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South Carolina's Forests, 2021



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Cover photo: South Carolina State Tree, Sabal Palm.
(Courtesy photo by Michelle Johnson, [SCFC])

Following page photo: Lake Jocassee, South Carolina,
fall colors . (Courtesy photo by Michelle Johnson, [SCFC])

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FOREWORD

Each year, the U.S. Department of Agriculture, Forest Service, Southern Research Station's (SRS) Forest Inventory and Analysis (FIA) research work unit and State forestry agencies conduct forest inventories of resources in the U.S. Virgin Islands, the Commonwealth of Puerto Rico, and the 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia). All research stations and the corresponding FIA work units perform annual surveys using an accepted sampling strategy to provide nationally uniform information on America's forest resources. These surveys are mandated by law through the Agricultural Research Extension and Education Reform Act of 1998 (Farm Bill) (AREERA 1998).

The primary objective in conducting these inventories is to collect the multiresource data required to create economic development plans, forest policies, forest programs, and a scientific foundation for monitoring forest ecosystems. The inventory data are used to provide an overview of the forest resources, that may include, but are not limited to, forest size, ownership, type, stand structure, volume of timber, growth, removals, mortality, management activities, biomass carbon sequestration and storage, invasive species, Timber Product Output, and down woody material. Although the data is meant to depict resource circumstances at larger scales such as the unit and State levels rather than at a lesser scale (county), it does set the stage for more thorough explorations of important scenarios.

The data is statistically applicable at the State and survey unit levels. Furthermore, FIA reprocesses its data when necessary, which may account for various attributes (volume, biomass, carbon, etc.) that show variations from FIADB results.

More information about Forest Service resource inventories is available in *Forest Resource Inventories: An Overview* (USDA Forest Service 1992). More detailed information about sampling methodologies used in the annual FIA inventories can be found in *The Enhanced Forest Inventory and Analysis Program—National Sampling Design and Estimation Procedures* (Bechtold and Patterson 2005) and *Sampling and Estimation Documentation for the Enhanced Forest Inventory and Analysis Program: 2022* (Westfall et al. 2022).

Data tables included in FIA reports are designed to provide an array of forest resource estimates, but additional information about the FIA program can be obtained at the Southern Forest Inventory and Analysis (4801) website (USDA Forest Service 2024). Additional information about any aspect of this survey may be obtained from:

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South Carolina FIA field crew, 2021. (Courtesy photo by Michelle Johnson [SCFC])

CONTENTS

FOREWORD	.ii
ACKNOWLEDGMENTS	.iii
HIGHLIGHTS	.1
INTRODUCTION	.3
A Brief Description and Overview of South Carolina Forests and Other Resources by Unit	.3
Unit 1 (Southern Coastal Plain)	.4
Unit 2 (Northern Coastal Plain)	.6
Unit 3 (Piedmont)	.8
AREA	.9
Forest Ownership, Forest Types, Stand Age and Stand Size	.9
Forest ownership	.13
Forest types	.14
Stand-age and stand-size class	.15
Forests and Land-Use Change	.16
Trends in Pine Forest Stand Origins and Age Class Distribution	.17
NUMBER OF TREES, VOLUME, AND BIOMASS	.20
GROWTH, REMOVALS, AND MORTALITY	.25
Growth, Removals, and Mortality by Stand Origin and Species Group Composition	.28
Treated Acres	.31
DISTURBANCE AND FOREST HEALTH INDICATORS	.31
Disturbance	.31
Standing Dead Trees, Down Woody Materials, Forest Duff and Litter	.32
Carbon	.36
Nonnative Invasive Plants	.39

TIMBER PRODUCT OUTPUT AND UTILIZATION	39
Timber Products	39
Mill Residue	43
Land-Use Removals	47
Logging Residue	47
LITERATURE CITED	50
GLOSSARY	52
APPENDIX 1—INVENTORY METHODS	66
Phase 1	67
Phase 2	67
Phase 2+	68
Summary	68
Literature Cited	68
APPENDIX 2—DATA RELIABILITY	69
Measurement Error	69
Sampling Error	69
Literature Cited	70
APPENDIX 3—SUPPLEMENTAL TABLES	71

LIST OF FIGURES

Figure 1 —Forest types by county in South Carolina, 2021	3
Figure 2 —Major rivers and trails in South Carolina, 2021	4
Figure 3 —Land use, Unit 1, South Carolina, 2021	5
Figure 4 —Land use, Unit 2, South Carolina, 2021	6
Figure 5 —Land use, Unit 3, South Carolina, 2021	8
Figure 6 —Counties and forest survey units, South Carolina, 2021	12
Figure 7 —Percentage of county in forest land, South Carolina, 2021	12
Figure 8 —Forest land area by survey unit, South Carolina, 2021	12
Figure 9 —Percent of forest land area by year and ownership class, South Carolina, 2011–2021	13
Figure 10 —Percentage of forest land area by forest-type group, South Carolina, 2021	14
Figure 11 —Distribution of forest land area by stand-age class, South Carolina, 2001–2021	15
Figure 12 —Distribution of forest land area by stand-size class, South Carolina, 2001–2021	15
Figure 13 —Annualized land-use change by area and inventory year, South Carolina, 2006–2021	16
Figure 14 —Natural and artificially regenerated softwood timberland by sampling method and inventory year, South Carolina, 1968–2001 and 2001–2021	18
Figure 15 —Natural and artificially regenerated softwood timberland area by stand origin and inventory year, South Carolina, 2001–2021	19
Figure 16 —Planted pine timberland area distribution by survey unit and stand age, South Carolina, 2001–2021	20
Figure 17 —Net volume of live trees on timberland by major species group, South Carolina, 2001–2021	22
Figure 18 —Net volume of growing-stock trees on timberland by ownership group, South Carolina, 2021	24
Figure 19 —Net softwood volume by diameter class, South Carolina, 2001–2021	24
Figure 20 —Net hardwood volume by diameter class, South Carolina, 2001–2021	25
Figure 21 —Average annual volume of net growth, removals, and mortality by species group (major), on forest land by survey year, South Carolina, 2011–2021	25
Figure 22 —Average annual volume of net growth by species group and stand-size class, South Carolina, 2011–2021	26
Figure 23 —Average annual volume of net removals by stand-size class and species group, South Carolina, 2011–2021	26

Figure 24 —Average annual volume of net mortality by inventory cycle and species group, South Carolina, 2011–2021	27
Figure 25 —Average annual hardwood net growth, removals, mortality by tree-size class and inventory year, South Carolina, 2011–2021	28
Figure 26 —Average annual softwood net growth, removals, mortality by tree-size class and inventory year, South Carolina, 2011–2021	28
Figure 27 —Average annual forest land acreage affected by cutting activity, South Carolina, 2011–2021 . . .	31
Figure 28 —Total carbon, in short tons, by forest-type group, on forest land, South Carolina, 2021	36
Figure 29 —Timber product output primary mill map, South Carolina, 2021	40
Figure 30 —Timber product output, primary mill residue volume by roundwood and residue type, South Carolina, 2017–2021	44
Figure A1.1 —National and regional fixed-plot design, 2021	66
Figure A1.2 —National Forest Inventory and Analysis regions.. . . .	67

LIST OF TABLES

Table 1 —Total land and water area in South Carolina by land use and survey year	10
Table 2 —Area by survey unit and land status, South Carolina, 2021	11
Table 3 —Area of softwood stands by ownership group and stand origin on timberland in South Carolina, 2021	18
Table 4 —Number of live trees (d.b.h. ≥ 1 inch), net volume (trees with d.b.h. ≥ 5 inches), and aboveground green weight (d.b.h. ≥ 1 inch) on forest land by species group, South Carolina, 2021	21
Table 5 —Net merchantable bole volume of live trees on forest land by species group and stand origin, South Carolina, 2021	23
Table 6 —Net volume in the saw-log portion of sawtimber trees, in cubic feet, on timberland, South Carolina, 2001–2021	25
Table 7 —Average annual removals of live trees on forest land by speciesgroup and stand origin, South Carolina, 2021	29
Table 8 —Net average annual growth of live trees on forest land by species group and stand origin, South Carolina, 2021	30
Table 9 —Area of forest land disturbed annually by forest-type group and disturbance class, South Carolina, 2021	32
Table 10 —Number of standing dead trees on forest land by forest-type group and diameter class, South Carolina, 2021	33
Table 11 —Total carbon in DWM (FWD, CWD, and piles) in short tons by survey unit and stand origin on forest land, South Carolina, 2021	34
Table 12 —Total volume of DWM (FWD, CWD, and piles) in cubic feet, on forest land by forest ownership class and survey unit, South Carolina, 2021	34
Table 13 —Total volume of DWM (FWD, CWD, and piles) in cubic feet, on forest land by ownership class and survey unit, South Carolina, 2021	35
Table 14 —Total softwood volume of DWM (FWD, CWD, and piles) in cubic feet, on forest land by ownership class and survey unit, South Carolina, 2021	36
Table 15 —Total carbon in short tons on forest land by forest-type group and survey unit, South Carolina, 2021	37
Table 16 —Area of forest land and timberland per invasive species, South Carolina, 2021	39
Table 17 —Output of industrial roundwood products by product, species group, and year, South Carolina, 2017–2021	42
Table 18 —Primary mill residue volume by roundwood type, species group, and residue type, South Carolina, 2017–2021	45

Table 19 —Disposal of residue at primary wood-using plants by product, species group, and type of residue, South Carolina, 2017–2021	46
Table 20 —Volume of timber removals by year, species group, removals class, and source, South Carolina, 2017–2021	48
Table A3.1 —Area of forest land by ownership class and land status, South Carolina, 2021	71
Table A3.2 —Area of forest land by forest-type group and ownership group, South Carolina, 2021	72
Table A3.3 —Area of forest land by forest-type group and stand-size class, South Carolina, 2021	73
Table A3.4 —Area of forest land by forest-type group and stand origin, South Carolina, 2021	74
Table A3.5 —Area of forest land disturbed annually by forest-type group and disturbance class, South Carolina, 2021	75
Table A3.6 —Area of forest land treated annually by forest-type group and treatment class (cutting), South Carolina, 2021	76
Table A3.7 —Number of live trees on forest land by species group and diameter class, South Carolina, 2021	77
Table A3.8 —Net volume of live trees on forest land by ownership class and land status, South Carolina, 2021	78
Table A3.9 —Net volume of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021	79
Table A3.10 —Net volume of live trees on forest land by species group and ownership group, South Carolina, 2021	80
Table A3.11 —Net volume of live trees on forest land by species group and diameter class, South Carolina, 2021	81
Table A3.12 —Net volume of live trees on forest land by forest-type group and stand origin, South Carolina, 2021	82
Table A3.13 —Aboveground dry weight of live trees on forest land by ownership class and land status, South Carolina, 2021	83
Table A3.14 —Total carbon of live trees on forest land by ownership class and land status, South Carolina, 2021	84
Table A3.15 —Average annual net growth of live trees by ownership class and land status, South Carolina, 2021	85
Table A3.16 —Average annual net growth of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021	86
Table A3.17 —Average annual net growth of live trees on forest land by species group and ownership group, South Carolina, 2021	87
Table A3.18 —Average annual mortality of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021	88

Table A3.19 —Average annual mortality of live trees on timberland by species group and ownership group, South Carolina, 2021	89
Table A3.20 —Average annual net removals of live trees by ownership class and land status, South Carolina, 2021	90
Table A3.21 —Average annual removals of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021	91
Table A3.22 —Average annual removals of live trees on forest land by species group and ownership group, South Carolina, 2021	92
Table A3.23 —List of tree species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021	93
Table A3.24 —List of seedling species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021	95

HIGHLIGHTS

- In 2021, there were 12.8 million acres (66 percent) of the State's entire area (19.3 million acres) covered by forests in South Carolina. The amount of forest land in South Carolina has stayed relatively stable for the last 30 years.
- The most notable change in ownership has primarily been forest industry's acquisition of timberland acres from nonindustrial corporate entities. In 2016, forest industry owned 227,800 acres in South Carolina, and by 2021 it has more than doubled to 462,000 acres.
- The average annual number of agricultural acres reverting to forest land was 19,559, a notable decrease from previous years. Conversely, the trend of forest land being cleared for agriculture surpassed the reversion of forest land in 2014. This figure remained relatively stable in 2021, with an average of 19,018 acres being cleared annually. The amount of developed land reverting to forest has seen a slight increase, reaching a low of 10,142 acres in 2018 but rising to an annual average of 13,140 acres in 2021.
- Loblolly-shortleaf pine (*Pinus taeda-echinata*) was the State's predominant forest type group in 2021, accounting for over 43 percent of all forests. Oak-hickory (*Quercus-Carya*) was the second most recorded forest type, representing over one-fifth (21 percent) of the forest land base. Oak-gum-cypress (*Q.-nyssa-taxoidum*), oak-pine (*Q. palustris*), longleaf-slash pine (*Pinus palustris-elliottii*), and elm-ash-cottonwood (*Ulmus-Fraxinus-Populus*), accounted for 14 percent, 12 percent, 5 percent, and 3 percent, respectively.
- There were an estimated 720 million oven-dry tons of aboveground live-tree biomass in 2021. Volume of all-live trees with a diameter at breast height (d.b.h.) ≥ 5 inches on forest land in 2021 was slightly under 28 billion cubic feet.
- Loblolly pine (*Pinus taeda*) was the State's most prevalent tree species in 2021, accounting for 47 percent of all-live trees with a diameter of at least 5 inches and 46 percent of total volume. Sweetgum (*Liquidambar styraciflua*) was second accounting for 9 percent of total volume and 20 percent of all trees.
- Over 53.2 percent of the State's volume in 2021 was found in softwoods and 46.7 percent in hardwoods. The majority of the standing volume for both softwoods and hardwoods was in the large diameter stand-size class, which trended upwards during the 2006–2021 period. Overall, the volume of medium diameter stand-size class decreased slightly for all species, in contrast to small diameter stand-size volume which trended slightly downwards until 2016, but increased slightly upwards in 2021.
- During the 2006–2021 period, softwood annual net growth and removals trended upwards, with 2021 values over 25 percent higher than 2006 estimates. In contrast, estimates of annual net growth and removals for hardwoods were close to 8 percent lower in 2021, compared to 2006. Overall, annual mortality of trees at least 5 inches d.b.h. and diameter at root collar decreased in softwoods and increased in hardwoods. Possible causes of the hardwood mortality increase were disturbances such as weather (hurricanes), fire, or insect damage such as the emerald ash borer (*Agrilus planipennis*) which decimated ash trees in the South.
- Growth to removals ratio, a measure used to assess resource sustainability, remained stable during the 2016–2021 period with an average rate of 1.4 in softwoods and 1.6 in hardwoods, indicating annual growth surpassed removals by approximately 40 percent in softwoods and 60 percent in hardwoods.

- South Carolina's forests held an average of 2.4 green tons of biomass per acre of down woody materials in 2021. A total of 68.0 million tons of carbon are stored in down woody materials and another 144.6 million tons on the forest floor in the form of duff and litter.
- Fire was the most frequently recorded disturbance on forest land in South Carolina, affecting an estimated 828,259 acres (165,652 annually) of forest land from 2016–2021. South Carolina had an extensive fire season in 2016. Weather, followed by disease, affected 107,306 acres and 40,141 acres annually, respectively.
- Chinaberry (*Melia azedarach*), Chinese tallow (*Triadica sebifera*), Chinese/European privets (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*), Nepalese browntop (*Microstegium vimineum*), and Chinese or sericea lespedeza (*Lespedeza cuneata*) were the most commonly encountered nonnative invasive plants on forested plots.
- A diverse forest products industry in South Carolina is made up of a variety of mills, ranging from small to large-sized softwood and hardwood sawmills, pole, veneer, composite, bioenergy and other miscellaneous mills to very large pulp mills. In 2017, there were 98 primary wood using mills, 101 in 2018, 98 in 2019, 87 in 2020, and 84 in 2021. Since 2017, the total number of sawmills, pulpwood mills, and other primary wood-processing plants distributed across the State has decreased moderately.

INTRODUCTION

This resource bulletin provides an overview of South Carolina's forest resources based on an inventory carried out by the South Carolina Forestry Commission and the U.S. Department of Agriculture, Forest Service, Southern Research Station's (SRS) Forest Inventory and Analysis (FIA) program. Under the annual forest inventory and monitoring system of the FIA program, this publication is the fifth 5-year resource bulletin that estimates the State's forest resources. FIA has been implementing tree inventories for over 90 years. Information about each State's forest resource, including plot location (internal only), species composition, volume, and distribution was provided by these inventories. Forest industry was a major contributor to the development of this effort which at that time used a variable radius sampling plot. Since the late 1990s, the emphasis has shifted to a methodology to develop a more comprehensive, annual inventory using a fixed-radius plot (see app. 1). Prior to employing FIA data for long-term analysis, it is important to know the limitations of the data in doing trend analyses.

The data estimates presented in this report come from 3,676 FIA sampling points across the State of South Carolina that were surveyed from 2016 to 2021. Of those sampling points, 2,684 were forested and had a FIA forest inventory and monitoring plot. The remaining 992 points were not forested or not sampled (958 nonforest, 34 nonsampled), and the only data collected was land use. The data used in this publication were accessed from the FIA database from July 2023 to January 2024 unless otherwise indicated (USDA Forest Service 2024).

This resource bulletin highlights the stability of forest land and timberland acreage, along with the growing maturity (age) of the trees and stands within it. Although there was a decrease in acreage from 2011 to 2021 documented in this publication and in previous publications (Rose 2015a, Rose 2015b, Brandeis et al. 2016), net volume on both forest land and timberland have

been increasing. Forest stands are comprised of older, larger trees. Even with a slight drop in the total forest land acreage, stands are more fully stocked in terms of volume, as also shown in Rose (2015b). Net tree growth and mortality in terms of their volume has increased and removals from both harvesting and land clearing to nonforest land uses have shown fluctuations likely related to varying economic conditions similar to the recent recession in the late 2000s (Brandeis et al. 2018; Harper and Rominger 2013; Rose 2015a, Rose 2015b).

