.5	21.3	6.7	0.0	0.0
Other eastern hard hardwoods	564.4	68.5	99.0	99.1	99.7	64.2	48.4	34.3	16.6	26.0	4.6	4.0	0.0	0.0
Other eastern soft hardwoods	918.6	92.3	112.4	125.8	117.5	100.9	88.6	73.2	64.3	94.8	20.1	22.6	6.1	0.0
Other red oaks	2,130.8	106.1	170.5	249.4	273.2	293.7	289.2	177.9	185.6	207.3	66.6	43.9	22.2	45.3
Other white oaks	1,562.1	47.6	103.9	160.3	184.4	187.6	210.1	180.8	145.2	177.9	76.0	30.7	50.6	7.1
Select red oaks	1,082.9	29.6	48.2	68.0	83.0	120.2	119.4	112.2	108.1	221.8	71.2	62.3	7.8	31.1
Select white oaks	1,826.4	62.9	111.3	167.9	202.2	234.4	265.0	244.9	174.2	226.5	78.9	20.9	13.7	23.6
Soft maple	2,092.3	247.8	311.2	320.0	284.1	273.7	215.7	149.9	112.1	93.4	63.2	0.0	21.3	0.0
Sweetgum	2,115.5	188.7	259.7	298.9	285.1	306.7	271.3	165.7	138.1	128.5	50.0	13.9	8.9	0.0
Tupelo and blackgum	1,633.4	83.5	164.5	209.5	249.3	259.7	232.5	179.8	82.0	114.7	31.8	19.5	0.0	6.7
Yellow birch	53.8	7.9	9.3	8.5	9.8	7.7	0.0	3.4	0.0	2.7	0.0	4.4	0.0	0.0
Yellow-poplar	4,579.4	154.7	274.5	361.3	479.5	551.5	600.0	514.8	504.4	636.8	302.6	113.2	59.2	26.8
Total hardwoods	20,683.2	1,202.9	1,846.8	2,320.0	2,532.3	2,712.7	2,674.0	2,055.7	1,668.8	2,152.9	821.0	347.2	198.4	150.2
All species	32,713.5	2,176.0	3,604.3	4,345.5	4,510.8	4,359.9	3,892.2	2,922.5	2,263.9	2,706.5	1,057.5	458.5	236.7	179.2

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Excludes rotten, missing, and form cull defects volume.

Table D.17—Net[a] volume of growing-stock trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	369.9	9.6	34.2	31.9	29.9	264.4
Eastern hemlock	292.0	101.9	0.0	11.8	1.5	176.9
Eastern white and red pines	983.7	137.9	0.0	37.0	30.1	778.7
Loblolly and shortleaf pines	8,158.8	214.4	203.9	366.3	1,431.8	5,942.5
Longleaf and slash pines	555.8	22.3	145.5	83.7	33.8	270.5
Other eastern softwoods	122.0	0.1	14.7	13.3	1.8	92.1
Other yellow pines	1,523.6	138.0	90.0	148.0	19.6	1,128.0
Spruce and balsam fir	24.5	13.7	0.0	0.8	0.0	10.0
Total softwoods	12,030.3	637.8	488.3	692.7	1,548.4	8,663.1
Hardwood						
Ash	551.4	26.9	14.3	26.2	37.4	446.6
Basswood	124.8	42.8	0.0	0.0	6.7	75.4
Beech	279.7	34.0	1.0	8.3	10.1	226.3
Black walnut	74.0	0.0	0.0	1.1	1.5	71.3
Cottonwood and aspen	24.0	1.5	0.0	6.0	4.7	11.7
Hard maple	143.5	41.8	0.0	3.3	0.1	98.2
Hickory	926.1	103.6	9.4	35.5	9.3	768.2
Other eastern hard hardwoods	564.4	122.2	3.7	17.3	4.2	417.0
Other eastern soft hardwoods	918.6	106.0	34.3	59.3	29.1	690.0
Other red oaks	2,130.8	230.2	29.9	77.6	40.4	1,752.6
Other white oaks	1,562.1	432.6	10.4	77.1	2.1	1,039.9
Select red oaks	1,082.9	264.0	7.7	67.3	11.6	732.3
Select white oaks	1,826.4	158.5	9.1	86.4	13.8	1,558.6
Soft maple	2,092.3	287.4	48.5	122.0	86.0	1,548.5
Sweetgum	2,115.5	17.5	98.7	121.3	81.8	1,796.3
Tupelo and blackgum	1,633.4	65.7	147.9	103.3	160.3	1,156.3
Yellow birch	53.8	32.5	0.0	0.1	0.0	21.2
Yellow-poplar	4,579.4	458.4	19.8	140.5	64.9	3,895.8
Total hardwoods	20,683.2	2,425.8	434.7	952.7	563.9	16,306.1
All species	32,713.5	3,063.6	923.0	1,645.4	2,112.3	24,969.2

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Excludes rotten, missing, and form cull defects volume.

Table D.18—Net[a] volume of sawtimber trees on timberland by species group and diameter class, North Carolina, 2007

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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
						million board feet[b]						
Softwood												
Cypress	1,728.4	68.9	133.6	194.9	332.9	140.0	174.2	425.4	60.0	97.3	36.6	64.5
Eastern hemlock	1,296.8	71.5	123.0	164.8	132.9	128.7	161.7	134.8	158.9	87.5	0.0	132.9
Eastern white and red pines	4,807.7	289.9	374.9	379.8	460.7	683.7	743.5	710.2	707.3	457.7	0.0	0.0
Loblolly and shortleaf pines	30,763.5	5,277.0	6,053.4	5,805.1	4,703.6	3,581.7	2,290.5	2,047.0	655.9	105.4	243.9	0.0
Longleaf and slash pines	2,444.9	363.5	562.5	545.0	530.5	296.4	101.3	45.6	0.0	0.0	0.0	0.0
Other eastern softwoods	347.8	92.0	86.3	69.4	16.3	38.5	14.4	31.0	0.0	0.0	0.0	0.0
Other yellow pines	5,116.2	1,205.2	1,521.5	1,222.8	565.7	265.3	183.4	152.3	0.0	0.0	0.0	0.0
Spruce and balsam fir	83.9	12.1	30.8	15.9	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	46,589.1	7,380.0	8,886.0	8,397.6	6,767.6	5,134.1	3,669.2	3,546.5	1,582.2	747.9	280.6	197.4
Hardwood												
Ash	1,810.7	0.0	217.7	246.3	315.9	227.6	288.5	420.0	34.8	0.0	0.0	59.8
Basswood	465.1	0.0	30.1	108.6	111.1	68.1	32.7	114.5	0.0	0.0	0.0	0.0
Beech	857.6	0.0	108.9	157.1	166.5	96.5	66.0	122.4	81.2	21.5	37.6	0.0
Black walnut	219.9	0.0	44.5	36.3	63.9	31.2	19.6	24.4	0.0	0.0	0.0	0.0
Cottonwood and aspen	96.7	0.0	2.3	20.0	23.2	29.5	0.0	21.8	0.0	0.0	0.0	0.0
Hard maple	456.8	0.0	47.7	57.7	87.4	34.2	63.7	119.6	46.5	0.0	0.0	0.0
Hickory	2,975.3	0.0	456.8	615.5	682.7	540.7	203.4	311.3	124.7	40.3	0.0	0.0
Other eastern hard hardwoods	1,163.8	0.0	346.8	247.4	196.3	153.3	73.7	111.1	18.6	16.7	0.0	0.0
Other eastern soft hardwoods	2,638.9	0.0	401.9	398.3	387.0	348.5	317.5	506.2	114.9	130.3	34.2	0.0
Other red oaks	7,572.0	0.0	977.9	1,214.0	1,313.8	873.4	952.5	1,132.5	387.8	270.9	141.8	307.4
Other white oaks	5,604.5	0.0	619.4	730.1	902.6	828.3	703.3	909.6	408.1	170.0	290.9	42.1
Select red oaks	4,360.6	0.0	276.8	463.9	506.2	510.2	516.4	1,118.9	378.9	339.0	43.3	207.0
Select white oaks	6,862.0	0.0	685.2	936.0	1,175.7	1,169.6	877.6	1,213.1	445.3	123.1	87.9	148.7
Soft maple	5,029.1	0.0	927.1	1,045.7	910.7	678.7	536.1	471.3	338.1	0.0	121.4	0.0
Sweetgum	6,507.1	0.0	1,020.9	1,320.2	1,307.9	865.0	766.6	760.2	314.3	91.4	60.5	0.0
Tupelo and blackgum	4,974.5	0.0	786.0	988.3	993.4	839.4	407.2	617.3	183.7	115.4	0.0	43.9
Yellow birch	119.1	0.0	34.6	30.6	0.0	16.1	0.0	13.7	0.0	24.1	0.0	0.0
Yellow-poplar	19,946.3	0.0	1,713.6	2,395.0	2,954.4	2,755.3	2,885.9	3,887.4	1,967.8	771.1	419.3	196.5
Total hardwoods	71,660.2	0.0	8,698.2	11,011.0	12,098.6	10,065.4	8,710.8	11,875.1	4,844.8	2,113.9	1,236.9	1,005.4
All species	118,249.3	7,380.0	17,584.3	19,408.6	18,866.2	15,199.5	12,379.9	15,421.6	6,427.0	2,861.8	1,517.5	1,202.8