A Brief Description and Overview of South Carolina Forests and Other Resources by Unit

The FIA program divides States into survey units and broad physiographic and political groupings of counties. The State of South Carolina has three units: Unit 1 (Southern Coastal Plain), Unit 2 (Northern Coastal Plain), and Unit 3 (Piedmont). An overview of the State's forests and other resources is presented below, followed by a detailed description by survey unit.

South Carolina has nearly 200 miles of oceanfront, as shown in figure 1. Beyond a narrow strip of beach along most of the coast are fingers of wetlands that go farther inland along the rivers. There are stretches of development throughout the sea islands coast, particularly near Charleston and Myrtle Beach, SC. Beyond this coastal

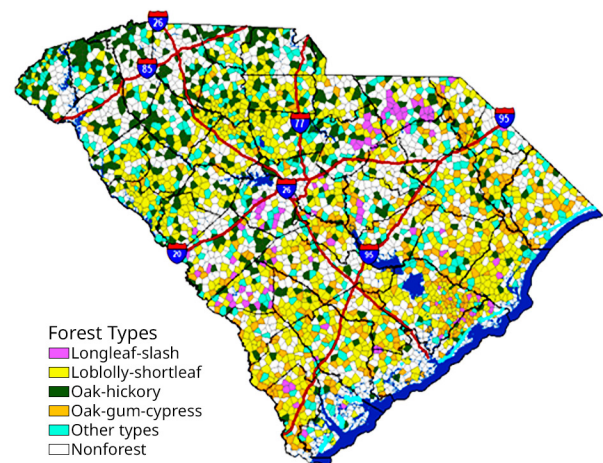


Figure 1—Forest types by county in South Carolina, 2021.

development, lying east of Interstate 95, is a band of forest that is predominately the loblolly-shortleaf pine (*Pinus taeda*–*P. echinata*) forest-type group, although elm-ash-cottonwood (*Ulmus*–*Fraxinus*–*Populus*) appears along rivers, especially the Great Pee Dee River. Oak-pine (*Quercus Pinus*) forest stands are peppered throughout the State.

Beyond that forest is a band of agricultural land. Reaching Interstate 20, we encounter more development, including the cities of Florence and Columbia, SC and the bedroom communities of Augusta, GA. Development thins north of Interstate 20 and the landscape is once again forest. Loblolly-shortleaf is the dominant forest type group again, but there is a pocket of longleaf-slash pine (*Pinus palustris*–*elliottii*) around the Carolina Sandhills (fig. 1). To the northwest, the forest transitions to oak-hickory (*Quercus*–*Carya*) before the Interstate 85 corridor, which is heavily developed around the cities of Greenville and Spartanburg, SC (fig. 1).

Forest resumes north of the I-85 corridor and oak-hickory forest types are again dominant. This part of the State's topography is dominated by an escarpment with its long, steep increase in elevation. The city of Gaffney, SC located on Interstate 85 is the peach capital of South Carolina and Westminster, further up the escarpment, hosts the South Carolina apple festival.

Figure 2 shows two major hiking trails crossing the State: the East Coast Greenway and Palmetto

Trail. The East Coast Greenway enters the State near Little River and crosses through Myrtle Beach, Charleston, several of the Sea Islands, and exits the State at the Savannah National Wildlife Refuge. The Palmetto Trail begins at the Stumphouse Passage in the northwestern part of the State and winds its way by many of the State's points of interest. The two trails join just north of Bulls Bay, SC.

Like the Palmetto Trail, most of the State's rivers flow from the northwest. The longest flowline of any one named river is the Savannah River, followed by the Lynches River. The Broad River and Saluda River join at Columbia, SC to form the Congaree River which flows into Lake Marion, SC and the Santee River flows out of Lake Marion to the sea. The Enoree River and Wateree River flow into this system as well. Other major rivers include the Great Pee Dee River, Little Pee Dee River, and the Black River. The Pee Dee River is named after the Pee Dee Native American tribe.

Unit 1 (Southern Coastal Plain)

The Southern Coastal Plain is in the southeastern part of the State (fig. 3). The southernmost point of land is Jones Island, on the banks of the Savannah River. The Sea Islands are stepping stones along the shore, some with famous names like Hilton Head Island, Parris Island, and Pinckney Island. Wetlands are the primary land cover. The area also hosts an important tourism industry and military community.

The East Coast Greenway enters the State at the Savannah National Wildlife Refuge. Spanish moss (*Tillandsia usneoides*) hangs from the trees along the trail, especially near Parris Island, SC. This section of the trail is called the "Spanish Moss Trail." The ACE Basin is named after the Ashepoo, Combahee, and Edisto Rivers. The Edisto River marks the boundary of Unit 1 (Southern Coastal Plain) at the southern end. To the north is Dorchester County and the boundary goes to the east.

Approaching Interstate 26 and bedroom communities of Charleston going northwest,

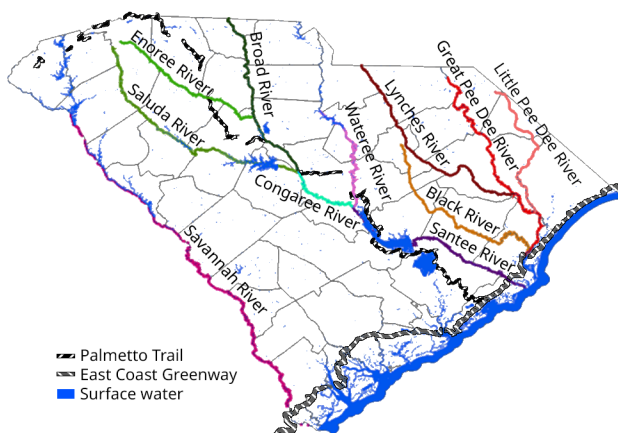


Figure 2—Major rivers and trails in South Carolina, 2021.

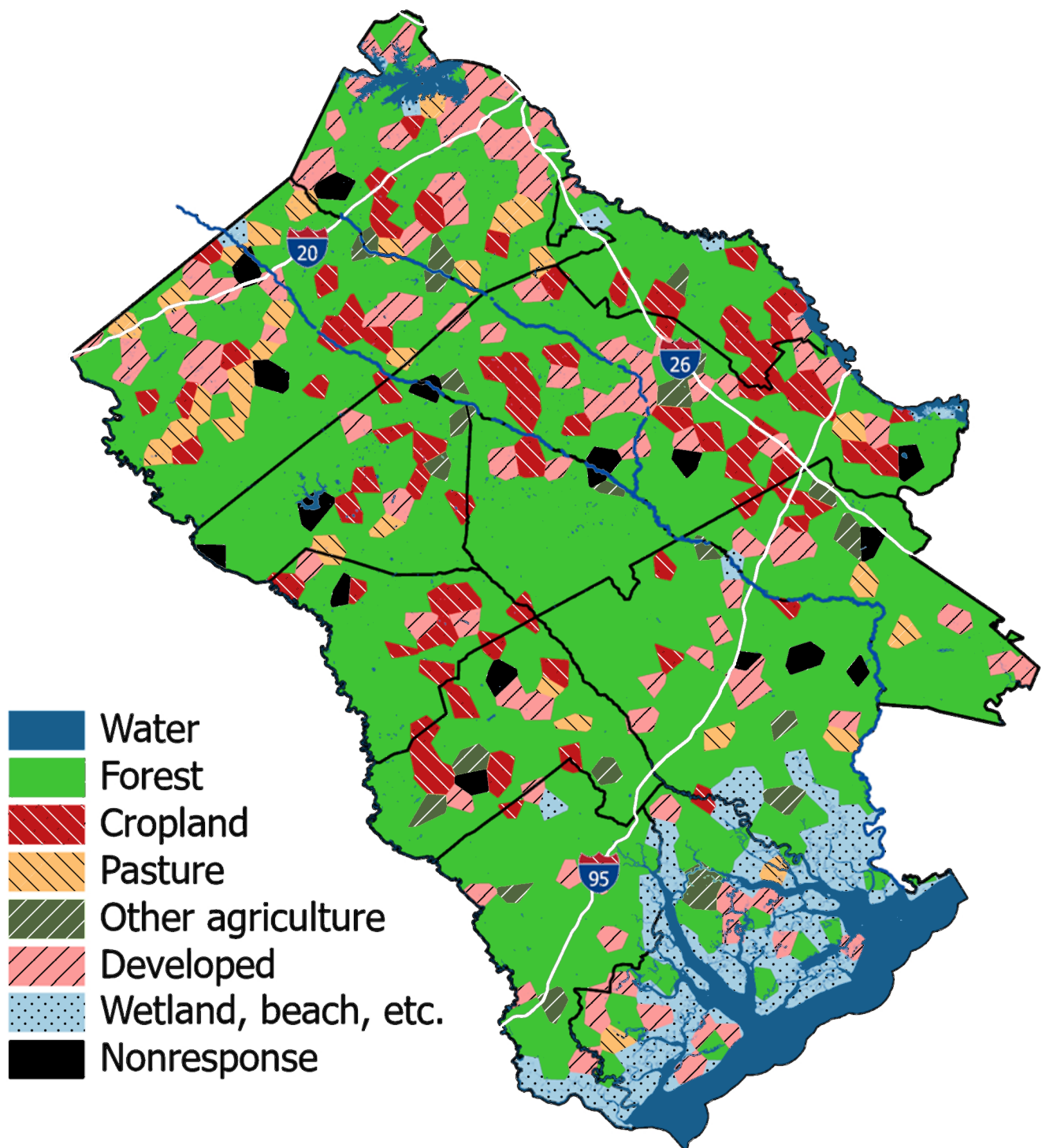


Figure 3—Land use, Unit 1, South Carolina, 2021.

development thins and the landscape becomes more agricultural, especially west of the Edisto River. The most important agriculture commodities in this part of the State are corn,

cotton, and peanuts (USDA NASS 2022). Further to the northwest, development increases near Columbia, SC. To the west is Lake Murray, near the northern corner of Unit 1 (Southern Coastal Plain).

Interstate 20 heads west out of Columbia, SC and crosses the South Fork of the Edisto River at the Aiken County boundary. Aiken County has the highest concentration of pasture in Unit 1 due to its many horse farms. Aiken County also hosts the nation's champion longleaf pine (American Forests 2021).

Following the Savannah River south is the U.S. Department of Energy's Savannah River Site. In 2021, the site is almost completely forested, but historically has been used for research on atomic energy. Further to the south, the land becomes more agricultural, but less so on the eastern side

of the Edisto River. Top crops include cotton, corn, and soybeans (USDA NASS 2022). Further south lies Interstate 95 which passes through the Savannah National Wildlife Refuge.

Unit 2 (Northern Coastal Plain)

The Northern Coastal Plain is in the eastern part of the State (fig. 4). The easternmost point of land is on the western end of Bird Island. The larger, eastern end is in North Carolina. Going down the coast, is Myrtle Beach, SC, the largest city in Horry County named after the wax myrtle (*Morella cerifera*) (Lewis 1998). The wax myrtle rarely

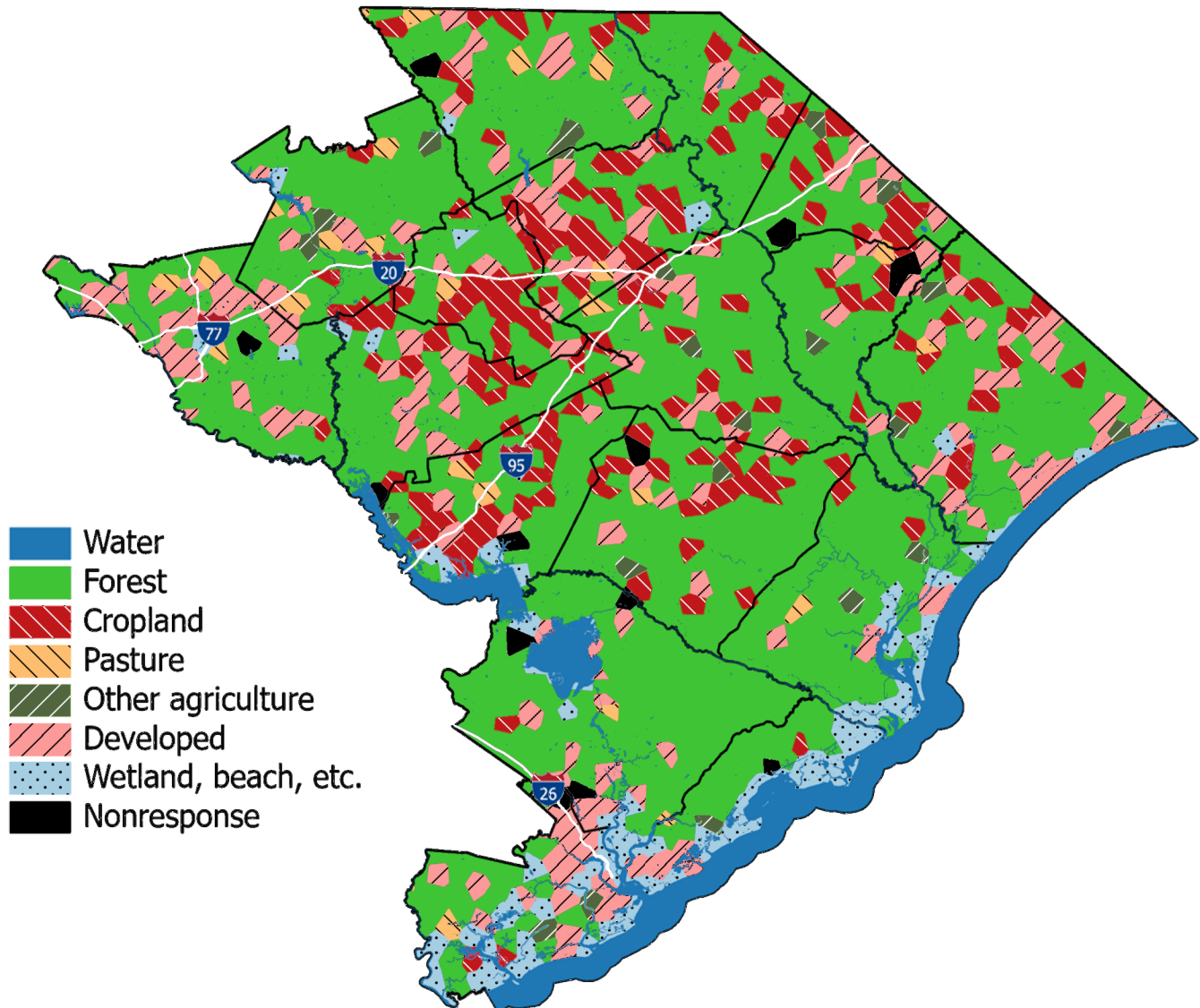


Figure 4—Land use, Unit 2, South Carolina, 2021.



Marshland between Mainland and Pawley's Island. (USDA Forest Service photo by Sam Lambert)

attains a 5-inch diameter and contributes little toward the State's volume, but it is among the top 10 species found in Georgetown and Charleston Counties, SC.

Going further south down the coast, development thins, while wetlands and forest cover increase. Near Bulls Bay, just beyond the wetlands, is the intersection of the Palmetto Trail and the East Coast Greenway. Nestled between Bulls Bay, Lake Marion, and Lake Moultrie is the Francis Marion National Forest. Named after the "Swamp Fox" of Revolutionary War fame (Brigadier General Francis Marion), the forest is dominated by loblolly pine as well as swamp tupelo (*Nyssa biflora*), longleaf pine (*Pinus palustris*), and sweetgum (*Liquidambar styraciflua*).

On the ocean side of the bay is one of South Carolina's "boneyard beaches" an area where uprooted trees have been bleached by the sun and now resemble large skeletons. The chain of islands continues to the southwest. There is a break in the chain at Charleston Harbor. On the east bank is Fort Moultrie National Historic Park

and on a small island near the west bank is Fort Sumter National Historic Park. In the early days of the American Revolution, Fort Moultrie was called Fort Sullivan. The palmetto logs used in its construction resisted the cannonade from the British warships during the Revolutionary War. Today, the palmetto tree adorns the State flag, State seal, and is the official State tree.

The Ashley and Cooper Rivers empty into Charleston Harbor, and on the west bank, the chain of Sea Islands resumes. Johns Island is home to the Angel Oak, a live oak (*Quercus virginiana*) which has stood for hundreds of years. The Edisto River at the southern end marks the boundary between Units 1 and 2.

Upstream from the Cooper River is Lake Moultrie, and further upstream is Lake Marion. Upstream from Lake Marion is the Congaree River and to its east are croplands of corn, cotton, and soybeans. Along the shore of the river is the Congaree National Park. The park is home to many large trees, including a national champion loblolly pine (American Forests 2021).

A few miles upstream from the Congaree National Park is the State capital, Columbia, SC. Located along Interstate 20 east of Columbia, SC is Fort Jackson and some 50 miles further east is Lee State Park and the Lynches River. Upstream and to the east of the Lynches River, is the Carolina Sandhills Wildlife Refuge, beyond which are several State-owned lands.

The Great Pee Dee River, flowing south, merges with the Waccamaw River. Upstream on the Waccamaw are several State-owned lands. The Great Pee Dee River enters the State at the Waccamaw River Heritage Preserve, where the State boundary runs to the southeast.

Unit 3 (Piedmont)

The Piedmont is in the northwestern part of the State (fig. 5). The westernmost point of land in the State is on the shores of Lake Yonah in the Pickens Ranger District (RD) of the Sumter National Forest (NF). At the far end of the Pickens RD is Lake Jocassee, the first in a chain of lakes and adjoining

wetlands leading south. On the other side of the lake is the Jocassee Gorges Wildlife Management Area, home to the highest point in the State, Sassafras Mountain. Further to the east is the northernmost point in the State, the North Saluda Watershed Protection Area. Elevation continues to decrease going east. Just to the east of Interstate 85 is Kings Mountain National Military Park, the site of a Revolutionary War battle. The Interstate 85 corridor is extensively developed, including the cities of Spartanburg and Greenville, SC. Lake Hartwell is visible from the Georgia border.

The landscape transitions from developed to forest southeast of Interstate 85. In the southern part of Unit 3 is the Long Cane RD of the Sumter NF. Approaching Interstate 26 to the northwest is the Enoree RD of the Sumter NF. To the northeast is York County, SC and the bedroom communities of Charlotte, NC.

To the south are some of the most heavily forested counties in the State: Lancaster County (74

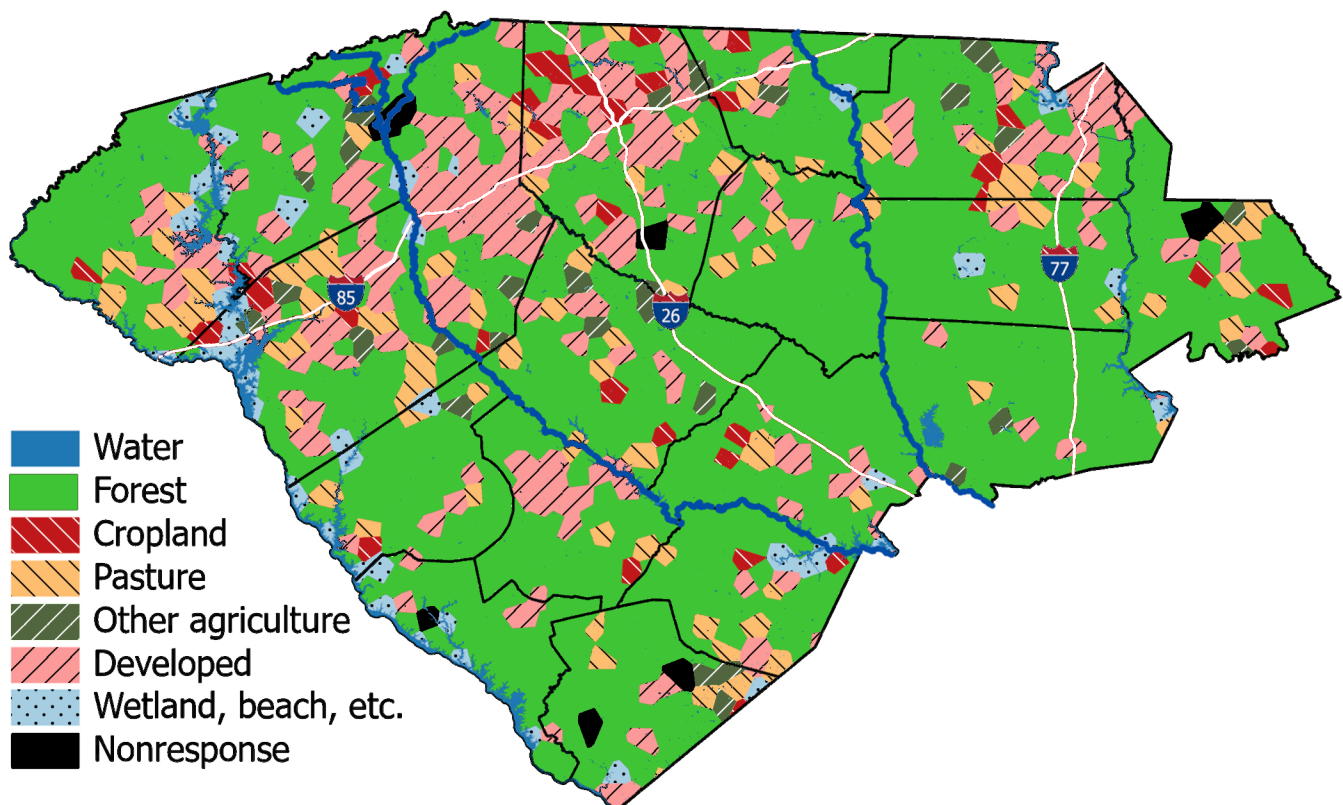


Figure 5—Land use, Unit 3, South Carolina, 2021.



A view of Table Rock Mountain from Lake Jocassee in Autumn. (Courtesy photo by Michelle Johnson, [SCFC])

percent), Chester County (84 percent), Fairfield County (87 percent), despite its closeness to Columbia and Newberry, SC (82 percent). On the other side of Newberry County is the western end of Lake Murray.

Forestry is still the dominant land use in Saluda and Edgefield Counties to the west, however, there is a greater agricultural focus with the top crops of peaches and forage (USDA NASS 2022).

Upstream from the Savannah River is Lake Hartwell and upstream from the lake is the Tugaloo River. Further upstream from the Tugaloo River is Lake Yonah.

AREA

Forest Ownership, Forest Types, Stand Age and Stand Size

Alterations in land use and ownership represent two key factors of change that directly impact the size and quality of forest land in South Carolina. Comprehending the objectives of forest landowners is imperative when assessing the possible impact on the administration and accessibility of the State's forests. Determining the possible impact that forest proprietors may have on the accessibility and management of the State's forests requires an understanding of their goals. It is possible to improve and sustain wildlife habitats or provide new recreational opportunities by replacing traditional techniques of harvesting timber and other forest product-based activities.

SOUTH CAROLINA'S FORESTS, 2021

The 2021 Census reports the population of South Carolina at over 5.2 million individuals or about 170 people per square mile of land (USDC Census Bureau 2021). Since the 2001 census, an additional 1.2 million people now make their home in South Carolina in 2021 (USDC Census Bureau 2021). The two largest counties are Horry (Myrtle Beach, SC) and Berkeley (Charleston, SC). The State's forest land and other critical natural resources may be under more stress due to an increasing population.

Table 1 summarizes the distribution of land use (in acres) in South Carolina since 2001. In 2021, the total area of South Carolina was nearly 20.5 million acres (stable since 2001), including 1.2 million acres of census water and 100,069 acres of noncensus water. Forests covered 12.8 million acres, or over 66 percent of the State's land. A range of nonforest uses, including agriculture and urban development, are represented on the remaining 7.7 million acres of land.

Table 1—Total land and water area in South Carolina by land use and survey year

Land use		Survey year				
		2001	2006	2011	2016	2021
Forest land	Timberland	12,658,030	12,885,073	12,913,245	12,737,653	12,630,631
	Reserve productive	113,986	142,129	152,790	161,905	162,675
	Other forest land	0	20,359	54,473	15,502	23,601
	Total forest land	12,772,016	13,047,561	13,120,508	12,915,060	12,816,907
Agricultural land	Cropland	2,062,528	1,569,500	1,672,578	1,687,922	1,678,674
	Pasture	808,918	958,879	869,474	909,759	830,858
	Idle farmland	430,317	448,286	157,558	187,441	192,832
	Other Agricultural land ¹	55,300	128,868	138,082	93,171	194,423
	Total agriculture land	3,357,063	3,105,534	2,837,693	2,878,293	2,896,787
Urban land	Developed	2,482,910	296,620	459,892	269,516	271,816
	Wetland/marsh/beach	570,325	508,995	178,250	115,620	129,476
	Beach	0	5,474	306,476	375,748	0
	Cultural	0	1,615,485	1,543,869	1,875,887	1,989,099
	Rights-of-way	0	531,733	627,735	637,208	687,139
	Other nonforest	0	51,766	109,398	172,523	448,221
	Total urban/developed	3,053,235	3,010,073	3,225,620	3,446,502	3,525,751
	Total nonforest land ²	6,410,298	6,115,607	6,063,313	6,324,796	6,422,538
Water	Noncensus water	91,893	119,752	126,826	113,513	100,069
	Census water	1,218,638	1,209,925	1,182,198	1,139,651	1,153,622
	Total water	1,310,531	1,329,677	1,309,024	1,253,164	1,253,691
	Total land area and water ³	20,492,845	20,492,845	20,492,845	20,493,020	20,493,136
Total land area ⁴		19,274,207	19,282,920	19,310,647	19,353,369	19,339,514

0 = No data.

¹ Includes orchards and wildlife openings.

² Exclude all water.

³ USDC Census Bureau (2021).

⁴ Excludes census water.



A view of Table Rock Mountain from Lake Jocassee in Autumn. (Courtesy photo by Michelle Johnson [SCFC])

Total nonforest land has gone up slightly since 2001. Land used for agriculture has declined by 14 percent since 2001. Another long-term trend in land use is the increase in urbanized (development) areas which have increased almost 500,000 acres since 2001. Previously, clearing land for agriculture was the primary driver of forest loss. Since 2001, urbanization has been the primary threat to forest land. Table 2 shows the area by survey unit and land status. South Carolina is divided into three survey units: Unit 1 (Southern Coastal Plain), Unit 2 (Northern Coastal

Plain), and Unit 3 (Piedmont) (fig. 6). Each of the three survey units was between 18 percent and 25 percent forested (fig. 7). Of these units (fig. 7), the Southern Coastal Plain has more than 5.5 million acres of land area with 3.4 million acres (62 percent) of forest land. The Northern Coastal Plain has the highest acreage with 8.1 million acres of land and 4.9 million acres (60 percent) of forest land. The Piedmont has about 6.9 million acres of land with 4.5 million acres (65 percent) of forest land (fig. 8).

Table 2—Area by survey unit and land status, South Carolina, 2021

Survey unit	Total area	All forest	Unreserved			Reserved			Nonforest land	Census water
			Total	Timberland	Unproductive	Total	Productive	Unproductive		
thousand acres										
Unit 1 Southern Coastal Plain	5,515.8	3,389.3	3,368.6	3,368.6	0.0	20.7	20.7	0.0	1,788.2	338.3
Unit 2 Northern Coastal Plain	8,113.7	4,880.8	4,789.8	4,771.1	18.7	91.0	91.0	0.0	2,619.8	613.1
Unit 3 Piedmont	6,863.6	4,546.8	4,495.9	4,490.9	4.9	51.0	51.0	0.0	2,114.6	202.2
All survey units	20,493.1	12,816.9	12,654.3	12,630.6	23.6	162.7	162.7	0.0	6,522.6	1,153.6

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

SOUTH CAROLINA'S FORESTS, 2021

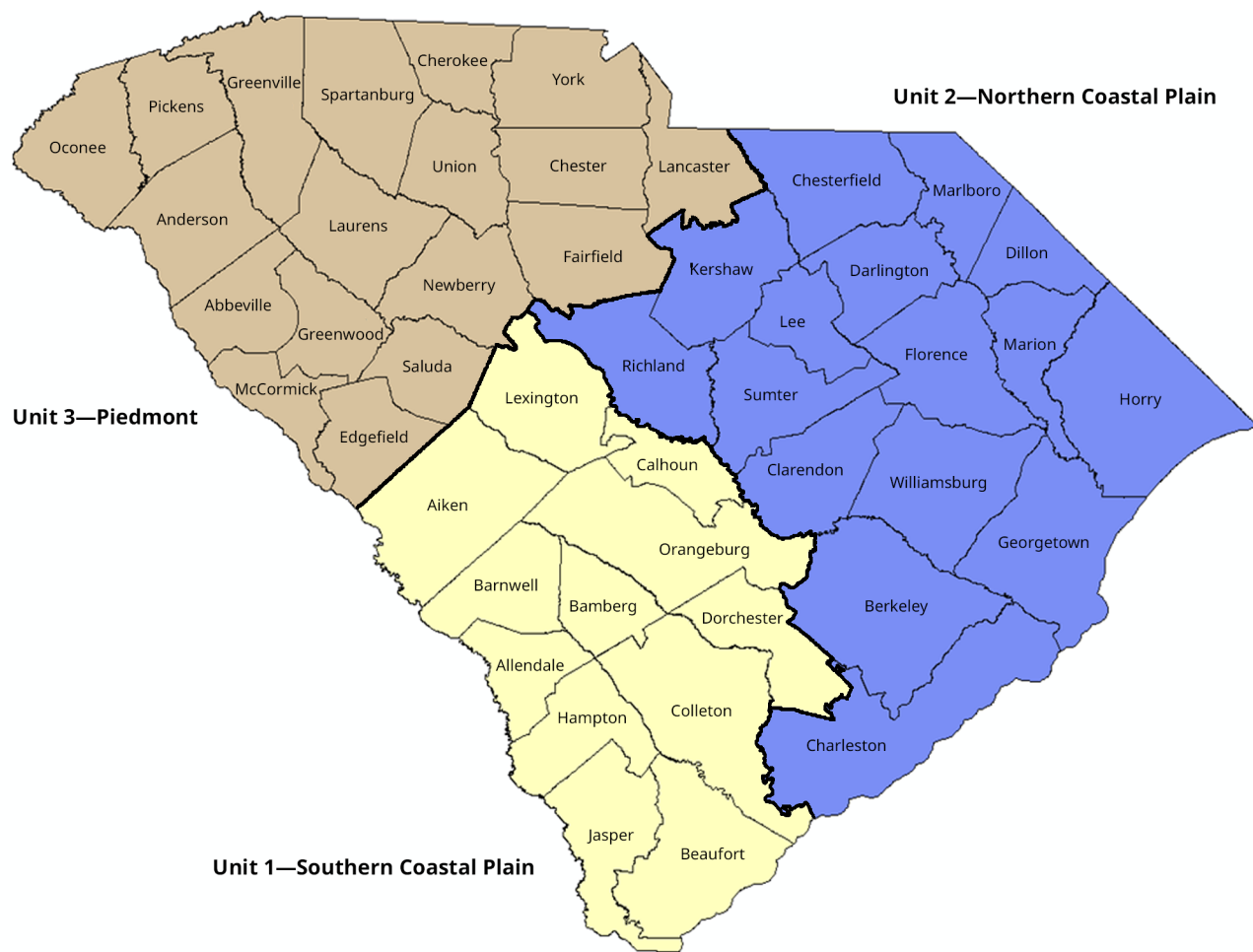


Figure 6—Counties and forest survey units, South Carolina, 2021.

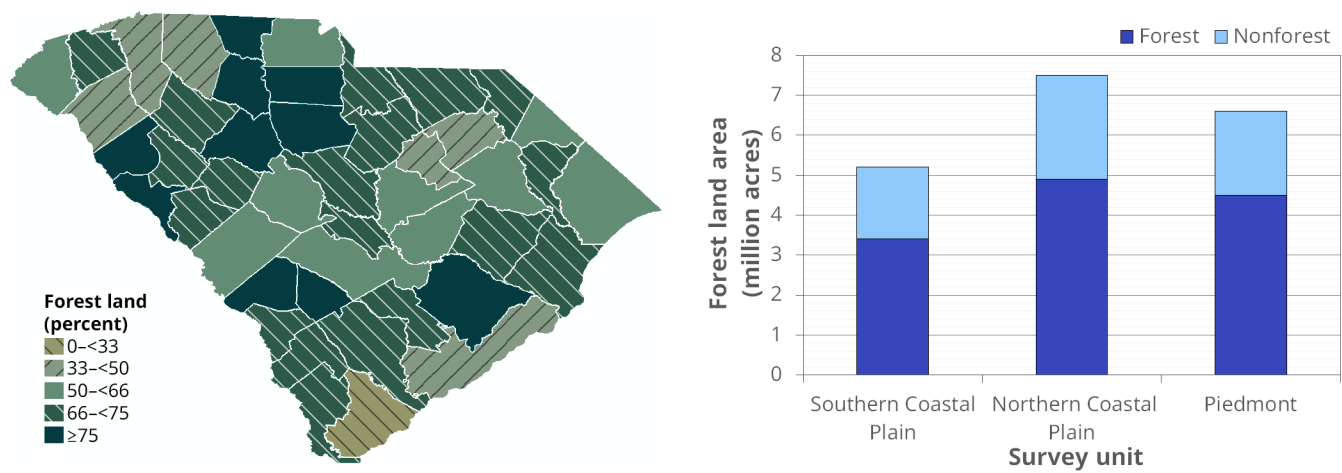


Figure 7—Percentage of county in forest land, South Carolina, 2021.

Figure 8—Forest land area by survey unit, South Carolina, 2021.

The previous four, 5-year cycles of FIA data collection under the annualized forest inventory have estimated forest land acreage at 12.8 million (2001), 13.0 million (2006), 13.1 million (2011), and 12.9 million (2016) forested acres for the State. Forest land changes of this size or greater have been observed in previous surveys and likely reflect both the normal error associated with a sample-based estimate and dynamic forest land reversion and diversion. SRS FIA will be able to ascertain whether longer-term trends exist if these changes persist in the South in the following years.

Forest ownership

For more than 50 years, the FIA program has surveyed and tracked ownership, categorizing it in four major groups: (1) national forest; (2) other Federal; (3) State and local, which collectively represent public ownership; and (4) private ownership, which is composed of nonindustrial private forest (NIPF) and forest industry lands (FIA is mandated by Congress to protect private landowner data, so these two categories are combined under one group, private, for estimates).

The prevalence of nonindustrial private forest ownership is a characteristic of South Carolina's forest ownership, which is also common in many other Southern States (fig. 9). The most

notable trend has been the divestiture by the forest products industry of its timberland and its acquisition by nonindustrial corporate entities, primarily Timber Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs). In 2001, forest industry owned just over 2.1 million acres of forest land (Harper and Rominger 2013). By 2016, that number dropped to 227,000 acres. There are indications in South Carolina and other Southern States that these ownership changes have reached a degree of completion, mostly because the forest products industry has little land left from which to divest. In 2016 forest industry land owned by Plum Creek Timber Company (landowner that does not own a wood-processing mill) divested its holdings to Weyerhaeuser Company (landowner that does own wood-processing mills) to move acreage back to forest industry, almost doubling acreage to over 462,000 acres by 2021 (Weyerhaeuser Company 2015).