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.
[a] Excludes rotten, missing, and form cull defects volume.
[b] International ¼-inch rule.

Table D.19—Net[a] volume of sawtimber trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million board feet[b]					
Softwood						
Cypress	1,728.4	52.3	169.9	166.8	143.4	1,196.0
Eastern hemlock	1,296.8	445.5	0.0	57.3	4.5	789.5
Eastern white and red pines	4,807.7	701.4	0.0	161.8	192.1	3,752.4
Loblolly and shortleaf pines	30,763.5	1,052.4	1,028.8	1,613.6	5,472.6	21,596.1
Longleaf and slash pines	2,444.9	121.9	718.2	305.4	120.4	1,179.0
Other eastern softwoods	347.8	0.0	78.1	41.3	8.2	220.2
Other yellow pines	5,116.2	533.9	314.6	571.3	77.9	3,618.6
Spruce and balsam fir	83.9	49.7	0.0	4.1	0.0	30.1
Total softwoods	46,589.1	2,957.0	2,309.6	2,921.7	6,019.0	32,381.8
Hardwood						
Ash	1,810.7	104.4	41.3	111.1	119.1	1,434.8
Basswood	465.1	184.8	0.0	0.0	21.8	258.4
Beech	857.6	87.7	0.0	30.3	34.4	705.3
Black walnut	219.9	0.0	0.0	2.4	5.4	212.2
Cottonwood and aspen	96.7	7.3	0.0	24.6	16.9	48.0
Hard maple	456.8	126.0	0.0	10.0	0.0	320.7
Hickory	2,975.3	346.8	30.6	145.2	24.4	2,428.3
Other eastern hard hardwoods	1,163.8	241.5	0.0	51.6	9.5	861.3
Other eastern soft hardwoods	2,638.9	318.6	63.5	222.9	90.5	1,943.3
Other red oaks	7,572.0	825.6	104.8	254.0	145.9	6,241.8
Other white oaks	5,604.5	1,741.2	53.1	279.6	4.8	3,525.9
Select red oaks	4,360.6	1,089.3	35.4	274.2	46.7	2,915.0
Select white oaks	6,862.0	675.9	41.1	309.4	44.9	5,790.7
Soft maple	5,029.1	707.6	111.0	315.3	223.7	3,671.5
Sweetgum	6,507.1	42.8	404.3	468.5	186.6	5,404.8
Tupelo and blackgum	4,974.5	196.2	435.3	310.6	532.0	3,500.4
Yellow birch	119.1	88.4	0.0	0.0	0.0	30.7
Yellow-poplar	19,946.3	2,158.3	83.6	592.5	297.4	16,814.4
Total hardwoods	71,660.2	8,942.6	1,403.9	3,402.2	1,804.0	56,107.4
All species	118,249.3	11,899.7	3,713.6	6,323.9	7,822.9	88,489.3

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Excludes rotten, missing, and form cull defects volume.

[b] International ¼-inch rule.

Table D.20—Aboveground dry weight[a] of live trees on timberland by species group and diameter class, North Carolina, 2007

Species group	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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
								thousand tons								
Softwood																
Cypress	9,102.3	40.8	114.9	159.6	321.5	511.4	769.7	999.2	1,640.5	651.4	833.2	1,919.8	252.8	428.1	170.2	289.0
Eastern hemlock	8,516.4	160.5	342.0	704.8	839.1	612.3	792.5	978.3	673.0	611.8	731.2	585.8	648.1	347.1	0.0	490.0
Eastern white and red pines	19,077.9	204.7	480.8	1,049.2	1,571.3	1,618.6	1,655.7	1,483.9	1,599.3	2,166.5	2,209.1	2,144.9	1,803.8	1,090.2	0.0	0.0
Loblolly and shortleaf pines	198,984.0	3,025.1	8,641.3	19,665.7	30,669.9	33,123.5	29,955.5	24,874.4	18,053.8	13,014.0	7,929.8	6,820.2	2,003.9	486.7	720.1	0.0
Longleaf and slash pines	13,995.2	170.6	307.0	672.0	1,315.7	2,225.3	2,798.7	2,390.1	2,153.2	1,141.3	508.5	313.0	0.0	0.0	0.0	0.0
Other eastern softwoods	4,862.5	486.8	629.0	836.8	739.4	626.0	533.0	347.7	174.9	168.1	95.2	121.3	104.2	0.0	0.0	0.0
Other yellow pines	38,894.0	1,015.9	2,302.7	3,819.8	6,123.2	7,580.6	7,750.4	5,587.9	2,342.4	1,071.7	736.4	563.2	0.0	0.0	0.0	0.0
Spruce and balsam fir	584.8	2.5	17.5	56.2	105.3	83.0	149.6	69.1	101.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	294,017.1	5,106.9	12,835.1	26,964.0	41,685.5	46,380.8	44,405.0	36,730.5	26,738.6	18,824.7	13,043.4	12,468.3	4,812.8	2,352.2	890.3	779.0
Hardwood																
Ash	13,444.1	595.6	1,068.9	1,154.2	1,407.7	1,497.8	1,425.5	1,321.4	1,439.0	890.0	982.6	1,273.3	161.4	0.0	89.3	137.4
Basswood	2,778.8	26.3	32.8	94.1	168.5	167.4	196.3	568.0	553.0	333.4	146.5	492.5	0.0	0.0	0.0	0.0
Beech	10,366.3	407.6	546.2	484.4	659.3	973.5	991.5	1,325.9	1,326.8	784.4	725.3	999.0	700.9	158.3	283.2	0.0
Black walnut	2,985.7	30.7	82.7	133.8	199.7	320.6	444.9	388.9	608.5	341.2	236.9	197.8	0.0	0.0	0.0	0.0
Cottonwood and aspen	665.5	16.7	34.4	19.8	37.7	36.8	13.9	104.1	107.2	131.2	0.0	163.7	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	23,875.4	3,997.8	5,072.7	5,072.3	4,007.7	2,214.7	1,475.2	813.1	230.3	267.9	204.0	203.1	105.0	211.3	0.0	0.0
Hard maple	5,519.1	205.5	325.5	330.4	389.9	540.6	452.0	422.2	634.5	224.5	394.5	832.7	284.2	179.6	0.0	302.9
Hickory	28,411.5	791.1	1,056.6	1,517.0	2,409.4	3,349.8	3,655.7	4,162.4	4,292.8	3,248.0	1,318.9	1,749.9	659.4	200.4	0.0	0.0
Other eastern hard hardwoods	27,325.9	3,075.6	3,437.1	2,683.0	3,203.0	3,350.5	3,422.2	2,400.7	1,800.3	1,348.5	858.2	1,179.6	330.0	237.3	0.0	0.0
Other eastern soft hardwoods	32,933.1	3,063.1	3,818.1	3,422.9	3,437.1	3,378.8	3,221.7	2,538.7	2,352.4	2,032.4	1,734.9	2,438.9	491.3	563.8	157.0	282.2
Other red oaks	72,695.0	2,267.4	3,322.9	3,854.2	5,498.6	7,510.4	8,288.4	8,918.6	8,678.0	5,526.9	5,474.8	6,550.9	2,634.6	1,654.8	1,084.4	1,430.0
Other white oaks	49,327.5	389.3	1,024.2	1,592.1	3,037.6	4,716.4	5,435.2	5,344.3	6,054.7	5,329.5	4,307.1	5,913.7	2,724.6	1,139.3	2,029.1	290.3
Select red oaks	32,586.0	242.3	544.4	882.3	1,383.1	1,943.8	2,405.4	3,372.5	3,461.4	3,315.7	3,037.9	6,431.7	2,121.2	2,130.1	365.7	948.6
Select white oaks	56,220.6	710.6	1,333.5	1,954.6	3,185.5	4,679.7	5,734.2	6,663.9	7,632.4	7,066.1	5,081.5	7,410.0	2,645.1	633.5	415.9	1,074.0
Soft maple	81,809.2	6,456.6	8,782.4	9,174.6	10,143.8	9,888.2	8,779.9	8,020.4	6,320.0	4,399.8	3,503.3	3,304.5	2,314.5	108.5	612.7	0.0
Sweetgum	61,030.2	4,063.6	5,760.6	5,495.3	6,276.3	6,840.1	6,740.1	7,260.6	6,193.3	3,823.3	3,259.9	3,285.1	1,326.1	330.1	375.8	0.0
Tupelo and blackgum	44,684.7	1,426.9	2,162.4	2,364.6	3,765.4	4,667.7	5,838.5	6,014.3	5,788.5	4,632.6	2,307.8	3,137.2	1,083.2	675.1	0.0	820.5
Yellow birch	2,039.2	68.3	152.1	232.4	318.2	273.3	335.3	284.0	0.0	95.6	53.1	91.2	0.0	135.8	0.0	0.0
Yellow-poplar	104,102.3	1,896.6	2,675.9	3,628.1	5,949.3	7,604.1	10,038.3	11,746.0	12,722.1	11,092.3	11,029.0	13,934.5	6,757.1	2,848.3	1,581.6	599.0
Total hardwoods	652,799.9	29,731.7	41,233.3	44,090.3	55,477.9	63,954.2	68,894.1	71,670.0	70,195.1	54,883.5	44,656.2	59,589.2	24,338.7	11,206.1	6,994.7	5,884.9
All species	946,817.0	34,838.5	54,068.4	71,054.3	97,163.3	110,335.0	113,299.1	108,400.5	96,933.7	73,708.2	57,699.6	72,057.5	29,151.5	13,558.4	7,885.0	6,663.9