Forest ownership patterns have changed over time. As reported previously, divestiture of timberland by traditional forest industry, defined as companies that own wood-processing facilities, has continued and the concurrent acquisition of these lands by other corporate owners, in particular TIMOs and REITs. More than 83 percent of South Carolina's forests belong to individual private landowners (fig. 9).

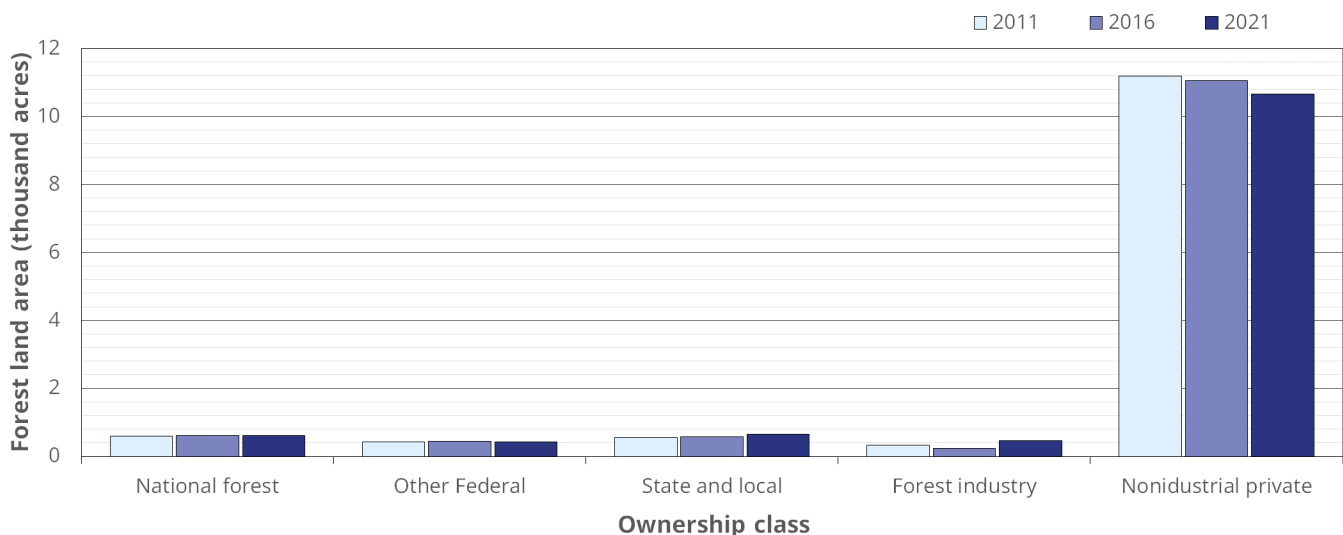


Figure 9—Percent of forest land area by year and ownership class, South Carolina, 2011–2021.

SRS FIA divides forest industry (mill-owning) into two categories: (1) corporate, and (2) individual. NIPF ownership (no mill) is divided into four categories: (1) corporate, (2) conservation/natural resource organizations, (3) unincorporated local/clubs, and (4) individual. Acres in the NIPF corporate category can be challenging to identify properly.

Since the late 1990s, TIMOs and REITs have taken a lead role in land ownership. In 2021, some of the TIMO and REIT acreage may still be in either the NIPF or forest industry categories, as a forest industry entity may retain its ownership designation even when under a REIT structure (Hickman 2007). To track the impact of these changes of ownerships on forest resources, it is essential that all ownerships are identified to their correct private category. During data collection for SRS FIA surveys, the TIMO and REIT investment groups have not been specifically identified as an ownership class and, therefore, are not listed and reported in the tables as an ownership category.

Due to the many ways that ownership information is recorded and stored in courthouses across the

State, TIMO and REIT ownerships are often not readily identifiable in public courthouse records, which further complicates the identification of these ownerships. Hopefully, future refinements in the collection of FIA ownership information will differentiate these two important categories and provide more insight into their role in forest ownership.

Forest types

The distribution of forest types in South Carolina is illustrated in figure 10. Loblolly-shortleaf pine was the most prevalent forest type group in 2021, making up more than 43 percent of all forests. In 2021, oak-hickory maintained its place as the second most common forest type group, covering over one-fifth (21 percent) of the forest land base. Oak-gum-cypress, oak-pine, longleaf-slash pine, and elm-ash-cottonwood made up 14 percent, 12 percent, 5 percent, and 3 percent, respectively. Nonstocked forests, forest land with <10 percent tree canopy coverage, are not accounted for in this data. Nonetheless, nonstocked forests in 2021 represent <1 percent of the total forest land base in the State.

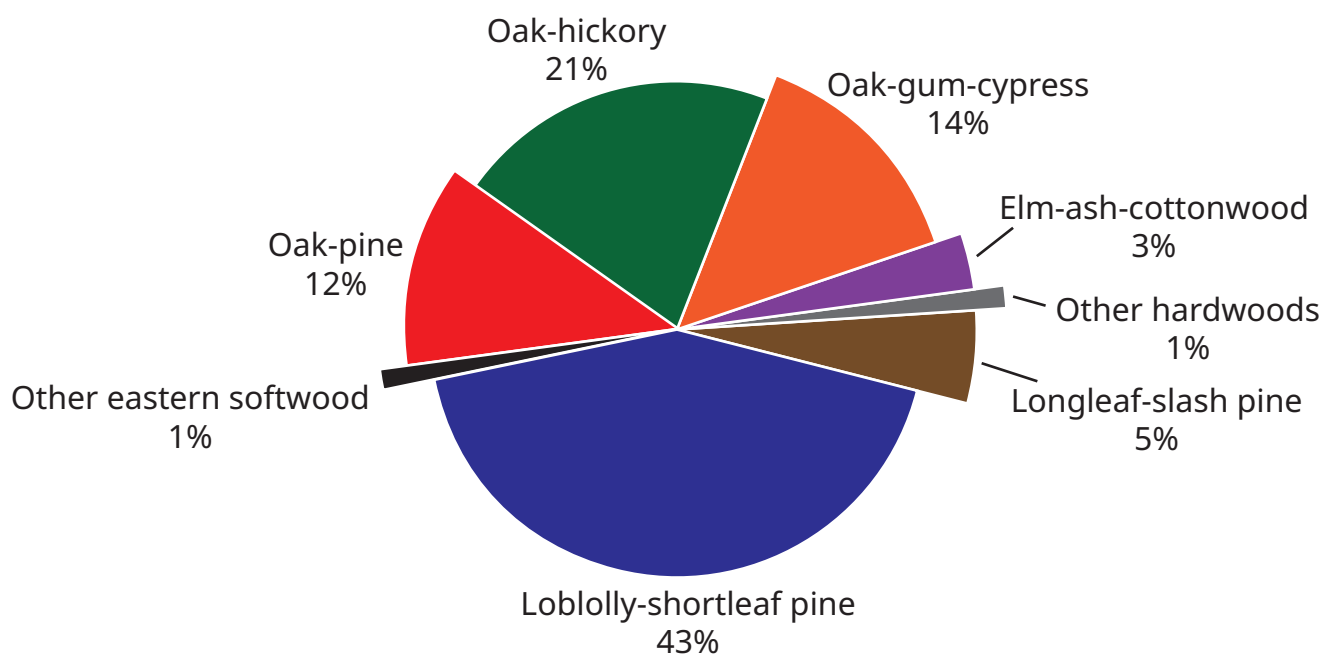


Figure 10—Percentage of forest land area by forest-type group, South Carolina, 2021.

Stand-age and stand-size class

The forests of South Carolina are dynamic in terms of their age composition. Much of the historic change over time can be attributed to Federal incentive programs such as the Conservation Reserve Program (CRP) and the Soil Bank Program of the 1950s (AA 1956). Additionally, the impact of CRP of the late 1980s and the Hurricane Hugo recovery effort in 1989 are evident even today (Conner et al. 2004). The large number of stands established around the same time period has been referred to as the “Wall of Wood” in previous publications such as Conner et al. (2009). Figure 11 shows a considerable increase in the 0–5 year stand-age class, a slight increase in the 6–10 year stand-age class from 2016, and a decrease of stands established between 11 (the 11–15 stand-age class) and 30 (the 26–30 year stand-age class) years ago. There was an increase in acreages of older stands (31–45 year age classes) indicating the effects of stands established during these Federal programs. This trend is reflected in the distribution of forest land area by stand size classes which shows an increasingly greater proportion in the large diameter stand-size class (stands where the trees are predominately softwoods ≥ 9.0 inches diameter at breast height (d.b.h.) and hardwoods ≥ 11.0 inches d.b.h., which

are also known as sawtimber trees) versus the small (1.0–4.9 inches in d.b.h.) or medium stand size classes (5.0–8.9 inches d.b.h.) and hardwood timber species (5.0–10.9 inches d.b.h.) (fig. 12). A notable shift was witnessed in 2021 as small diameter trees outpaced medium diameter trees, indicating a potential rise in the growth of smaller diameter trees through both artificial and natural regeneration in the forested regions of South Carolina. Future forest inventories will provide answers to this interesting development.

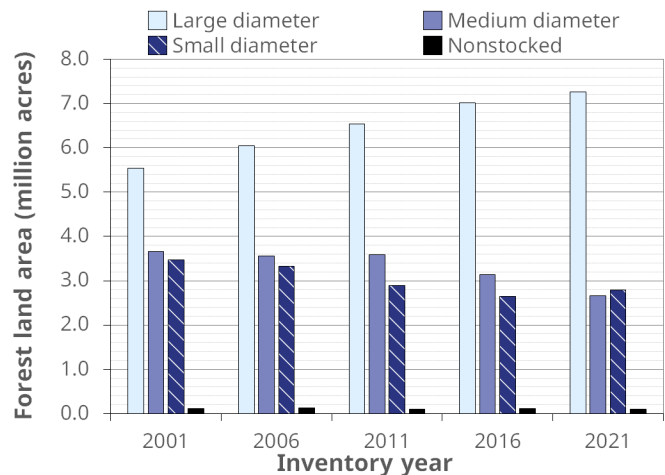


Figure 12—Distribution of forest land area by stand-size class, South Carolina, 2001–2021.

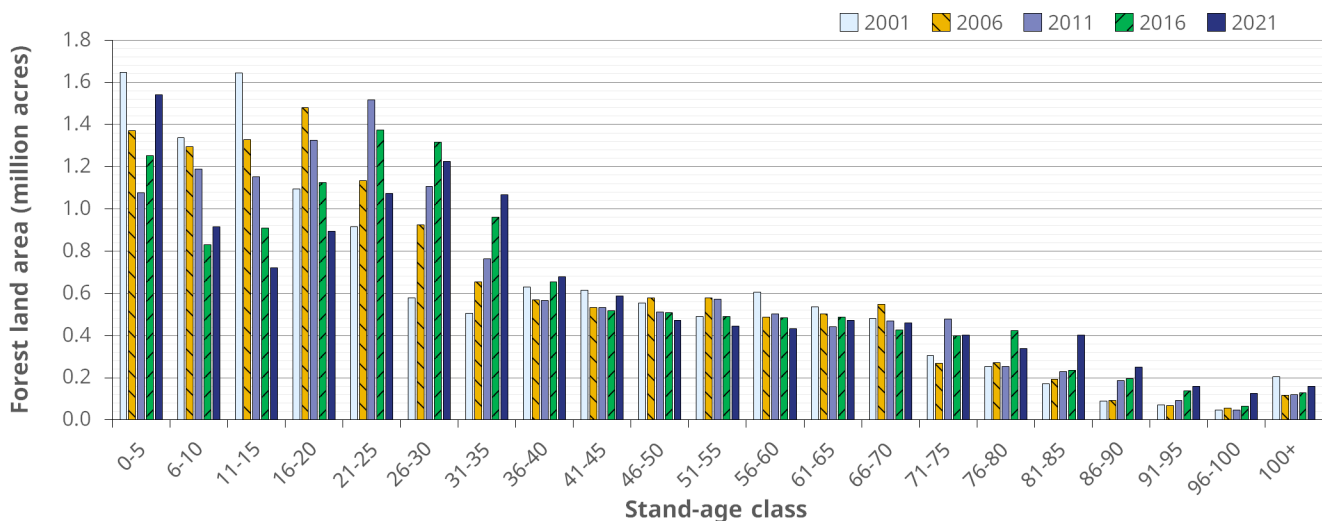


Figure 11—Distribution of forest land area by stand-age class, South Carolina, 2001–2021.

Forests and Land-Use Change

The FIA program records land use on both nonforest and forest plots (see FIA national core field guide for details on land use categories and how they are delineated on FIA plots) (USDA Forest Service 2014). We are then able to create a matrix of land-use change using the remeasured plots that are also used to calculate tree level growth, removals, and mortality (see Scott et al. 2005 for the methods used to calculate these components of change). Forest and nonforest conditions on forested plots are categorized by land use allowing us to apply that condition's expansion factor to the land use and estimate area change.

If a previously forested plot is found to have been cleared for development, 6,000 acres (the area represented by each FIA plot) will be considered as having been deforested. Assuming 5-year intervals between measurements, this would reflect a yearly transfer of 1,200 acres from forest to developed land use. If only half of the plot was cleared for development, 3,000 acres would stay as forest and 3,000 acres would change to land use. In this case, the annual change would be 600 acres per year. The statewide yearly change totals would then be the sum of all these annually changed acres.

However, because FIA plots lack comprehensive mapping of nonforest land use, the program's ability to assess land-use change is limited. All changes in forest and nonforest conditions

are recorded on forested plots, the area of each condition is known, and its expansion factor can be calculated. Only the first nonforest condition that is encountered on the plot is given a land use; all other nonforest conditions are associated with the initial condition and land use. For example, if a section of a forest plot becomes agricultural land, that is the first nonforest status detected and it is mapped and assigned a land use. If the field crew comes upon a right-of-way on the plot, this new nonforest area is mapped but given the land use and condition of agriculture rather than a new nonforest condition. On areas that are entirely devoid of forests, the situation is comparable. Even if a nonforest plot has numerous nonforest land uses, only the nonforest land use at the center of subplot 1 of the 4-subplot cluster is recorded if the entire plot is nonforest. See FIA national core field guide for details on field plot data collection and FIA plot layout (USDA Forest Service 2014).

Figure 13 shows annualized area change estimated in South Carolina from 2006 to 2021. The most notable trend over the survey period was the decrease in the average annual number of agricultural acres reverting to forest land, from a high of 64,898 acres annually in 2006 to a low of 15,815 in 2015, back up to 19,559 acres annually in 2021. The trend of clearing forest land for agricultural purposes has slowed slightly from 22,355 acres annually in 2006 to a high of 29,526 acres annually in 2017, back down to 19,018 acres annually in 2021. The reversion of developed

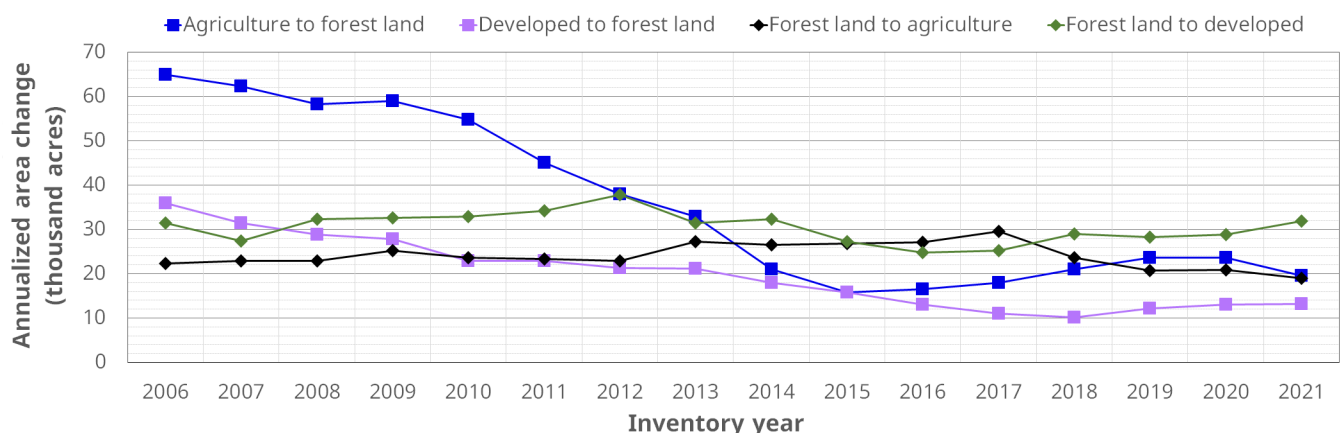
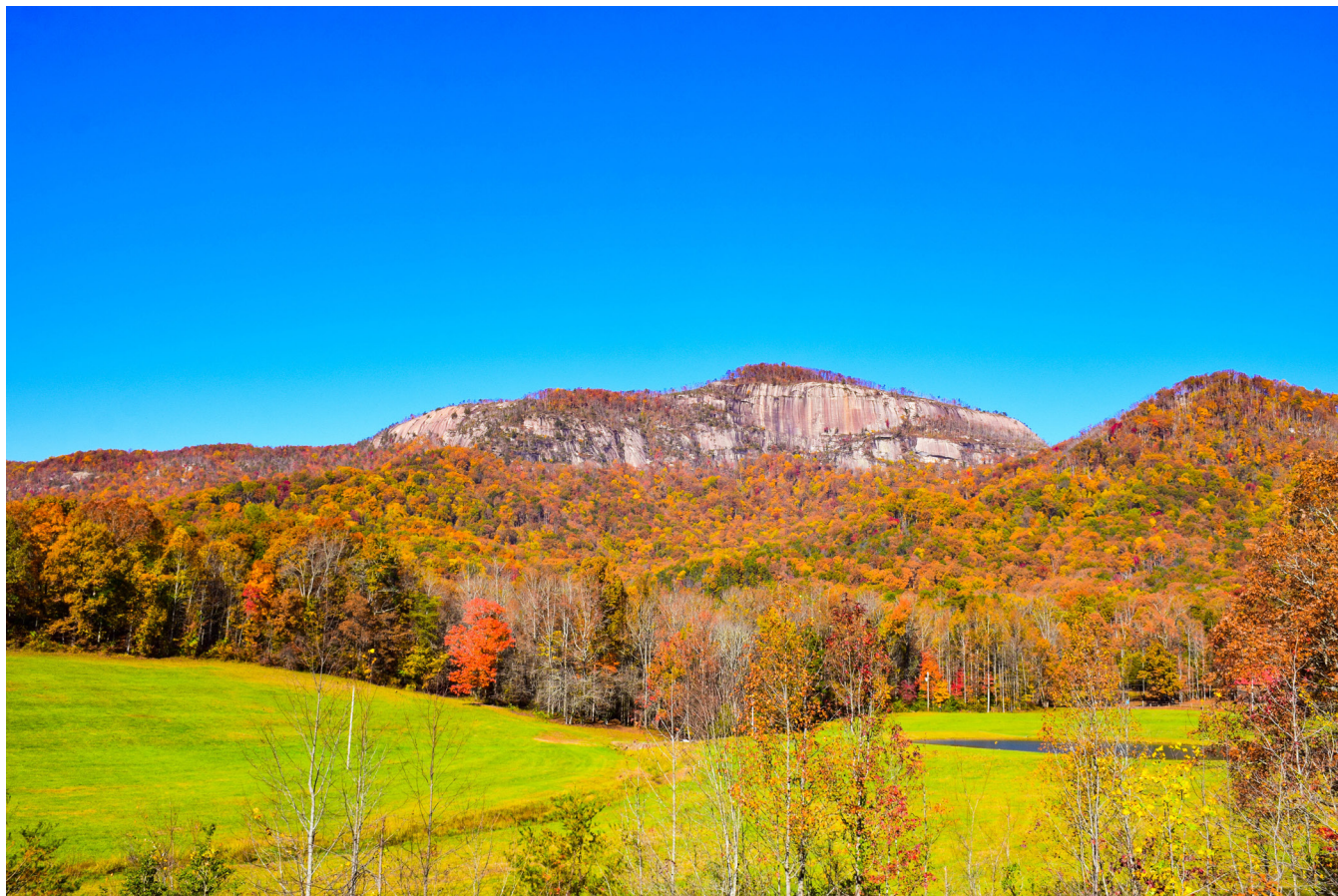


Figure 13—Annualized land-use change by area and inventory year, South Carolina, 2006–2021.



A view of Table Rock Mountain from a field in Autumn. (Courtesy photo by Michelle Johnson [SCFC])

land to forest has experienced a decline, reaching a peak of 35,874 acres per year in 2006 and subsequently dropping to a low of 10,142 acres in 2018. The average annual reversion stands at 13,140 acres in 2021. This number does not include all reversions and is only for developed to forest land.

Clearance of forest land for development fluctuated from 31,492 acres per year in 2006 to a high in 2012 to 37,856 acres, then back down to 31,866 acres per year in 2021. In general, the data indicates that there has been some land-use change across the study periods. The highest yearly land-use change recorded was 156,625 acres in 2006, with a low of 85,604 acres in 2021. However, the reported total forest acreage in South Carolina has been reasonably consistent in recent years.

Knowing the extent of change in relation to the total acreage in those categories helps inform analyses of land-use change across time (e.g., the loss of forest area relative to the State's total forested acreage). The rate of change over time may indicate trends in land-use change that are speeding up or slowing down when changes are observed in both the annual land-use change acres and the total forest land area.

Trends in Pine Forest Stand Origins and Age Class Distribution

In 2021, southern yellow pine plantations accounted for almost 25 percent of all forests. Of the softwood forests under private landowner control, close to 54 percent are the result of artificial regeneration. This differs greatly from publicly owned forests which range from 12 percent (national forests), 31 percent

(other Federal), and 38 percent (State and local governments) artificially established (planted) (table 3).

Another area of change that appears to be stabilizing is the balance between naturally occurring and artificially regenerated southern-yellow pine timberlands. Figure 14 shows these trends before and after changes were made to the FIA program's sampling methods (see the Methodology section for details on these changes) to illustrate the trend's development. FIA data users should familiarize themselves with these program changes when looking at trends that cross this methodological divide.

In 1968, there were approximately 4.4 million acres of naturally regenerated pine stands and just under 1.0 million acres of southern yellow pine plantations (fig. 14). Twenty-five years later, these numbers have changed to the extent that in

1993 there were 2.8 million acres of natural pine stands and 2.7 million acres of planted forests (fig. 14). It appears that the two stand resources are in proportion. Since 1993, there have been only minor variations between the two stand types, with one slightly surpassing the other before the trend reverses. Estimates for 2021 are 3.1 million acres for natural southern yellow pine and 3.0 million acres for planted southern yellow pine (fig. 14). These estimates reflect growth in southern pine stands during the last 50 years, although the stand origin distribution is nearly unchanged for the last 25 years.

Figure 15 illustrates how natural "softwood stand" acres increased for all units between 2001 and 2016, with a minor decline in 2021. Planted stands have changed very little over the past 20 years, although Unit 2 and Unit 3 indicate a minor gain and loss in acres, respectively.

Table 3—Area of softwood stands by ownership group and stand origin on timberland in South Carolina, 2021

Ownership group	Total	Stand origin		Total	Stand origin	
		Natural	Planted		Natural	Planted
		thousand acres			percent	
National Forest	362	318	44	6	10	1
Other Federal	198	138	61	3	5	2
State and local government	227	139	87	4	5	3
Private landowner	5,317	2,464	2,853	87	81	94
Total	6,104	3,060	3,044	100	100	100

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

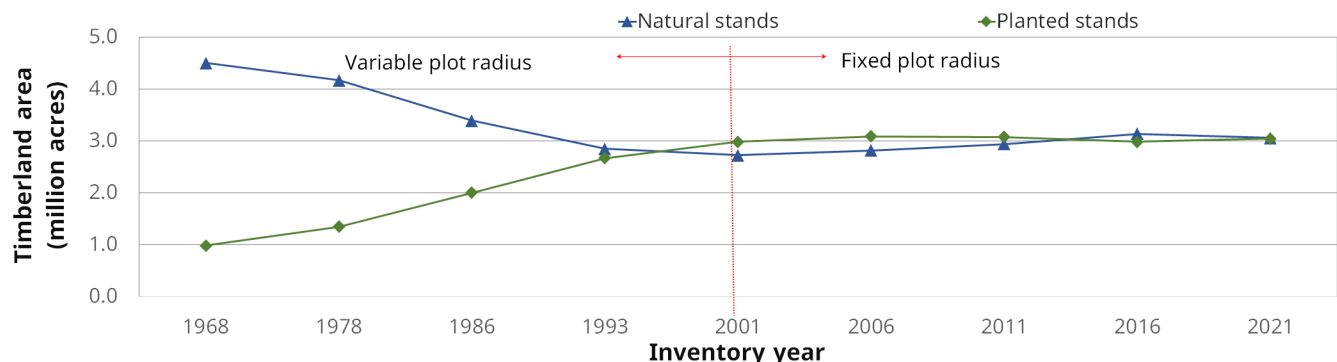


Figure 14—Natural and artificially regenerated softwood timberland by sampling method and inventory year, South Carolina, 1968–2001 and 2001–2021.

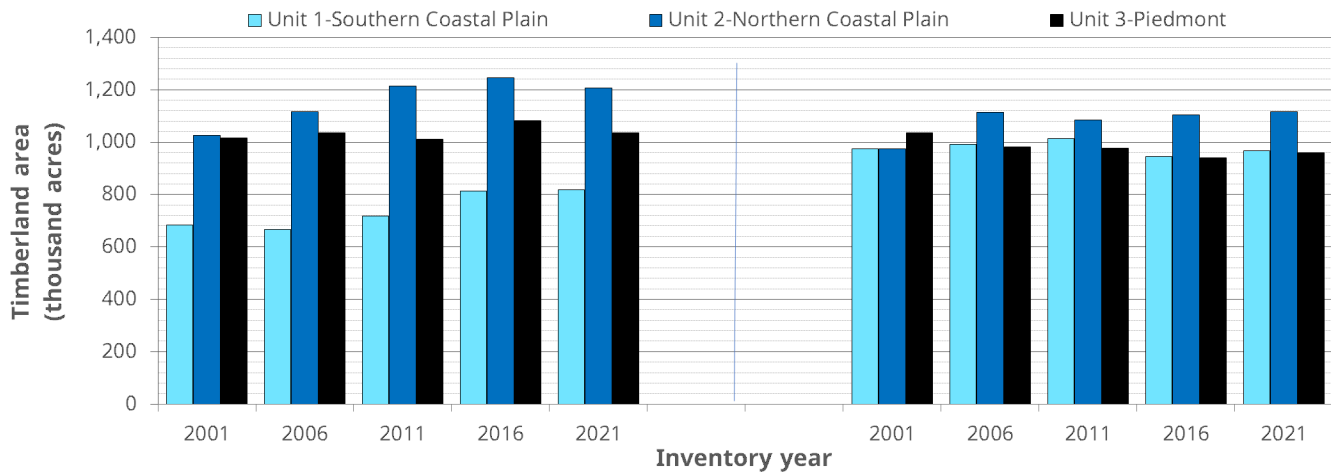


Figure 15—Natural and artificially regenerated softwood timberland area by stand origin and inventory year, South Carolina, 2001–2021.

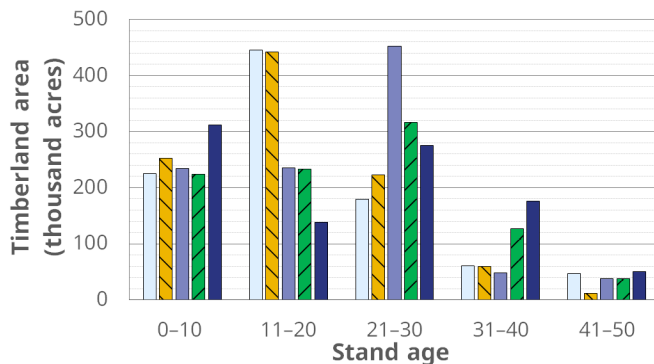
According to a previous 5-year report (Brandeis et al. 2018), the current stand-age distribution of South Carolina's forests is believed to be the result of federally subsidized programs in the 1980s and 1990s that encouraged private landowners to plant forests and recovery efforts to replace forests in the coastal plains survey units damaged by

Hurricane Hugo. Plantation activities were mostly focused on southern yellow pine (Brandeis et al. 2018). Figure 16 displays these stands according to unit and stand age (2001–2021) and continues to demonstrate the impact of these government-funded initiatives (more than 30 years old).

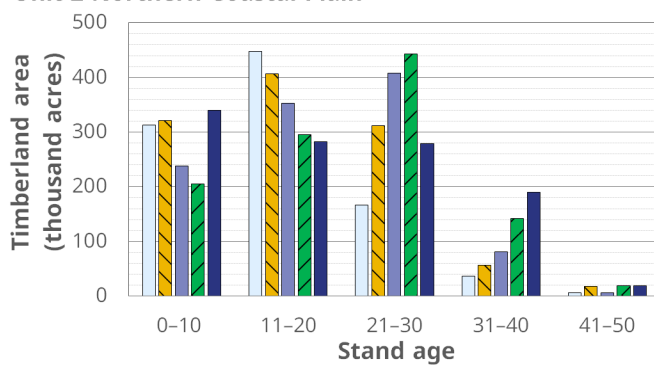


A logging container on scale. (Courtesy photo by Scott Danskin [SCFC])

Unit 1-Southern Coastal Plain



Unit 2-Northern Coastal Plain



Unit 3-Piedmont

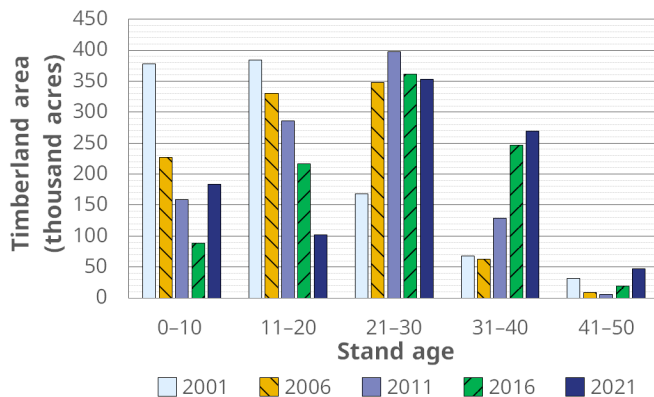


Figure 16—Planted pine timberland area distribution by survey unit and stand age, South Carolina, 2001–2021.

Currently, the 0–10 year class of planted southern yellow pine by unit, shows a considerable increase in planting for all units, but especially in Unit 2 (Northern Coastal Plain). While both 11–20 year and 21–30 year classes have declined, the 21–30 year class has the highest acreage for the State. The resulting stand-age distribution curve peaked



Snow in a pine plantation. (Courtesy photo by SCFC)

at the 21–30 year class. The aforementioned effects of federally subsidized programs show up in stand ages greater than the 30-year class. In past forest surveys in the Southern United States, it was usually more common to have more area in the younger age classes with a tapering off in area as stand age increases. Lands planted in the late 1980s accounted for over 25 percent of the State's pine forests, making it the most dominant stand-age class for this forest-type group in the State (Brandeis et al. 2018).

NUMBER OF TREES, VOLUME, AND BIOMASS

South Carolina's 2021 forest inventory was estimated to be almost 9.0 billion trees with a d.b.h. ≥ 1 inch on all forest land (table 4). The trees with d.b.h. ≥ 5 inches hold approximately 28 billion cubic feet (bcf) of volume and almost 1.2 billion tons of aboveground live-tree biomass (table 4). Loblolly and shortleaf pine were the State's most common tree species group on forest land, leading both in number of trees (23 percent of all live trees with d.b.h. ≥ 5 inches) and in total volume (45 percent of all volume). Sweetgum (*L. styraciflua*) followed second, accounting for 20 percent of all trees and 9 percent of all volume (table 4).

SOUTH CAROLINA'S FORESTS, 2021

Table 4—Number of live trees (d.b.h. ≥ 1 inch), net volume (trees with d.b.h. ≥ 5 inches), and aboveground green weight (d.b.h. ≥ 1 inch) on forest land by species group, South Carolina, 2021

Species group		Number of live trees	Net volume	Aboveground green weight
		<i>million trees</i>	<i>million cubic feet</i>	<i>thousand tons</i>
Softwoods	Longleaf and slash pine	225.9	1,005.2	41,582.8
	Loblolly and shortleaf pine	2,081.5	12,526.7	475,890.1
	Other yellow pines	90.8	460.9	17,005.0
	Eastern white and red pine	10.6	142.1	3,744.5
	Eastern hemlock	3.2	21.3	800.8
	Cypress	55.5	542.5	21,710.8
	Other eastern softwoods	203.1	174.7	5,666.4
	Total softwoods	2,670.7	14,873.4	566,400.4
Hardwoods	Select white oaks	134.0	1,095.0	53,469.7
	Select red oaks	33.8	446.9	22,982.2
	Other white oaks	138.4	504.9	27,263.9
	Other red oaks	982.0	2,896.7	156,552.6
	Hickory	200.4	528.2	28,512.0
	Hard maple	43.1	13.8	955.8
	Soft maple	711.3	993.8	46,217.1
	Beech	35.6	63.9	2,958.6
	Sweetgum	1,757.4	2,493.7	112,154.1
	Tupelo and blackgum	354.9	1,373.1	63,172.3
	Ash	175.6	287.9	13,619.5
	Cottonwood and aspen	9.6	70.5	2,614.7
	Basswood	1.1	5.3	172.6
	Yellow-poplar	140.3	1,205.3	46,485.7
	Black walnut	4.4	16.6	731.5
	Other eastern soft hardwoods	602.2	775.4	36,899.1
	Other eastern hard hardwoods	366.0	100.5	8,801.5
	Eastern noncommercial hardwoods	534.4	179.7	13,759.3
	Tropical and subtropical hardwoods	29.7	0.1	190.4
	Other	37.0	3.8	442.5
	Total hardwoods	6,291.2	13,055.1	637,955.1
All species group		8,961.9	27,928.6	1,204,355.5

Volume on timberland overall has been trending upward for the last 2 decades (2001–2021), with the proportions of hardwood versus softwood volume remaining relatively constant (fig. 17). Table 5 displays the estimated net merchantable bole volume of living trees on forest land in South Carolina as of 2021, with similar distribution of hardwood and softwood species (14.9 bcf, 53 percent of softwoods and 13.1 bcf, 47 percent of hardwoods), based on the State's 2021 inventory estimates. Twenty-two percent (6.0 bcf) of the standing volume originates from plantations, of which 93 percent corresponds to softwood species and 7 percent to hardwoods. Rather than planted hardwood trees, some or all of the volume represented as planted hardwoods may be hardwood trees naturally regenerated within softwood plantations, comprising a majority of the stocking in these stands.

Loblolly and shortleaf pines accounted for the largest volume with 12.5 billion cubic feet; of this amount, 5.3 billion comes from planted stands (table 5). In terms of standing volume, longleaf and slash pines, along with cypress, were in second and third place and accounted for 7 and 4 percent of the softwood volume, respectively. The top four species in hardwood volume were other red oaks, sweetgum, tupelo, and blackgum, accounting for 22, 19, and 11 percent of total hardwood volume, respectively (table 5).