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT table in FIADB users guide.

Table D.21—Aboveground green weight[a] of live trees on timberland by species group and diameter class, North Carolina, 2007

Species group	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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							thousand acres									
Softwood																
Cypress	18,204.5	81.7	229.7	319.1	643.0	1,022.8	1,539.4	1,998.4	3,281.0	1,302.9	1,666.3	3,839.7	505.6	856.3	340.5	578.1
Eastern hemlock	17,032.9	321.0	683.9	1,409.5	1,678.2	1,224.7	1,584.9	1,956.5	1,346.0	1,223.5	1,462.4	1,171.6	1,296.3	694.3	0.0	979.9
Eastern white and red pines	38,155.8	409.5	961.5	2,098.3	3,142.6	3,237.1	3,311.4	2,967.7	3,198.5	4,333.0	4,418.2	4,289.9	3,607.6	2,180.4	0.0	0.0
Loblolly and shortleaf pines	397,968.0	6,050.1	17,282.6	39,331.4	61,339.9	66,247.1	59,911.0	49,748.8	36,107.6	26,028.0	15,859.7	13,640.4	4,007.8	973.5	1,440.2	0.0
Longleaf and slash pines	27,990.5	341.1	613.9	1,344.0	2,631.4	4,450.6	5,597.4	4,780.2	4,306.3	2,282.5	1,017.0	626.0	0.0	0.0	0.0	0.0
Other eastern softwoods	9,724.9	973.5	1,258.1	1,673.6	1,478.9	1,252.0	1,065.9	695.4	349.8	336.2	190.5	242.6	208.4	0.0	0.0	0.0
Other yellow pines	77,788.1	2,031.8	4,605.4	7,639.6	12,246.3	15,161.2	15,500.7	11,175.8	4,684.8	2,143.4	1,472.8	1,126.4	0.0	0.0	0.0	0.0
Spruce and balsam fir	1,169.6	4.9	35.0	112.4	210.7	166.1	299.2	138.2	203.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	588,034.2	10,213.7	25,670.1	53,928.0	83,370.9	92,761.6	88,809.9	73,461.1	53,477.1	37,649.5	26,086.9	24,936.6	9,625.7	4,704.5	1,780.6	1,558.0
Hardwood																
Ash	26,888.2	1,191.2	2,137.8	2,308.3	2,815.5	2,995.7	2,850.9	2,642.8	2,878.0	1,780.0	1,965.1	2,546.5	322.8	0.0	178.7	274.8
Basswood	5,557.7	52.7	65.6	188.2	337.0	334.7	392.7	1,135.9	1,106.0	666.8	293.1	985.0	0.0	0.0	0.0	0.0
Beech	20,732.6	815.2	1,092.4	968.8	1,318.6	1,946.9	1,983.0	2,651.9	2,653.6	1,568.8	1,450.6	1,998.1	1,401.9	316.6	566.3	0.0
Black walnut	5,971.3	61.3	165.3	267.7	399.4	641.3	889.8	777.8	1,217.1	682.4	473.7	395.6	0.0	0.0	0.0	0.0
Cottonwood and aspen	1,331.0	33.5	68.7	39.6	75.4	73.6	27.8	208.3	214.4	262.4	0.0	327.4	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	47,750.8	7,995.5	10,145.5	10,144.7	8,015.4	4,429.5	2,950.4	1,626.3	460.6	535.8	408.1	406.2	210.1	422.6	0.0	0.0
Hard maple	11,038.1	411.1	651.0	660.8	779.8	1,081.1	904.0	844.3	1,269.0	449.1	789.0	1,665.5	568.3	359.2	0.0	605.8
Hickory	56,822.9	1,582.2	2,113.2	3,034.1	4,818.9	6,699.6	7,311.4	8,324.7	8,585.6	6,496.1	2,637.8	3,499.9	1,318.8	400.8	0.0	0.0
Other eastern hard hardwoods	54,651.9	6,151.3	6,874.2	5,366.0	6,406.0	6,701.0	6,844.4	4,801.4	3,600.6	2,696.9	1,716.3	2,359.2	660.0	474.6	0.0	0.0
Other eastern soft hardwoods	65,866.3	6,126.2	7,636.2	6,845.9	6,874.1	6,757.6	6,443.3	5,077.4	4,704.7	4,064.8	3,469.8	4,877.8	982.6	1,127.5	314.0	564.4
Other red oaks	145,389.9	4,534.8	6,645.8	7,708.4	10,997.1	15,020.8	16,576.7	17,837.3	17,355.9	11,053.9	10,949.6	13,101.7	5,269.3	3,309.7	2,168.9	2,860.0
Other white oaks	98,654.9	778.5	2,048.4	3,184.2	6,075.2	9,432.8	10,870.4	10,688.7	12,109.4	10,659.0	8,614.1	11,827.3	5,449.3	2,278.6	4,058.3	580.6
Select red oaks	65,171.9	484.5	1,088.8	1,764.6	2,766.2	3,887.6	4,810.7	6,744.9	6,922.8	6,631.4	6,075.8	12,863.4	4,242.4	4,260.2	731.4	1,897.1
Select white oaks	112,441.1	1,421.1	2,667.1	3,909.1	6,371.1	9,359.4	11,468.4	13,327.8	15,264.8	14,132.2	10,163.1	14,820.1	5,290.2	1,267.0	831.7	2,148.0
Soft maple	163,618.4	12,913.3	17,564.8	18,349.2	20,287.7	19,776.3	17,559.7	16,040.9	12,640.0	8,799.6	7,006.5	6,609.0	4,629.1	216.9	1,225.3	0.0
Sweetgum	122,060.3	8,127.2	11,521.2	10,990.6	12,552.7	13,680.2	13,480.1	14,521.1	12,386.7	7,646.7	6,519.8	6,570.1	2,652.3	660.1	751.6	0.0
Tupelo and blackgum	89,369.4	2,853.7	4,324.7	4,729.3	7,530.8	9,335.4	11,677.1	12,028.6	11,576.9	9,265.2	4,615.6	6,274.3	2,166.3	1,350.2	0.0	1,641.1
Yellow birch	4,078.4	136.6	304.2	464.8	636.4	546.7	670.6	568.0	0.0	191.1	106.2	182.3	0.0	271.7	0.0	0.0
Yellow-poplar	208,204.7	3,793.3	5,351.8	7,256.3	11,898.6	15,208.2	20,076.7	23,492.0	25,444.2	22,184.6	22,058.1	27,869.0	13,514.2	5,696.5	3,163.3	1,198.0
Total hardwoods	1,305,599.7	59,463.3	82,466.6	88,180.6	110,955.8	127,908.4	137,788.2	143,339.9	140,390.2	109,767.0	89,312.4	119,178.4	48,677.4	22,412.3	13,989.5	11,769.8
All species	1,893,633.9	69,677.0	108,136.7	142,108.5	194,326.7	220,670.1	226,598.2	216,801.0	193,867.3	147,416.5	115,399.2	144,115.0	58,303.1	27,116.8	15,770.1	13,327.8