Coastal marshland near Murrells Inlet, SC. (USDA Forest Service photo by Sam Lambert)

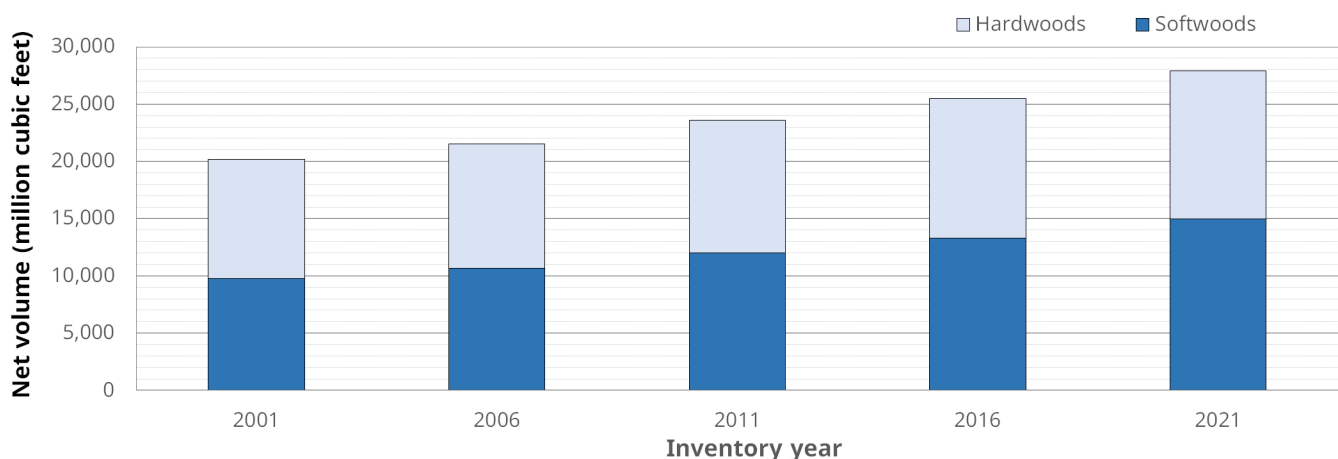


Figure 17—Net volume of live trees on timberland by major species group, South Carolina, 2001–2021.

SOUTH CAROLINA'S FORESTS, 2021

Table 5—Net merchantable bole volume of live trees on forest land by species group and stand origin, South Carolina, 2021

Species group		Total	Stand origin	
			Natural	Planted
million cubic feet				
Softwoods	Longleaf and slash pine	1,005.2	705.3	299.9
	Loblolly and shortleaf pine	12,526.7	7,251.5	5,275.2
	Other yellow pines	460.9	453.8	7.1
	Eastern white and red pine	142.1	141.8	0.3
	Eastern hemlock	21.3	21.3	0.0
	Cypress	542.5	542.5	0.0
	Other eastern softwoods	174.7	160.3	14.5
	Total softwoods	14,873.4	9,276.4	5,597.0
Hardwoods	Select white oaks	1,095.0	1,072.2	22.9
	Select red oaks	446.9	429.5	17.4
	Other white oaks	504.9	494.1	10.8
	Other red oaks	2,896.7	2,788.8	107.9
	Hickory	528.2	514.8	13.3
	Hard maple	13.8	13.4	0.4
	Soft maple	993.8	976.2	17.6
	Beech	63.9	63.8	0.1
	Sweetgum	2,493.7	2,358.7	135.0
	Tupelo and blackgum	1,373.1	1,361.2	11.8
	Ash	287.9	283.4	4.4
	Cottonwood and aspen	70.5	68.4	2.1
	Basswood	5.3	5.2	0.1
	Yellow-poplar	1,205.3	1,187.4	18.0
	Black walnut	16.6	15.3	1.3
	Other eastern soft hardwoods	775.4	731.9	43.6
	Other eastern hard hardwoods	100.5	99.0	1.4
	Eastern noncommercial hardwoods	179.7	174.8	4.9
	Tropical and subtropical hardwoods	0.1	0.1	0.0
	Other	3.8	2.4	1.4
	Total hardwoods	13,055.1	12,640.7	414.4
All species		27,928.6	21,917.1	6,011.5

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

0.0 = No sample for the cell.

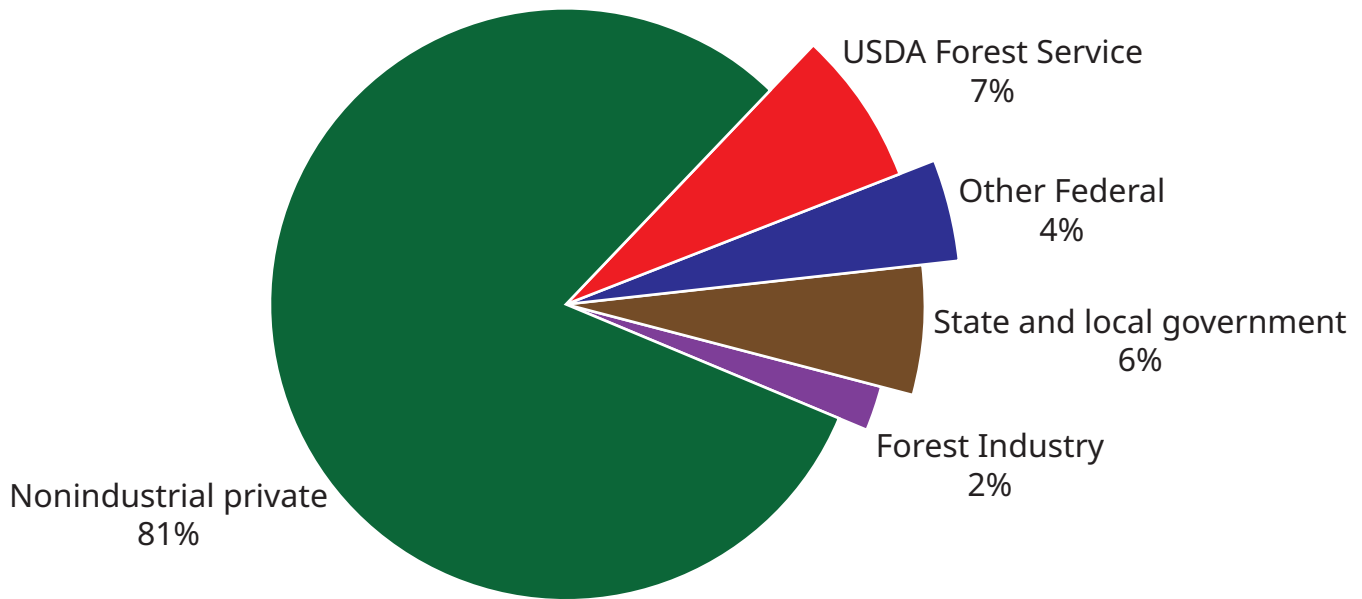


Figure 18—Net volume of growing-stock trees on timberland by ownership group, South Carolina, 2021.

Eighty-one percent of the growing-stock volume in the State was found in forests owned by nonindustrial private landowners (fig. 18). The increases in standing volume for both softwoods and hardwoods occurred primarily in the larger, sawtimber-sized diameter classes which have trended upwards during the 2001–2021 period (figs. 19 and 20). Seen from another perspective,

net volume in the saw-log portion of sawtimber trees has also been trending upward over the survey periods, reaching its highest level of 17.3 bcf in 2021 (table 6). In comparison to small diameter stand-size volume, which declined, volume in the medium diameter stand-size class declined somewhat overall for all species.

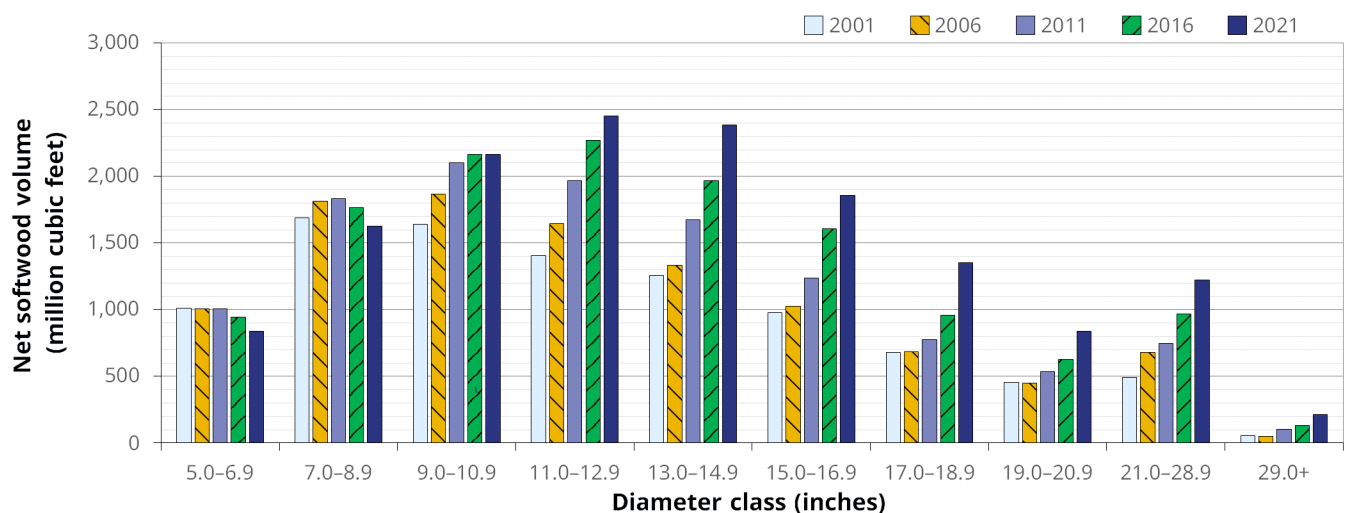


Figure 19—Net softwood volume by diameter class, South Carolina, 2001–2021.

SOUTH CAROLINA'S FORESTS, 2021

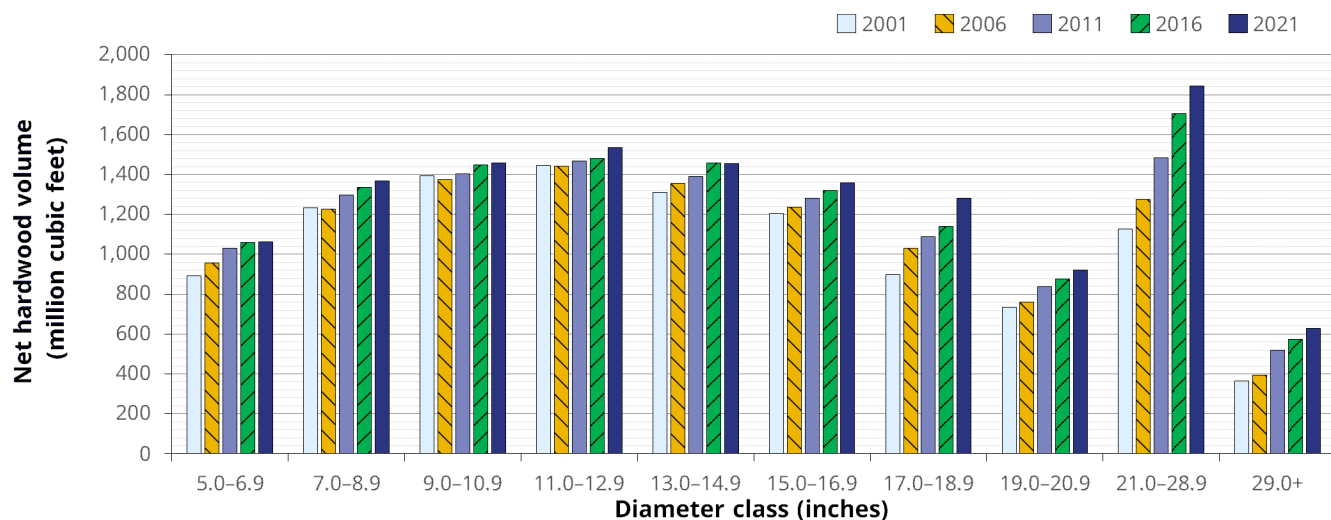


Figure 20—Net hardwood volume by diameter class, South Carolina, 2001–2021.

Table 6—Net volume in the saw-log portion of sawtimber trees, in cubic feet, on timberland, South Carolina, 2001–2021

Inventory year	Total	Softwoods	Hardwoods
<i>million cubic feet</i>			
2001	11,265	6,058	5,207
2006	12,071	6,605	5,466
2011	13,130	7,624	5,506
2016	14,951	9,108	5,842
2021	17,341	10,822	6,519

GROWTH, REMOVALS, AND MORTALITY

Plots surveyed in two consecutive inventories were analyzed to establish the mean yearly volume of net growth, removals, and mortality (GRM), which provides an assessment of inventory change (Brandeis et al. 2018). For example, GRM projections for South Carolina's 2021 inventory are derived from plots surveyed in the 2016 cycle and resurveyed in the 2021 cycle. As shown in figure 21, annual net growth and removal volume for both softwoods and hardwoods declined

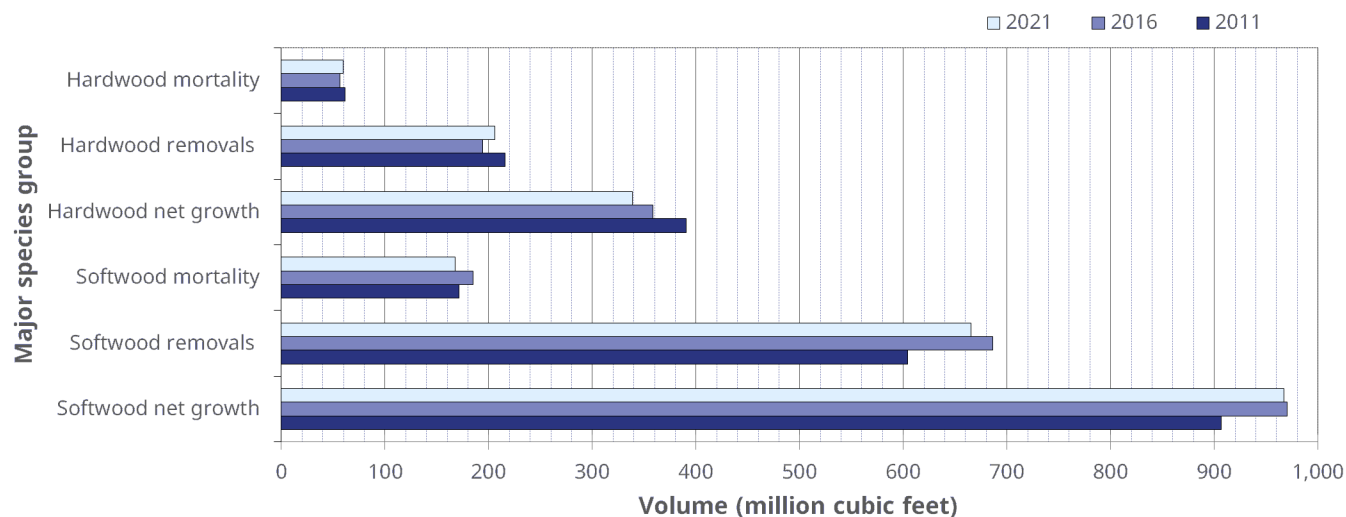


Figure 21—Average annual volume of net growth, removals, and mortality by species group (major), on forest land by survey year, South Carolina, 2011–2021.

marginally and softwood mortality was slightly lower between 2016 and 2021 inventory cycles. Annual net growth and removals volume of hardwood species were both less in 2021 than 2011 and mortality was marginally consistent with 2021.

Figure 22 shows net annual growth volume by species group and stand-size class. Large-diameter hardwood volume dropped from 2011 to 2021 and softwood annual net growth significantly increased. Between 2011 and 2021, the medium-diameter volume trend for both hardwoods and softwoods varied; with annual growth for hardwoods falling slightly while annual

growth for softwoods declined considerably. Both hardwoods and softwoods have maintained comparatively consistent growth in the small diameter stand-size class. Although softwoods have not consistently increased since 2011, hardwoods showed a slight but steady decrease in average yearly net growth in all diameter stand size classes. There was a slight increase in small diameter stand-size class for hardwoods from 2016 to 2021.

The majority of the State's yearly total removals comes from the removal of softwoods, which made up more than 76 percent of all annual removals (fig. 23). In both softwoods and

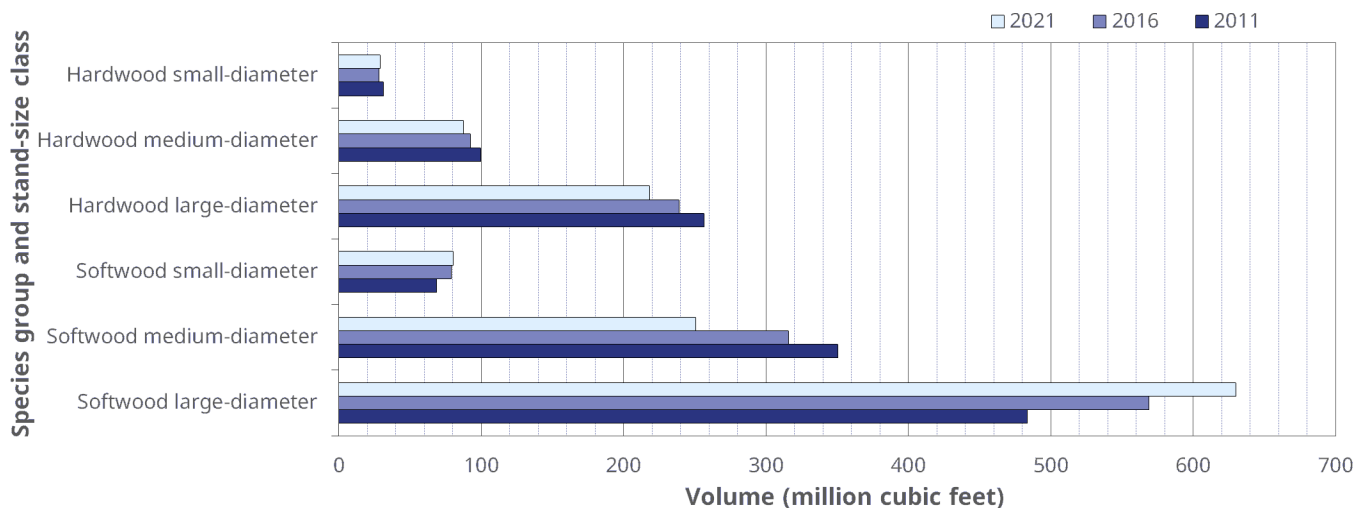


Figure 22—Average annual volume of net growth by species group and stand-size class, South Carolina, 2011–2021.

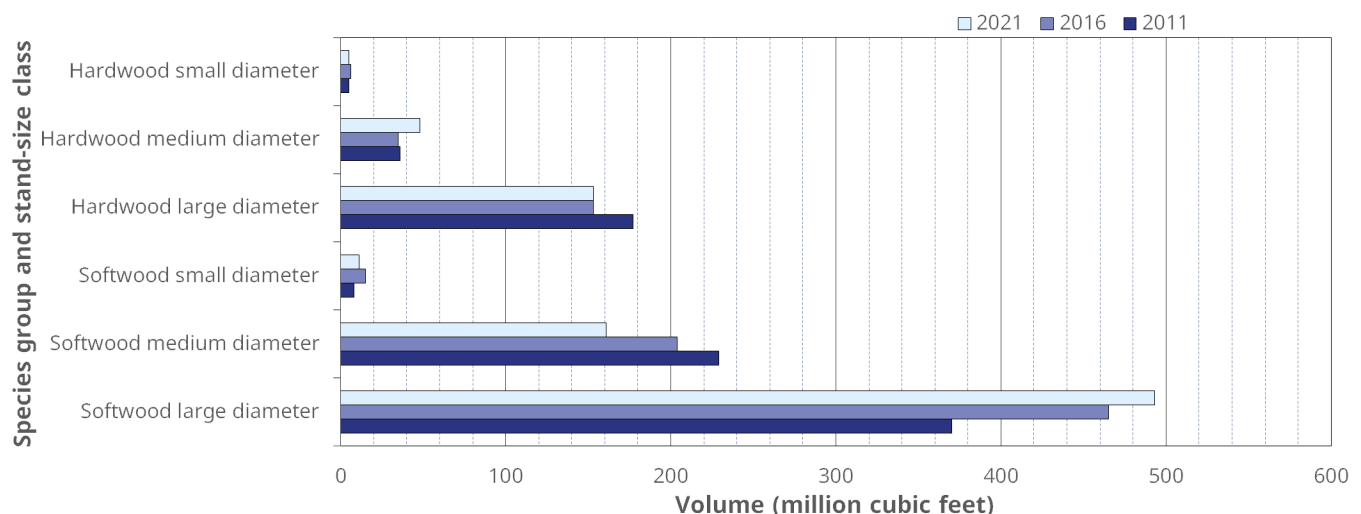


Figure 23—Average annual volume of net removals by stand-size class and species group, South Carolina, 2011–2021.

hardwoods, there was minimal variation in the small diameter stand-size class in 2011 and 2021, but a slight decrease in the medium diameter stand-size class for softwoods and an increase in medium diameter stand-size class for hardwoods. The 2021 inventory cycle shows an increase in softwood annual removals from the large diameter stand-size class accompanied by a slight drop in removals from large diameter stands in hardwood, a shift that could have possibly reflected saw-log demand. This pattern is not observed in hardwoods however, possibly due to strong export markets that kept hardwood saw-log prices and demand up during this period (Stuber 2015).

In both the hardwood and softwood classes, the early mortality rate for softwoods increased in the large diameter stand-size class, resulting in the highest losses in a decade. The yearly mortality trend for the large diameter stand-size class was also evident in hardwoods; however, the increase seen in 2021 significantly outpaced the estimates for 2011 deaths (fig. 24). Between 2011 and 2021, there was little change in the medium and small diameter stand size classes for both hardwoods and softwoods.

A closer examination of annual growth and removals provides an indication of removals

sustainability when annual growth exceeds removals, which is also indicated by a growth to removals ratio above 1 (Brandeis et al. 2018). When examining hardwood net annual growth and removals by tree-size class, net annual growth volumes for both poletimber and sawtimber stand size classes exceeded annual removals (fig. 25). For both tree size classes, the trend indicates a growth-to-removal ratio that is substantially greater than 1. The ratio dropped by almost 7 percent for the sawtimber stand-size class between 2011 and 2021 and it climbed slightly for the poletimber stand-size class, a trend that reflects lower net annual growth and relatively constant annual removals as previously mentioned.



Forested land use of a planted pine from saplings, seedlings, and land clearing to plant pines. (Courtesy photo by Michelle Johnson [SCFC])

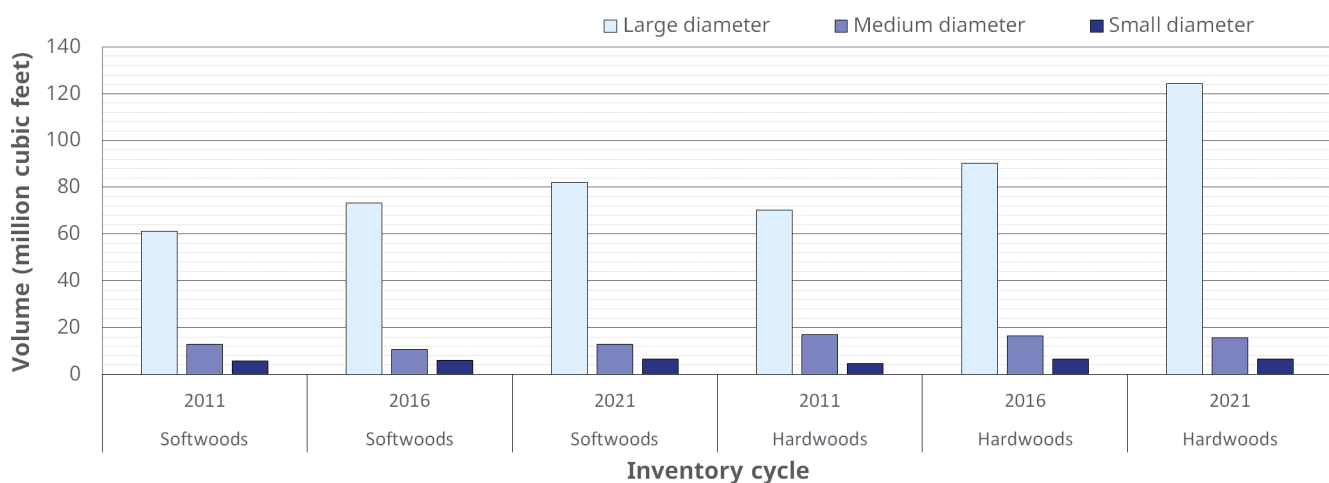


Figure 24—Average annual volume of net mortality by inventory cycle and species group, South Carolina, 2011–2021.

Softwood net annual growth and removals (fig. 26) display a pattern similar to hardwoods for the poletimber stand-size class, with net annual growth consistently surpassing removals. The softwood sawtimber stand-size class shows the same association, with net annual growth consistently surpassing removals. Net growth for the softwood sawtimber stand-size class increased by almost 8 percent from 2011 to 2021.

Growth, Removals, and Mortality by Stand Origin and Species Group Composition

Total average annual removals for 2021 (table 7) are different between natural and planted stands for softwoods and hardwoods. Softwood planted

stands accounted for 54 percent of softwood removals and natural stands accounted for 75 percent of hardwood removals. The predominant types of removals are loblolly and shortleaf pines, which accounted for roughly 636.5 million cubic feet (mmcf) or 95 percent of softwood removals and 73 percent of all removals. Sweetgum and other red oak species had the largest annual removal volumes among hardwoods at 54.97 and 50.22 mmcf or 27 and 25 percent of hardwood removals, respectively. Net annual growth shows loblolly and shortleaf pines ranking first, representing 68 percent of all species net annual growth and 92 percent of softwood species net annual growth (table 8).

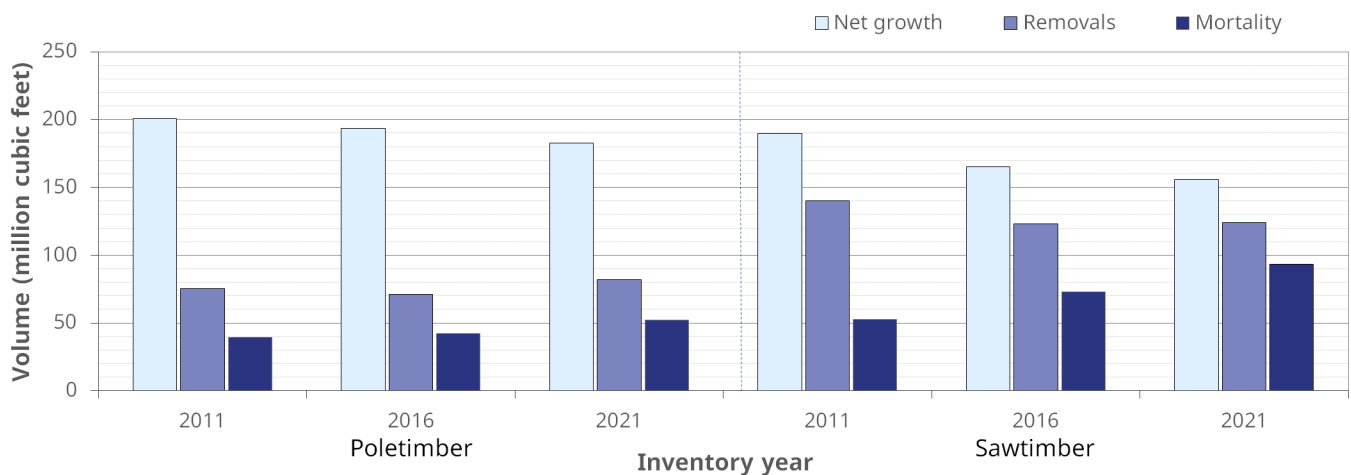


Figure 25—Average annual hardwood net growth, removals, mortality by tree-size class and inventory year, South Carolina, 2011–2021.

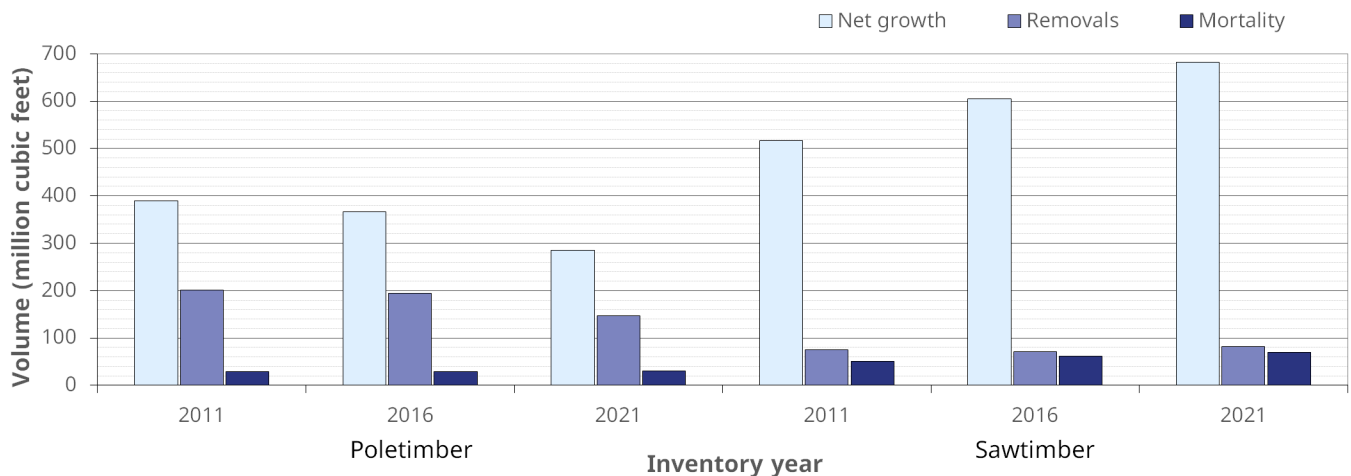


Figure 26—Average annual softwood net growth, removals, mortality by tree-size class and inventory year, South Carolina, 2011–2021.

SOUTH CAROLINA'S FORESTS, 2021

Table 7—Average annual removals of live trees on forest land by speciesgroup and stand origin, South Carolina, 2021

Species group		Total	Stand origin		
			Natural	Planted	Not available
million cubic feet					
Softwoods	Longleaf and slash pine	18.45	6.40	10.10	1.94
	Loblolly and shortleaf pine	636.50	261.23	349.49	25.78
	Other yellow pines	10.56	6.72	0.04	3.80
	Eastern white and red pine	0.02	—	—	0.02
	Cypress	0.71	0.71	—	—
	Other eastern softwoods	1.35	0.71	0.20	0.44
	Total softwoods	667.57	275.77	359.83	31.98
Hardwoods	Select white oaks	15.86	13.33	1.73	0.79
	Select red oaks	4.18	3.90	0.19	0.09
	Other white oaks	6.73	3.26	1.38	2.09
	Other red oaks	50.22	38.57	6.02	5.63
	Hickory	5.40	3.70	0.55	1.15
	Yellow birch	0.03	0.03	—	—
	Hard maple	0.17	0.17	—	—
	Soft maple	12.24	9.22	1.87	1.15
	Beech	0.25	0.25	—	—
	Sweetgum	54.97	37.87	13.15	3.95
	Tupelo and blackgum	6.31	5.91	0.22	0.19
	Ash	8.25	7.95	0.09	0.21
	Cottonwood and aspen	2.32	2.32	—	—
	Yellow-poplar	15.26	11.55	3.59	0.12
	Black walnut	1.03	1.00	0.03	—
	Other eastern soft hardwoods	13.01	8.47	2.26	2.27
	Other eastern hard hardwoods	1.53	0.95	0.22	0.36
	Eastern noncommercial hardwoods	4.91	3.38	1.25	0.28
	Total hardwoods	202.67	151.82	32.57	18.28
	All species	870.24	427.59	392.39	50.26

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

— = No sample for the cell.

SOUTH CAROLINA'S FORESTS, 2021

Table 8—Net average annual growth of live trees on forest land by species group and stand origin, South Carolina, 2021

Species group		Total	Stand origin		
			Natural	Planted	Not available
million cubic feet					
Softwoods	Longleaf and slash pine	42.84	19.94	22.77	0.13
	Loblolly and shortleaf pine	863.27	397.01	463.35	2.91
	Other yellow pines	12.62	12.22	0.36	0.04
	Eastern white and red pine	4.28	4.26	0.02	—
	Eastern hemlock	-1.14	-1.14	—	—
	Cypress	12.88	12.87	0.01	—
	Other eastern softwoods	5.97	5.15	0.79	0.03
	Total softwoods	940.73	450.32	487.29	3.12
Hardwoods	Select white oaks	25.34	24.08	1.22	0.05
	Select red oaks	9.60	8.68	0.93	—
	Other white oaks	4.12	3.55	0.60	-0.03
	Other red oaks	81.14	75.63	5.74	-0.22
	Hickory	10.56	9.99	0.57	—
	Yellow birch	—	—	—	—
	Hard maple	0.55	0.51	0.04	—
	Soft maple	19.63	18.31	1.39	-0.07
	Beech	2.02	2.01	0.01	—
	Sweetgum	89.96	79.44	10.22	0.30
	Tupelo and blackgum	20.92	20.34	0.57	—
	Ash	7.63	7.16	0.45	0.01
	Cottonwood and aspen	1.21	1.08	0.13	—
	Basswood	0.16	0.13	0.02	—
	Yellow-poplar	34.89	33.52	1.36	0.01
	Black walnut	0.40	0.25	0.14	—
	Other eastern soft hardwoods	16.73	13.71	2.96	0.07
	Other eastern hard hardwoods	3.14	3.09	0.06	—
	Eastern noncommercial hardwoods	3.91	3.61	0.32	-0.01
	Other	0.57	0.40	0.17	—
	Total hardwoods	332.47	305.48	26.88	0.11
All species	1,273.20	755.80	514.17	3.23	

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

— = No sample for the cell.

Treated Acres

South Carolina's harvested acreage is directly correlated with the amount of volume removed from the State's forests. Along with documenting the harvesting activity on remeasured plots, the SRS FIA program categorizes the type of harvesting that occurred. With clearcut harvesting, most of a stand's merchantable trees are removed and used, reducing residual stand stocking to <50 percent. Partial or selective harvesting is when a residual stand of >50 percent of the original stocking is retained. This type of cutting can also apply to silvicultural practices such as uneven-aged management. In the Southern States, seed-tree/shelterwood harvesting—crop trees are removed but seed source trees are left in a shelterwood or seed tree—was also observed but less frequently documented (Brandeis et al. 2018). Commercial thinning involves removing most of the trees from medium diameter stands, leaving a healthy stocking of growing stock trees for use in future stand development. Timber stand enhancements and salvage cutting are also included (see Glossary for additional information on SRS FIA harvesting types).

Over the last 10 years, there has been a notable increase in clear-cutting (final harvest) and a minor drop in the amount of land used for partial

harvesting or commercial thinning, according to recent surveys (fig. 27). Softwoods have had a minor reduction in the number of acres under partial harvest since 2011 and hardwoods saw a slight increase in 2016 before marginally returning to the 2011 levels in 2021.