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT table in FIADB users guide.

Table D.22—Merchantable dry weight[a] of live trees on timberland by species group and diameter class, North Carolina, 2007

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	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							thousand tons							
Softwood														
Cypress	7,271.3	108.8	243.2	409.2	612.8	826.9	1,351.4	539.0	696.0	1,580.4	212.0	344.4	128.6	218.6
Eastern hemlock	6,742.5	498.5	679.0	513.4	674.1	834.6	579.4	529.1	633.6	508.3	563.5	302.0	0.0	426.9
Eastern white and red pines	15,658.7	781.6	1,296.0	1,368.5	1,416.7	1,267.9	1,369.9	1,878.7	1,904.8	1,865.5	1,559.0	949.9	0.0	0.0
Loblolly and shortleaf pines	158,739.7	14,104.5	25,186.9	28,378.3	26,022.4	21,792.7	15,944.8	11,476.9	7,034.0	6,034.3	1,780.2	364.6	620.0	0.0
Longleaf and slash pines	11,709.3	486.9	1,091.6	1,913.8	2,449.0	2,105.6	1,913.1	1,014.5	453.8	281.1	0.0	0.0	0.0	0.0
Other eastern softwoods	3,083.0	635.6	607.6	527.9	451.8	297.5	145.6	139.7	82.0	105.0	90.3	0.0	0.0	0.0
Other yellow pines	30,138.5	2,872.7	5,080.8	6,485.2	6,696.7	4,876.2	2,036.5	945.5	643.1	501.9	0.0	0.0	0.0	0.0
Spruce and balsam fir	468.2	39.1	85.3	69.6	127.4	59.3	87.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	233,811.2	19,527.8	34,270.3	39,665.8	38,451.0	32,060.8	23,428.4	16,523.4	11,447.3	10,876.4	4,205.1	1,960.9	748.6	645.5
Hardwood														
Ash	9,610.0	798.1	1,118.5	1,226.9	1,171.4	1,082.7	1,210.7	773.5	857.2	1,098.6	123.2	0.0	27.6	121.5
Basswood	2,277.0	66.1	133.9	137.8	164.1	487.3	467.3	270.0	127.1	423.4	0.0	0.0	0.0	0.0
Beech	7,213.1	314.1	485.9	744.1	778.7	1,031.5	1,033.0	630.8	509.5	790.2	534.1	129.5	231.8	0.0
Black walnut	2,257.6	89.5	143.5	248.1	354.3	306.9	483.6	277.4	193.0	161.3	0.0	0.0	0.0	0.0
Cottonwood and aspen	517.8	12.9	30.2	30.8	11.8	89.5	92.6	113.6	0.0	136.5	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	10,754.4	3,347.1	2,975.6	1,696.4	1,148.2	657.8	189.8	215.0	171.3	147.2	86.8	119.2	0.0	0.0
Hard maple	3,691.3	218.4	291.3	415.9	355.0	333.1	511.3	176.9	321.2	620.2	225.8	73.4	0.0	148.8
Hickory	20,918.3	977.8	1,811.5	2,640.7	2,939.1	3,378.9	3,469.7	2,644.7	980.8	1,383.1	524.0	167.9	0.0	0.0
Other eastern hard harwoods	15,503.5	1,744.9	2,388.2	2,553.7	2,656.9	1,818.2	1,397.9	1,045.2	657.3	884.4	230.7	126.2	0.0	0.0
Other eastern soft harwoods	20,902.2	2,366.6	2,691.0	2,765.8	2,677.3	2,130.4	1,956.4	1,699.2	1,427.1	2,050.0	420.8	491.0	123.1	103.4
Other red oaks	52,018.9	2,547.5	4,117.9	5,828.4	6,550.0	7,033.2	6,917.9	4,336.6	4,393.1	5,083.4	2,048.6	1,236.1	833.4	1,092.8
Other white oaks	37,461.4	1,110.5	2,346.5	3,714.1	4,332.9	4,323.2	4,871.0	4,277.9	3,440.1	4,685.0	2,046.8	842.3	1,302.7	168.4
Select red oaks	25,098.9	633.5	1,070.9	1,542.1	1,897.9	2,716.9	2,770.8	2,632.9	2,443.1	5,130.0	1,665.7	1,548.0	270.6	776.5
Select white oaks	42,891.3	1,322.2	2,412.9	3,668.1	4,539.5	5,334.5	6,105.2	5,683.1	4,102.4	5,868.6	2,135.8	502.1	340.0	876.7
Soft maple	51,508.4	6,393.1	7,870.8	7,829.2	6,966.8	6,400.6	5,019.3	3,502.9	2,734.5	2,597.9	1,605.2	87.1	500.8	0.0
Sweetgum	42,361.1	3,730.1	5,019.7	5,741.4	5,682.7	6,228.2	5,358.1	3,311.3	2,833.4	2,800.9	1,154.0	293.1	208.3	0.0
Tupelo and blackgum	32,650.2	1,667.7	2,967.4	3,817.6	4,785.7	4,985.1	4,729.2	3,815.0	1,839.3	2,463.4	767.8	476.8	0.0	335.2
Yellow birch	1,358.2	153.4	236.4	209.9	261.8	226.5	0.0	77.7	23.8	63.2	0.0	105.5	0.0	0.0
Yellow-poplar	86,118.6	2,713.1	4,960.5	6,509.4	8,703.5	10,206.0	11,206.5	9,746.2	9,680.4	12,290.2	5,884.8	2,445.7	1,235.9	536.5
Total hardwoods	465,112.2	30,206.6	43,072.6	51,320.4	55,977.6	58,770.4	57,790.3	45,229.9	36,734.5	48,677.5	19,454.2	8,643.9	5,074.4	4,159.9
All species	698,923.4	49,734.3	77,342.9	90,986.2	94,428.6	90,831.2	81,218.7	61,753.3	48,181.8	59,553.9	23,659.2	10,604.8	5,823.1	4,805.3

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOM table in FIADB users guide.

Table D.23—Total carbon[a] of live trees on forest land by ownership class and land status, North Carolina, 2007

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
	thousand tons						
U.S. Forest Service							
National forest	48,746.5	45,175.2	45,134.3	40.9	3,571.2	3,570.7	0.5
Total	48,746.5	45,175.2	45,134.3	40.9	3,571.2	3,570.7	0.5
Other Federal							
National Park Service	14,364.1	0.0	0.0	0.0	14,364.1	14,364.1	0.0
U.S. Fish and Wildlife Service	5,502.2	5,502.2	5,289.9	212.3	0.0	0.0	0.0
Dept. of Defense/Dept. of Energy	7,559.8	7,559.8	7,361.4	198.4	0.0	0.0	0.0
Total	27,426.0	13,062.0	12,651.3	410.7	14,364.1	14,364.1	0.0
State and local government							
State	14,492.4	14,238.5	14,222.2	16.3	253.9	253.9	0.0
Local	8,876.2	8,876.2	8,876.2	0.0	0.0	0.0	0.0
Total	23,368.7	23,114.7	23,098.4	16.3	253.9	253.9	0.0
Forest industry							
Corporate	27,973.4	27,973.4	27,958.0	15.4	0.0	0.0	0.0
Individual	251.6	251.6	251.6	0.0	0.0	0.0	0.0
Total	28,225.0	28,225.0	28,209.6	15.4	0.0	0.0	0.0
Nonindustrial private							
Corporate	64,740.2	64,740.2	64,739.2	1.0	0.0	0.0	0.0
Conservation/natural resources organization	3,270.8	3,270.8	3,259.1	11.7	0.0	0.0	0.0
Unincorporated local partnership/association/club	5,784.5	5,784.5	5,750.6	33.9	0.0	0.0	0.0
Native American	895.5	895.5	895.5	0.0	0.0	0.0	0.0
Individual	289,726.7	289,726.7	289,670.5	56.2	0.0	0.0	0.0
Total	364,417.7	364,417.7	364,314.9	102.8	0.0	0.0	0.0
All classes	492,183.8	473,994.6	473,408.5	586.2	18,189.2	18,188.7	0.5

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] Estimates of carbon calculated by multiplying aboveground dry weight by 0.5. Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT table in FIADB users guide.

Table D.24—Average annual net growth of live trees on timberland by forest-type group and stand-size class, North Carolina, 2007

Forest-type group	All size classes	Stand-size class: Saw-timber	Pole-timber	Sapling-seeding	Non-stocked
	million cubic feet				
Softwood					
White-red-jack pine	29.0	20.7	6.4	1.8	0.0
Spruce-fir	0.4	0.0	0.4	0.0	0.0
Longleaf-slash pine	16.3	8.6	5.7	2.0	0.0
Loblolly-shortleaf pine	570.9	227.7	248.9	94.4	0.0
Other eastern softwoods	3.3	0.7	1.2	1.4	0.0
Total softwoods	620.0	257.7	262.5	99.7	0.0
Hardwood					
Oak-pine	161.8	61.5	51.4	48.9	0.0
Oak-hickory	583.2	399.0	120.8	63.4	0.0
Oak-gum-cypress	52.5	18.9	24.2	9.5	0.0
Elm-ash-cottonwood	17.8	8.0	7.5	2.3	0.0
Maple-beech-birch	1.0	0.5	0.4	0.1	0.0
Aspen-birch	0.1	0.0	0.0	0.1	0.0
Other hardwoods	11.3	8.7	2.3	0.4	0.0
Exotic hardwoods	0.1	0.0	0.0	0.1	0.0
Total hardwoods	827.8	496.5	206.6	124.7	0.0
Nonstocked	2.2	0.0	0.0	0.0	2.2
All groups	1,450.0	754.3	469.1	224.4	2.2

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.25—Average annual net growth of live trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	9.6	0.5	1.3	1.6	0.8	5.4
Eastern hemlock	12.1	3.6	0.0	0.4	0.1	7.9
Eastern white and red pines	57.0	3.3	0.0	2.3	0.6	50.8
Loblolly and shortleaf pines	589.5	7.5	7.8	16.2	133.2	424.9
Longleaf and slash pines	20.1	0.7	2.8	2.9	1.9	11.7
Other eastern softwoods	2.0	0.0	-1.0	-0.4	0.0	3.3
Other yellow pines	11.0	-0.3	-2.4	1.7	0.5	11.4
Spruce and balsam fir	1.0	0.6	0.0	0.1	0.0	0.3
Total softwoods	702.2	16.0	8.6	24.8	137.1	515.6
Hardwood						
Ash	9.1	-0.7	-0.1	-2.1	0.9	11.2
Basswood	3.4	0.7	0.0	0.0	0.5	2.2
Beech	9.7	0.5	0.0	0.2	0.1	8.9
Black walnut	5.8	0.0	0.0	0.0	0.1	5.8
Cottonwood and aspen	0.5	0.0	0.0	0.2	-0.4	0.7
Eastern noncommercial hardwoods	21.4	1.6	-0.3	0.7	1.0	18.4
Hard maple	4.3	1.0	0.0	0.3	0.0	2.9
Hickory	32.1	4.3	0.6	1.7	0.1	25.5
Other eastern hard hardwoods	17.5	1.5	-0.1	3.4	0.2	12.4
Other eastern soft hardwoods	30.0	4.4	1.2	-0.6	-0.9	25.9
Other red oaks	62.5	1.9	0.9	3.1	2.5	54.0
Other white oaks	44.0	9.5	0.4	3.1	-0.1	31.1
Select red oaks	31.7	4.5	0.3	1.7	0.8	24.5
Select white oaks	70.8	-0.1	0.6	3.1	1.0	66.3
Soft maple	86.8	10.1	-0.8	0.3	3.2	74.0
Sweetgum	77.5	-0.2	2.3	3.9	4.5	67.0
Tupelo and blackgum	33.1	2.1	1.9	3.4	2.8	22.9
Yellow birch	2.5	1.5	0.0	0.0	0.0	0.9
Yellow-poplar	205.2	15.4	0.0	8.7	2.1	179.0
Total hardwoods	747.8	58.0	6.7	31.2	18.2	633.7
All species	1,450.0	74.0	15.3	56.0	155.4	1,149.3

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.26—Average annual net growth of growing-stock trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	9.2	0.5	1.3	1.6	0.7	5.1
Eastern hemlock	12.2	3.5	0.0	0.4	0.1	8.2
Eastern white and red pines	55.6	3.3	0.0	2.3	0.6	49.4
Loblolly and shortleaf pines	577.9	7.5	7.7	15.8	131.2	415.7
Longleaf and slash pines	19.8	0.7	2.8	2.9	1.9	11.4
Other eastern softwoods	0.3	0.0	-1.0	-0.3	0.0	1.7
Other yellow pines	8.9	0.0	-2.5	1.6	0.5	9.2
Spruce and balsam fir	0.9	0.5	0.0	0.1	0.0	0.3
Total softwoods	684.8	16.1	8.4	24.4	135.0	501.0
Hardwood						
Ash	9.4	-0.6	-0.2	-1.9	1.2	10.8
Basswood	3.6	0.7	0.0	0.0	0.3	2.5
Beech	9.3	0.1	0.0	0.2	0.1	8.9
Black walnut	4.7	0.0	0.0	0.0	0.1	4.6
Cottonwood and aspen	0.3	0.0	0.0	0.2	-0.4	0.6
Eastern noncommercial hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	5.9	1.8	0.0	0.2	0.0	3.9
Hickory	32.2	4.3	0.6	1.5	0.1	25.7
Other eastern hard hardwoods	17.2	1.8	0.1	3.6	0.2	11.5
Other eastern soft hardwoods	27.2	3.7	1.0	-0.2	1.0	21.7
Other red oaks	65.0	4.0	0.8	2.4	1.9	55.8
Other white oaks	41.3	9.6	0.4	2.7	-0.2	28.6
Select red oaks	34.0	5.9	0.3	1.8	0.6	25.3
Select white oaks	67.9	-0.2	0.5	3.0	0.9	63.8
Soft maple	82.4	9.2	-0.4	1.8	2.8	68.9
Sweetgum	71.2	-0.3	2.3	3.7	4.2	61.3
Tupelo and blackgum	34.4	1.9	1.7	3.0	2.7	25.1
Yellow birch	2.4	1.5	0.0	0.0	0.0	0.9
Yellow-poplar	208.5	15.2	0.0	8.5	2.5	182.3
Total hardwoods	716.6	58.6	7.1	30.4	18.1	602.5
All species	1,401.4	74.7	15.5	54.8	153.0	1,103.5

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.27—Average annual net growth of sawtimber on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million board feet[a]					
Softwood						
Cypress	55.2	3.5	8.2	9.1	4.8	29.5
Eastern hemlock	53.9	12.9	0.0	1.2	0.5	39.3
Eastern white and red pines	275.2	16.2	0.0	13.6	4.2	241.2
Loblolly and shortleaf pines	2,313.2	54.6	36.1	70.7	604.6	1,547.1
Longleaf and slash pines	95.3	4.8	16.1	12.4	6.9	55.2
Other eastern softwoods	-2.8	0.0	-4.3	-2.4	0.0	3.9
Other yellow pines	106.6	6.0	-11.0	12.3	5.0	94.4
Spruce and balsam fir	4.6	2.6	0.0	0.6	0.0	1.3
Total softwoods	2,901.1	100.6	45.1	117.5	626.0	2,011.9
Hardwood						
Ash	46.6	-0.2	0.2	-9.1	6.7	49.0
Basswood	12.2	2.3	0.0	0.0	0.7	9.2
Beech	34.2	-1.1	0.0	0.6	0.3	34.4
Black walnut	14.8	0.0	0.0	0.2	0.1	14.5
Cottonwood and aspen	4.9	0.2	0.0	1.9	-0.6	3.4
Eastern noncommercial hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	20.1	4.3	0.0	0.5	0.0	15.4
Hickory	130.3	18.2	2.4	7.1	0.7	101.9
Other eastern hard hardwoods	62.5	7.3	0.0	15.8	2.1	37.3
Other eastern soft hardwoods	88.5	13.0	2.1	0.2	3.9	69.4
Other red oaks	292.1	13.4	4.5	8.0	8.9	257.2
Other white oaks	181.9	41.6	2.6	14.9	0.1	122.8
Select red oaks	166.8	30.1	1.6	8.8	2.4	123.9
Select white oaks	323.8	4.1	3.2	11.2	2.6	302.7
Soft maple	251.6	26.0	-4.0	6.2	6.1	217.3
Sweetgum	202.1	-1.2	10.9	13.5	8.4	170.5
Tupelo and blackgum	158.8	6.7	7.9	10.8	16.5	116.9
Yellow birch	9.3	7.0	0.0	0.0	0.0	2.3
Yellow-poplar	1,017.1	83.8	0.7	48.9	10.8	872.8
Total hardwoods	3,017.5	255.6	32.0	139.4	69.6	2,520.8
All species	5,918.6	356.2	77.2	256.9	695.6	4,532.7

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] International ¼-inch rule.

Table D.28—Average annual mortality of live trees on timberland by forest-type group and stand-size class, North Carolina, 2007

Forest-type group	All size classes	Stand-size class: Saw-timber	Pole-timber	Sapling-seeding	Non-stocked
	million cubic feet				
Softwood					
White-red-jack pine	2.7	2.4	0.0	0.2	0.0
Spruce-fir	0.7	0.0	0.7	0.0	0.0
Longleaf-slash pine	1.1	0.8	0.3	0.0	0.0
Loblolly-shortleaf pine	119.1	88.1	27.6	3.4	0.0
Other eastern softwoods	0.1	0.1	0.0	0.0	0.0
Total softwoods	123.7	91.5	28.7	3.6	0.0
Hardwood					
Oak-pine	62.2	53.4	6.0	2.7	0.0
Oak-hickory	115.5	91.0	20.0	4.4	0.0
Oak-gum-cypress	82.0	68.3	11.5	2.1	0.0
Elm-ash-cottonwood	16.6	11.1	5.4	0.1	0.0
Maple-beech-birch	2.3	2.2	0.0	0.0	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0
Other hardwoods	1.3	1.1	0.2	0.0	0.0
Exotic hardwoods	0.0	0.0	0.0	0.0	0.0
Total hardwoods	279.7	227.2	43.1	9.4	0.0
Nonstocked	0.3	0.0	0.0	0.0	0.3
All groups	403.7	318.6	71.8	13.0	0.3

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.29—Average annual mortality of live trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	2.3	0.2	0.2	0.1	0.3	1.6
Eastern hemlock	0.7	0.0	0.0	0.0	0.0	0.7
Eastern white and red pines	6.5	3.4	0.0	0.1	0.0	3.1
Loblolly and shortleaf pines	95.4	3.3	1.1	4.2	13.7	73.0
Longleaf and slash pines	1.7	0.0	0.3	0.7	0.0	0.7
Other eastern softwoods	6.1	0.0	1.0	1.0	0.1	4.0
Other yellow pines	62.1	5.7	5.4	2.6	0.7	47.7
Spruce and balsam fir	0.2	0.0	0.0	0.0	0.0	0.2
Total softwoods	175.1	12.6	8.1	8.7	14.8	130.9
Hardwood						
Ash	13.3	1.1	0.4	2.4	1.2	8.2
Basswood	0.6	0.1	0.0	0.0	0.0	0.5
Beech	2.4	0.2	0.0	0.0	0.0	2.1
Black walnut	1.0	0.0	0.0	0.2	0.0	0.9
Cottonwood and aspen	1.3	0.0	0.0	0.1	0.8	0.4
Eastern noncommercial hardwoods	9.2	0.7	0.7	0.5	0.2	7.2
Hard maple	1.4	1.2	0.0	0.0	0.0	0.2
Hickory	5.2	0.7	0.0	0.0	0.0	4.4
Other eastern hard hardwoods	12.9	2.1	0.2	0.4	0.0	10.2
Other eastern soft hardwoods	19.8	1.0	1.1	2.6	0.8	14.2
Other red oaks	41.9	3.1	0.3	1.0	0.1	37.6
Other white oaks	7.3	1.6	0.1	0.0	0.2	5.3
Select red oaks	12.7	1.0	0.0	0.4	0.0	11.4
Select white oaks	8.1	2.2	0.0	0.1	0.0	5.7
Soft maple	33.4	1.4	2.8	2.8	2.4	24.0
Sweetgum	24.9	1.1	0.4	0.3	1.0	22.1
Tupelo and blackgum	9.9	0.1	1.6	0.0	1.0	7.2
Yellow birch	0.1	0.1	0.0	0.0	0.0	0.1
Yellow-poplar	23.3	0.8	0.6	0.5	0.5	20.9
Total hardwoods	228.6	18.4	8.1	11.5	8.3	182.3
All species	403.7	31.1	16.2	20.2	23.0	313.2

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.30—Average annual mortality of growing-stock trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	2.3	0.2	0.2	0.1	0.3	1.6
Eastern hemlock	0.3	0.0	0.0	0.0	0.0	0.3
Eastern white and red pines	6.5	3.3	0.0	0.1	0.0	3.0
Loblolly and shortleaf pines	93.3	3.3	1.1	4.2	13.1	71.5
Longleaf and slash pines	1.6	0.0	0.2	0.7	0.0	0.7
Other eastern softwoods	5.6	0.0	1.0	1.0	0.1	3.5
Other yellow pines	60.3	5.4	5.3	2.5	0.7	46.3
Spruce and balsam fir	0.2	0.0	0.0	0.0	0.0	0.2
Total softwoods	170.1	12.2	8.0	8.6	14.2	127.1
Hardwood						
Ash	11.3	1.1	0.4	2.4	0.5	6.9
Basswood	0.1	0.1	0.0	0.0	0.0	0.0
Beech	1.7	0.2	0.0	0.0	0.0	1.5
Black walnut	0.9	0.0	0.0	0.1	0.0	0.9
Cottonwood and aspen	1.2	0.0	0.0	0.1	0.8	0.4
Eastern noncommercial hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	0.4	0.3	0.0	0.0	0.0	0.1
Hickory	4.6	0.5	0.0	0.0	0.0	4.0
Other eastern hard hardwoods	8.2	1.7	0.0	0.0	0.0	6.5
Other eastern soft hardwoods	13.4	0.9	0.5	1.7	0.5	9.7
Other red oaks	33.2	2.5	0.3	1.0	0.1	29.3
Other white oaks	5.8	1.5	0.0	0.0	0.2	4.0
Select red oaks	12.0	0.9	0.0	0.4	0.0	10.6
Select white oaks	6.9	2.1	0.0	0.1	0.0	4.6
Soft maple	20.1	1.1	1.8	2.2	1.7	13.4
Sweetgum	22.1	1.1	0.1	0.3	1.0	19.5
Tupelo and blackgum	6.9	0.1	1.5	0.0	1.0	4.3
Yellow birch	0.1	0.1	0.0	0.0	0.0	0.0
Yellow-poplar	18.8	0.7	0.6	0.4	0.1	17.0
Total hardwoods	167.5	14.9	5.3	8.9	5.8	132.7
All species	337.6	27.1	13.2	17.5	20.0	259.8

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.31—Average annual mortality of sawtimber on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million board feet[a]					
Softwood						
Cypress	9.8	0.7	1.0	0.0	0.8	7.4
Eastern hemlock	1.3	0.0	0.0	0.0	0.0	1.3
Eastern white and red pines	35.2	20.5	0.0	0.3	0.0	14.5
Loblolly and shortleaf pines	325.6	9.4	5.2	18.7	39.1	253.1
Longleaf and slash pines	6.3	0.0	0.7	3.2	0.0	2.3
Other eastern softwoods	19.9	0.0	4.9	4.7	0.0	10.4
Other yellow pines	195.5	20.0	22.0	8.8	1.6	143.1
Spruce and balsam fir	0.8	0.0	0.0	0.0	0.0	0.8
Total softwoods	594.4	50.6	33.8	35.6	41.5	432.9
Hardwood						
Ash	43.7	2.1	0.9	12.9	1.1	26.6
Basswood	0.4	0.4	0.0	0.0	0.0	0.0
Beech	5.0	0.7	0.0	0.0	0.0	4.3
Black walnut	2.7	0.0	0.0	0.0	0.0	2.7
Cottonwood and aspen	3.6	0.0	0.0	0.0	2.2	1.4
Eastern noncommercial hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	1.0	1.0	0.0	0.0	0.0	0.0
Hickory	13.6	1.9	0.0	0.2	0.0	11.5
Other eastern hard hardwoods	10.1	1.1	0.0	0.0	0.0	9.0
Other eastern soft hardwoods	32.8	1.2	0.8	4.6	1.3	24.9
Other red oaks	126.1	8.6	0.4	4.6	0.0	112.5
Other white oaks	22.0	6.5	0.0	0.0	0.8	14.8
Select red oaks	48.2	2.2	0.0	1.7	0.0	44.3
Select white oaks	22.6	10.3	0.0	0.0	0.0	12.4
Soft maple	47.7	1.6	5.6	6.8	5.8	27.9
Sweetgum	77.9	4.6	0.0	0.9	2.0	70.4
Tupelo and blackgum	17.7	0.0	5.9	0.0	3.3	8.5
Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	70.0	1.6	2.2	1.0	0.0	65.2
Total hardwoods	545.1	43.8	15.9	32.6	16.4	436.5
All species	1,139.5	94.4	49.7	68.2	57.8	869.4

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] International ¼-inch rule.

Table D.32—Average annual removals of live trees on timberland by forest-type group and stand-size class, North Carolina, 2007

Forest-type group	All size classes	Stand-size class: Saw-timber	Pole-timber	Sapling-seeding	Non-stocked
	million cubic feet				
Softwood					
White-red-jack pine	14.4	14.0	0.0	0.4	0.0
Spruce-fir	0.1	0.1	0.0	0.0	0.0
Longleaf-slash pine	13.1	9.6	3.1	0.4	0.0
Loblolly-shortleaf pine	525.4	393.2	129.5	2.7	0.0
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0
Total softwoods	553.0	416.9	132.6	3.5	0.0
Hardwood					
Oak-pine	130.6	93.1	32.0	5.6	0.0
Oak-hickory	359.4	293.0	58.7	7.7	0.0
Oak-gum-cypress	91.8	74.6	16.2	1.0	0.0
Elm-ash-cottonwood	8.5	2.4	6.1	0.0	0.0
Maple-beech-birch	0.0	0.0	0.0	0.0	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0
Other hardwoods	2.8	0.0	2.1	0.7	0.0
Exotic hardwoods	0.0	0.0	0.0	0.0	0.0
Total hardwoods	593.2	463.1	114.9	15.1	0.0
Nonstocked	0.5	0.0	0.0	0.0	0.5
All groups	1,146.6	880.0	247.5	18.6	0.5

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.33—Average annual removals of live trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	9.8	0.0	0.0	0.0	3.8	6.0
Eastern hemlock	1.6	0.2	0.0	0.0	0.0	1.4
Eastern white and red pines	15.2	0.0	0.0	2.1	0.0	13.0
Loblolly and shortleaf pines	501.3	0.0	0.4	6.1	105.4	389.4
Longleaf and slash pines	15.7	0.0	0.3	0.0	8.0	7.4
Other eastern softwoods	2.7	0.0	0.0	0.1	0.0	2.6
Other yellow pines	67.2	0.0	0.0	1.7	3.5	62.0
Spruce and balsam fir	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	613.5	0.3	0.6	10.0	120.7	481.9
Hardwood						
Ash	6.5	0.0	0.0	0.1	1.6	4.8
Basswood	0.0	0.0	0.0	0.0	0.0	0.0
Beech	6.6	0.0	0.0	0.1	0.0	6.6
Black walnut	1.1	0.0	0.0	0.0	0.0	1.1
Cottonwood and aspen	0.0	0.0	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	7.2	0.0	0.0	0.2	0.1	6.9
Hard maple	2.2	0.0	0.0	0.0	0.0	2.2
Hickory	13.5	0.1	0.0	0.0	0.5	12.9
Other eastern hard hardwoods	8.6	0.1	0.0	0.1	0.0	8.4
Other eastern soft hardwoods	18.6	0.2	0.2	0.8	4.1	13.2
Other red oaks	77.8	0.0	0.1	0.3	3.1	74.3
Other white oaks	20.4	0.0	0.0	0.0	0.0	20.3
Select red oaks	20.6	0.7	0.0	0.0	0.1	19.8
Select white oaks	56.6	0.0	0.0	0.0	1.0	55.5
Soft maple	65.2	0.0	0.0	0.4	4.5	60.2
Sweetgum	91.9	0.0	0.0	1.1	2.7	88.2
Tupelo and blackgum	27.6	0.0	0.0	0.1	8.3	19.3
Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	108.6	0.0	0.0	0.0	0.9	107.7
Total hardwoods	533.1	1.1	0.4	3.3	27.0	501.3
All species	1,146.6	1.4	1.0	13.3	147.7	983.3

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.34—Average annual removals of growing-stock trees on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Cypress	9.4	0.0	0.0	0.0	3.8	5.7
Eastern hemlock	1.6	0.2	0.0	0.0	0.0	1.3
Eastern white and red pines	14.9	0.0	0.0	2.1	0.0	12.8
Loblolly and shortleaf pines	493.5	0.0	0.4	6.0	102.9	384.2
Longleaf and slash pines	15.7	0.0	0.3	0.0	8.0	7.4
Other eastern softwoods	2.0	0.0	0.0	0.0	0.0	2.0
Other yellow pines	64.4	0.0	0.0	1.5	3.4	59.4
Spruce and balsam fir	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	601.4	0.3	0.6	9.6	118.1	472.9
Hardwood						
Ash	6.1	0.0	0.0	0.1	1.6	4.4
Basswood	0.0	0.0	0.0	0.0	0.0	0.0
Beech	4.0	0.0	0.0	0.1	0.0	3.9
Black walnut	0.7	0.0	0.0	0.0	0.0	0.7
Cottonwood and aspen	0.0	0.0	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	1.4	0.0	0.0	0.0	0.0	1.4
Hickory	12.6	0.1	0.0	0.0	0.5	12.1
Other eastern hard hardwoods	6.0	0.1	0.0	0.0	0.0	6.0
Other eastern soft hardwoods	16.1	0.1	0.0	0.5	4.1	11.4
Other red oaks	71.7	0.0	0.1	0.3	2.7	68.6
Other white oaks	19.2	0.0	0.0	0.0	0.0	19.1
Select red oaks	20.1	0.7	0.0	0.0	0.1	19.2
Select white oaks	49.9	0.0	0.0	0.0	1.0	48.9
Soft maple	48.1	0.0	0.0	0.2	2.0	45.9
Sweetgum	85.2	0.0	0.0	1.1	2.5	81.7
Tupelo and blackgum	26.1	0.0	0.0	0.1	8.0	18.0
Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	107.7	0.0	0.0	0.0	0.9	106.8
Total hardwoods	475.1	1.1	0.1	2.5	23.3	448.0
All species	1,076.5	1.4	0.7	12.1	141.4	920.9

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

Table D.35—Average annual removals of sawtimber on timberland by species group and ownership group, North Carolina, 2007

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million board feet[a]					
Softwood						
Cypress	45.7	0.0	0.0	0.0	20.0	25.8
Eastern hemlock	7.3	0.8	0.0	0.0	0.0	6.4
Eastern white and red pines	78.7	0.0	0.0	8.5	0.0	70.3
Loblolly and shortleaf pines	1,938.8	0.0	0.7	20.6	364.3	1,553.2
Longleaf and slash pines	63.5	0.0	1.4	0.0	36.1	25.9
Other eastern softwoods	2.8	0.0	0.0	0.0	0.0	2.8
Other yellow pines	232.4	0.0	0.0	6.0	12.5	213.8
Spruce and balsam fir	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	2,369.2	0.8	2.1	35.1	433.0	1,898.3
Hardwood						
Ash	16.9	0.0	0.0	0.0	8.7	8.2
Basswood	0.0	0.0	0.0	0.0	0.0	0.0
Beech	8.5	0.0	0.0	0.0	0.0	8.5
Black walnut	1.3	0.0	0.0	0.0	0.0	1.3
Cottonwood and aspen	0.0	0.0	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	4.1	0.0	0.0	0.0	0.0	4.1
Hickory	38.1	0.0	0.0	0.0	0.9	37.2
Other eastern hard hardwoods	6.2	0.0	0.0	0.0	0.0	6.2
Other eastern soft hardwoods	27.7	0.0	0.0	0.0	3.0	24.6
Other red oaks	265.5	0.0	0.0	0.4	5.8	259.2
Other white oaks	66.5	0.0	0.0	0.0	0.0	66.5
Select red oaks	85.0	3.0	0.0	0.0	0.0	82.0
Select white oaks	178.9	0.0	0.0	0.0	1.3	177.6
Soft maple	120.6	0.0	0.0	0.0	4.5	116.1
Sweetgum	269.3	0.0	0.0	0.0	2.8	266.6
Tupelo and blackgum	77.9	0.0	0.0	0.0	25.5	52.4
Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	481.6	0.0	0.0	0.0	2.6	479.0
Total hardwoods	1,648.2	3.0	0.0	0.4	55.2	1,589.6
All species	4,017.4	3.8	2.1	35.5	488.1	3,487.9

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

0.0 = no sample for the cell or a value of >0.0 but <0.05.

[a] International ¼-inch rule.

Brown, Mark J.; New, Barry D.; Johnson, Tony G.; Chamberlain, James L. 2014. North Carolina's forests, 2007. Resour. Bull. SRS–199. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 112 p.

The principal findings of the eighth forest survey of North Carolina are presented. In 2007, forests covered 18.6 million acres of the State, of which 18.1 million were classified as timberland. Oak-hickory was the most common forest-type group and covered 7.3 million acres of the timberland. The second most common forest-type group was loblolly-shortleaf pine, which covered 5.3 million acres of timberland. Nonindustrial private forest ownerships controlled 78 percent of the State's timberland. Hardwood tree species accounted for 65 percent of the all-live wood volume that occurred on the State's timberland. Total net growth of all-live trees on timberland averaged 1.5 billion cubic feet and removals averaged >1.1 billion cubic feet.

Keywords: FIA, forest health, forest ownership, timber growth, timber product output, timber removals, timber volume, timberland.

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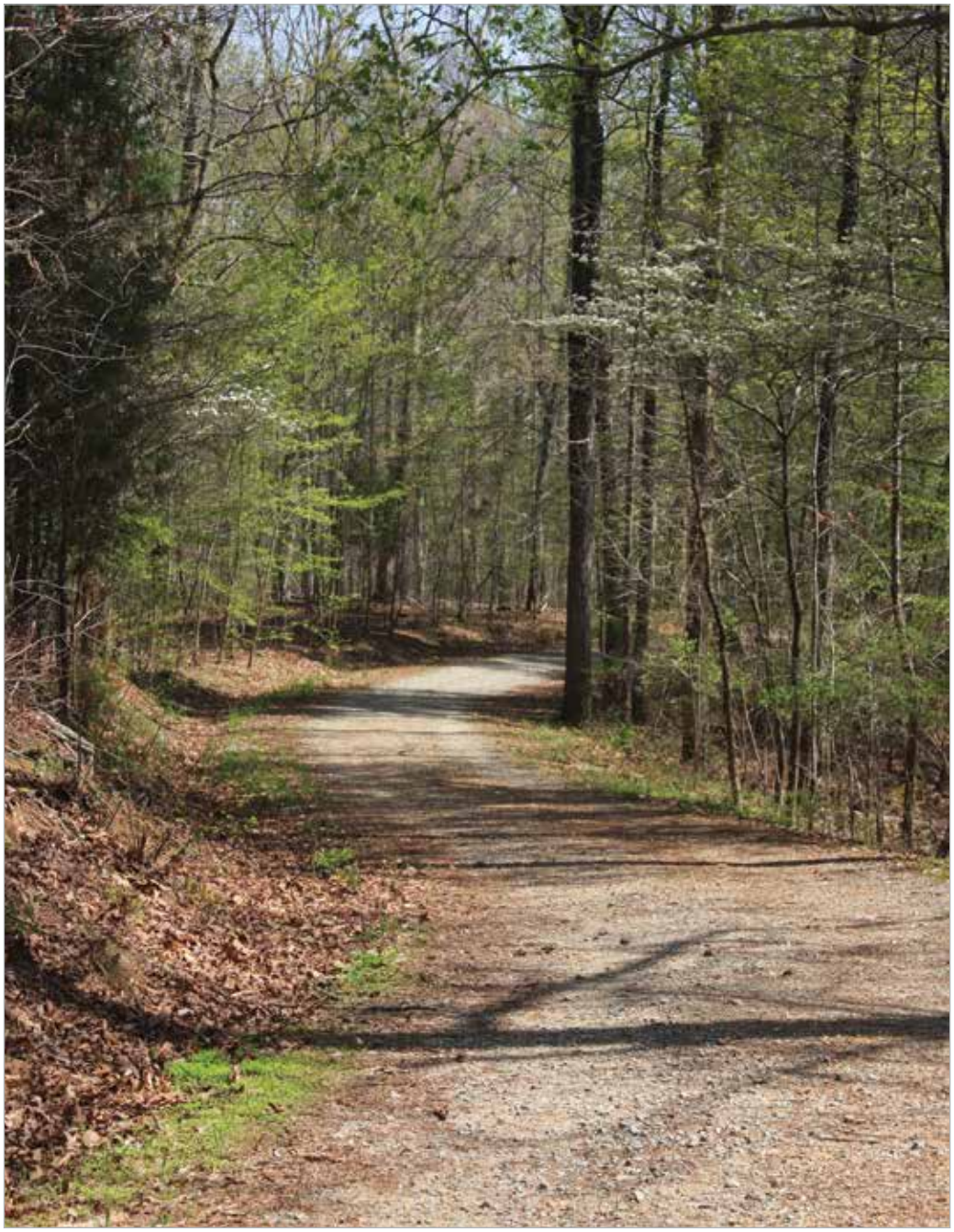

Concrete Bridge Road in the spring, Duke Forest, Durham, NC. (photo courtesy of Wikimedia.org)

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