DISTURBANCE AND FOREST HEALTH INDICATORS

Disturbance

In South Carolina, wildland forest fires (of all types) were recorded on 828,300 acres of forest land annually in 2021, making it the most common disturbance on forest land (table 9). Also, 631,000 acres were affected by fire for softwoods compared to only 197,300 for hardwoods. This was up from the average annual acreage (165,900 acres) affected by fire in 2016 with 130,400 acres for softwoods and 32,700 acres for hardwoods (Brandeis et al. 2018). Fire disturbance also includes prescribed burning on forested Federal, State, and private land. SRS FIA does not discern between natural and prescribed burning when collecting this variable. Weather, closely followed by disease, affected 536,500 acres and 200,700 acres annually, respectively. Forest acreage disturbed by weather affected softwood forest types (111,300 acres) differently compared to hardwood (425,300 acres) forest types; whereas

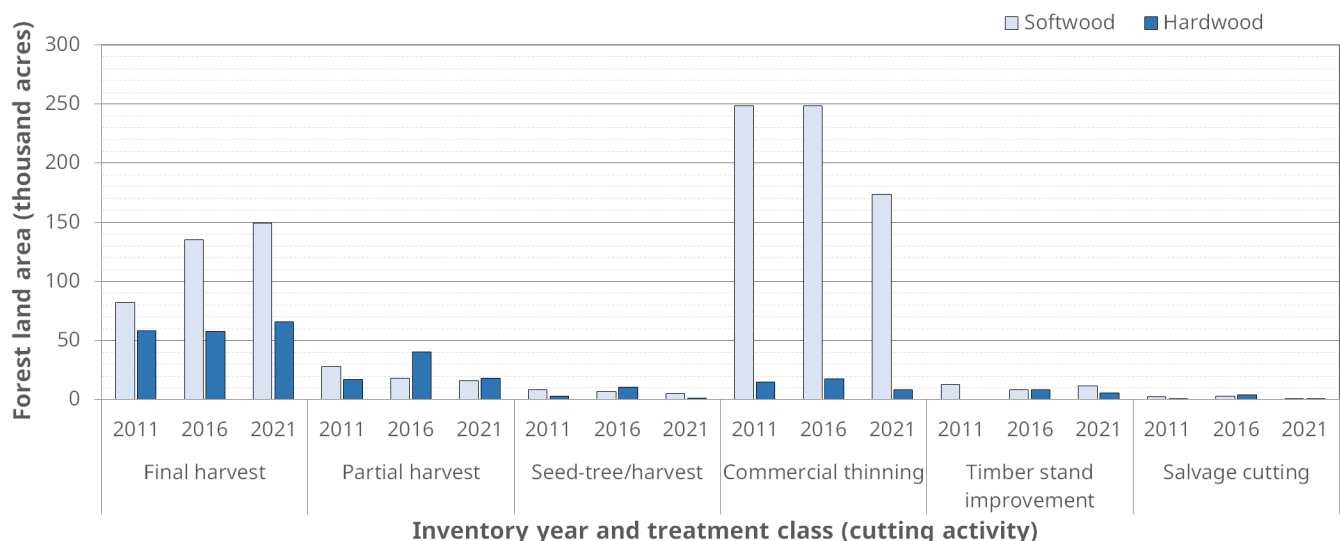


Figure 27—Average annual forest land acreage affected by cutting activity, South Carolina, 2011–2021.

Table 9—Area of forest land disturbed annually by forest-type group and disturbance class, South Carolina, 2021

Forest-type group ²		Disturbance class ¹									
		Total	No visible disturbance	Insect	Disease	Fire	Wild animals	Domestic animals	Weather	Vegetation	Human
		thousand acres									
Softwoods	White-red-jack pine group	17.9	15.7	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
	Longlea-slash pine group	602.7	369.1	0.0	5.3	158.7	0.0	0.0	0.0	0.0	69.6
	Loblolly-shortleaf pine group	5,505.7	4,670.5	0.0	80.5	470.0	3.9	5.8	111.3	37.2	13.2
	Other eastern softwoods group	41.8	40.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
	Total softwoods	6,168.1	5,095.7	0.0	85.8	631.0	3.9	5.8	111.3	37.2	84.3
Hardwoods	Oak-pine group	1,529.9	1,334.6	0.0	22.2	101.5	1.5	0.0	49.5	0.0	9.7
	Oak-hickory group	2,672.3	2,416.5	23.7	22.5	58.1	6.9	5.8	76.4	11.4	50.9
	Oak-gum-cypress group	1,862.5	1,463.9	0.0	63.9	31.8	29.9	0.0	248.3	0.0	11.5
	Elm-ash-cottonwood group	435.3	355.2	0.0	6.3	2.9	19.8	0.0	51.1	0.0	0.0
	Maple-beech-birch group	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other hardwoods group	19.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Exotic hardwoods group	24.2	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Nonstocked	103.4	94.4	0.0	0.0	2.9	0.0	0.0	0.0	0.0	6.1
	Total hardwoods	6,648.8	5,710.0	23.7	114.9	197.3	58.0	5.8	425.3	11.4	78.3
All species group		12,816.9	10,805.7	23.7	200.7	828.3	61.9	11.6	536.5	48.6	162.6

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 <0.5.

¹ Based on current conditions.

² Based on past conditions.

the incidence of disease appeared to be higher in hardwood forests types (114,900 acres) compared to softwood forest (85,800 acres), particularly the oak-gum-cypress forest type.

Standing Dead Trees, Down Woody Materials, Forest Duff and Litter

When the death of a tree or the breaking of sections of a living tree are initiated, physical and chemical decomposition begin, the process of returning nutrients and carbon held in the wood are transferred back to the soil and atmosphere.

In forests, standing dead trees are essential for both carbon sequestration and fauna. Many organisms found in forests rely on standing dead trees for all or part of their life cycle. The number of standing dead trees ≥ 5.0 inches d.b.h. in South Carolina forests was 82.5 million in 2021 (table 10).

Tree debris is referred to as down woody materials (DWM) and can range in size from very small twigs to logs that were once full tree stems. The FIA program includes monitoring and inventory of DWM biomass because of its crucial

Table 10—Number of standing dead trees on forest land by forest-type group and diameter class, South Carolina, 2021

Forest-type group		All classes	Diameter class (≥5.0 inches at d.b.h.)									
			5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
		number of trees										
Softwoods	White/red/jack pine group	428,162	184,461	104,797	81,485	22,967	22,967	—	11,484	—	—	—
	Longleaf/slash pine group	2,135,373	1,161,399	286,939	271,718	192,088	116,984	—	—	—	70,830	35,415
	Loblolly/shortleaf pine group	29,308,281	14,535,103	6,458,141	3,705,852	2,090,893	1,274,132	786,626	150,637	179,103	92,810	34,984
	Other eastern softwoods group	146,948	73,474	—	—	—	34,984	38,490	—	—	—	—
	Total softwoods	32,018,764	15,954,437	6,849,877	4,059,055	2,305,948	1,449,067	825,116	162,121	179,103	163,640	70,399
Hardwoods	Oak/pine group	10,633,165	4,512,691	2,681,708	1,513,259	639,166	440,026	427,554	122,471	82,994	178,312	34,984
	Oak/hickory group	18,112,538	7,444,411	3,881,424	2,258,907	1,599,792	1,053,568	643,808	494,349	369,058	318,785	48,435
	Oak/gum/cypress group	18,037,973	6,292,091	4,012,748	2,523,143	1,575,977	946,327	941,395	843,062	155,141	528,907	219,182
	Elm/ash/cottonwood group	3,088,993	1,108,627	398,585	316,663	313,717	285,565	162,276	236,495	80,824	186,243	—
	Maple/beech/birch group	105,053	70,035	11,673	—	11,673	—	—	—	—	—	11,673
	Other hardwoods group	73,902	36,951	36,951	—	—	—	—	—	—	—	—
	Exotic hardwoods group	318,049	248,395	69,654	—	—	—	—	—	—	—	—
Total hardwoods		50,369,673	19,713,201	11,092,743	6,611,972	4,140,325	2,725,486	2,175,033	1,696,377	688,017	1,212,247	314,274
Nonstocked		144,256	34,670	37,969	—	71,617	—	—	—	—	—	—
All groups		82,532,693	35,702,308	17,980,589	10,671,027	6,517,890	4,174,553	3,000,149	1,858,498	867,120	1,375,887	384,673

— = No sample for the cell.

role in maintaining healthy forest ecosystems. The productivity of a forest is partially based on its DWM's ability to recycle nutrients and carbon. Down woody material is found on the forest floor where many wildlife species find refuge and food supplies. When dry enough, DWM adds to the forest's fire fuel load.

The natural breakdown of DWM can happen at predictable rates in temperate forests like South Carolina. However, numerous variables, including climate, regional conditions, forest type, age of stands, and forest management practices might affect these rates. Natural disturbances such as forest fires and storms can significantly increase the amount of DWM on the forest floor. Also, a

human-caused disturbance like the harvesting of wood products can produce quick and substantial changes in DWM pools. The unpredictable nature and limited scope of these disturbances make forest DWM pools diverse and dynamic across the landscape.

DWM material is described by FIA in terms of tons per acre, green tons, short tons, and total tons for several categories and classifications. A short ton, in the context of forestry, is 2,000 pounds in U.S. weight units. When dealing with woody biomass, understanding weight metrics is essential. For instance, words like “dry tons” or “green tons” could be used when discussing the production or movement of energy:

- **Green Ton (GT):** Refers to 2,000 pounds of freshly cut woody material at its natural moisture content
- **Short Ton (ST):** U.S. weight measure equal to 2,000 pounds (same as GT) commonly used in the United States
- **Bone Dry Ton (BDT or DT):** Represents 2,000 pounds of woody material with 0-percent moisture content
- **Bone Dry Unit (BDU):** Equals 2,400 pounds of wood chips with 0-percent moisture content.

These metrics are important for a variety of applications, such as analyzing the logistics of shipping or estimating the amount of biomass in forests for energy production. One metric ton is equivalent to 2,204.62 pounds.

Table 11 displays South Carolina's total carbon in DWM (fine woody debris [FWD], coarse woody debris [CWD], and piles) in short tons broken down by unit in 2021. Unit 1 (Southern Coastal Plain) contains the bulk of the short tons of total carbon in DWM (FWD, CWD, and piles), with planted stands accounting for the majority of carbon (39.3 million tons). In Unit 2 (Northern Coastal Plain) and Unit 3 (Piedmont), natural stands are more prevalent with Unit 2 (Northern Coastal Plain) showing 14.0 million short tons in naturally regenerated stands and only 1.6 million short tons for planted stands. Unit 3 (Piedmont) showed 8.3 million short tons in natural stands and only 1.5 million short tons in planted stands.

Table 11—Total carbon in DWM (FWD, CWD, and piles) in short tons by survey unit and stand origin on forest land, South Carolina, 2021

Survey unit	Total	Stand origin	
		Natural	Planted
		<i>short tons</i>	
Unit 1 Southern Coastal Plain	42.54	3.27	39.27
Unit 2 Northern Coastal Plain	15.61	14.01	1.61
Unit 3 Piedmont	9.80	8.26	1.54
Total	67.95	25.54	42.41

Table 12 has a slightly different estimate than table 11. Table 12 shows the total volume of DWM (FWD, CWD, and piles) in cubic feet, by ownership class on forest land, South Carolina 2021. Again, the majority of DWM volume is in Unit 1 (Southern Coastal Plain) with 10.1 billion total cubic feet of volume in DWM (FWD, CWD, and piles) on forest land. Unit 2 (Northern Coastal Plain) and Unit 3 (Piedmont) show 3.5 billion cubic feet and 1.7 billion cubic feet, respectively.

Details for these DWM estimation procedures can be found in Woodall and Monleon (2008) and Woodall et al. (2011a). Based on the FIA plots where DWM was sampled, South Carolina's forests hold an average of 2.4 green tons of biomass per acre of DWM (Woodall and Monleon 2008, Woodall et al. 2011b). These estimates agree with those made previously in Conner et al. (2004) in which FWD and CWD combined, averaged around 2 tons per acre (Brandeis et al. 2018).

Table 12—Total volume of DWM (FWD, CWD, and piles) in cubic feet, on forest land by forest ownership class and survey unit, South Carolina, 2021

Survey unit	Ownership class							
	Total	National Forest	National Park Service	U.S. Fish and Wildlife Service	U.S. Dept. of Defense	State	County and Municipal	Private
	million cubic feet							
Unit 1 Southern Coastal Plain	10,096.5	0.0	0.0	0.6	99.9	0.0	0.0	9,995.9
Unit 2 Northern Coastal Plain	3,465.7	57.7	0.5	0.0	0.0	30.0	0.0	3,377.5
Unit 3 Piedmont	1,750.8	174.5	0.0	0.0	18.6	53.6	113.2	1,391.0
Total	15,313.0	232.2	0.5	0.6	118.6	83.5	113.2	14,764.4

Numbers in columns do not sum to totals due to rounding.

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

FIA measures and monitors forest floor organic material that is too small to be recorded as individual pieces of DWM. Litter is the layer of freshly fallen leaves, needles, twigs, cones, detached bark, dead moss, dead lichens, and all other detached tree and plant parts that cover the forest floor (USDA Forest Service 2014). Duff is the layer below the litter, located just above the uppermost layer of mineral soil, consisting of organic material derived from the decomposition of the litter (USDA Forest Service 2014). Both biomass deposits play important roles in forest ecosystem functioning similar to those of the DWM. The Glossary provides more thorough definitions of duff and litter, while the FIA national core field guide (USDA Forest Service 2014) contains information on data collection (Brandeis et al. 2018).

Forest floor biomass deposits are important forest carbon storage pools. The FIA program reports DWM in size categories useful for monitoring carbon cycling in the forest. FWD is counted in three size classes according to its diameter (Brandeis et al. 2018). Small FWD ranges from 0.01 to 0.24 inch, medium FWD ranges from 0.25 to 0.9 inch, and large FWD ranges from 1.0 to 2.9 inches, corresponding to 1, 10, and 100-hour fuel classes. Coarse woody debris is 3.0 inches and greater in diameter, unlike the 1,000-hour fuel category which ends at 8.0 inches. Once the number of biomass tons in DWM is estimated, it is converted to tons of carbon stored, considering decay reduction factors for CWD (Brandeis et al. 2018). This conversion is described in detail in Woodall and Monleon (2008). In South Carolina,

a total of 15.3 billion tons of carbon was stored in DWM, the majority (about 66 percent) was in Unit 1 (Southern Coastal Plain) (table 13). These estimates can be broken down further into softwood volume, ownership categories, and survey units that highlight the importance of the State's loblolly-shortleaf pine forests in terms of carbon storage and sequestration (table 14). Unit 1 (Southern Coastal Plain) contains the bulk of the softwood volume in cubic feet of total carbon in DWM (FWD, CWD, and piles). Also, private ownership land holds the highest volume in all units for both tables.

The 2021 calculated amounts of DWM, litter, and duff are within a broad range of values previously recorded for South Carolina and the Southern United States. Woodall et al. (2013) provide State-level DWM estimates derived from field-based FIA measurements between 2002 and 2010 through different data collection variables (Brandeis et al. 2018). In 2010, total DWM estimates in South Carolina were 28.7 million tons (Woodall et al. 2013). The average South Carolina litter values varied from 22.3 tons per acre to 6.8 tons per acre, still within the range of the highest values ever recorded (13.4 to 33.0 tons per acre), but they are substantially higher than the average values for the Southern United States reported by Domke et al. (2013). The differentiation between duff and litter is highly variable throughout the landscape, as demonstrated by this current work and prior publications; therefore, statewide average estimates may differ significantly from those made at finer, local scales (Brandeis et al. 2018).

Table 13—Total volume of DWM (FWD, CWD, and piles) in cubic feet, on forest land by ownership class and survey unit, South Carolina, 2021

Survey unit	Total	Ownership all classes			
		USDA Forest Service	Other Federal	State and local government	Private
Unit 1 Southern Coastal Plain	10,096,496,993	0	100,565,520	0	9,995,931,472
Unit 2 Northern Coastal Plain	3,465,702,578	57,748,250	467,236	29,953,871	3,377,533,222
Unit 3 Piedmont	1,750,849,225	174,496,910	18,640,001	166,748,043	1,390,964,269
Total	15,313,048,795	232,245,160	119,672,757	196,701,915	14,764,428,963

Numbers in columns do not sum to totals due to rounding.

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

Table 14—Total softwood volume of DWM (FWD, CWD, and piles) in cubic feet, on forest land by ownership class and survey unit, South Carolina, 2021

Survey unit	Total	Ownership class			
		USDA Forest Service	Other Federal	State and local government	Private
Unit 1 Southern Coastal Plain	689,803,939	0	99,922,115	0	589,881,823
Unit 2 Northern Coastal Plain	481,407,880	27,134,475	0	0	454,273,405
Unit 3 Piedmont	485,579,101	99,095,640	0	4,933,000	381,550,461
Total	1,656,790,920	126,230,115	99,922,115	4,933,000	1,425,705,689

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

Carbon

The need for studies on forest carbon have become more in demand recently due to concerns about global climate change. The FIA program has used models or additional data sources to convert estimates from field measurements, like tree volume, to carbon and estimated carbon stored in other pools like tree roots and nontree understory vegetation. FIA used models to estimate the amount of DWM, duff, and litter carbon before doing field-based observations. The models used species mix, stand age, and geographic location as predictive factors and integrated into the larger Component Ratio Method (CRM) set of forest carbon pool estimators (Brandeis et al.

2018). EPA (2012), Smith and Heath (2002), and Woodall et al. (2011b) present details for modeling procedures for DWM and forest floor carbon. There were notable differences when the field-based estimates are compared to the model-based estimates for South Carolina in 2021. At a national level, field-based litter estimates were 44 percent lower than model-based estimates (Domke et al. 2021) and CWD, the model-based estimates, were 9 percent higher than field-based estimates (Brandeis et al. 2018).

Figure 28 presents the model-based estimates of total carbon by forest type in short tons. Results are more in line with earlier estimates making it difficult to reproduce the same categories of forest

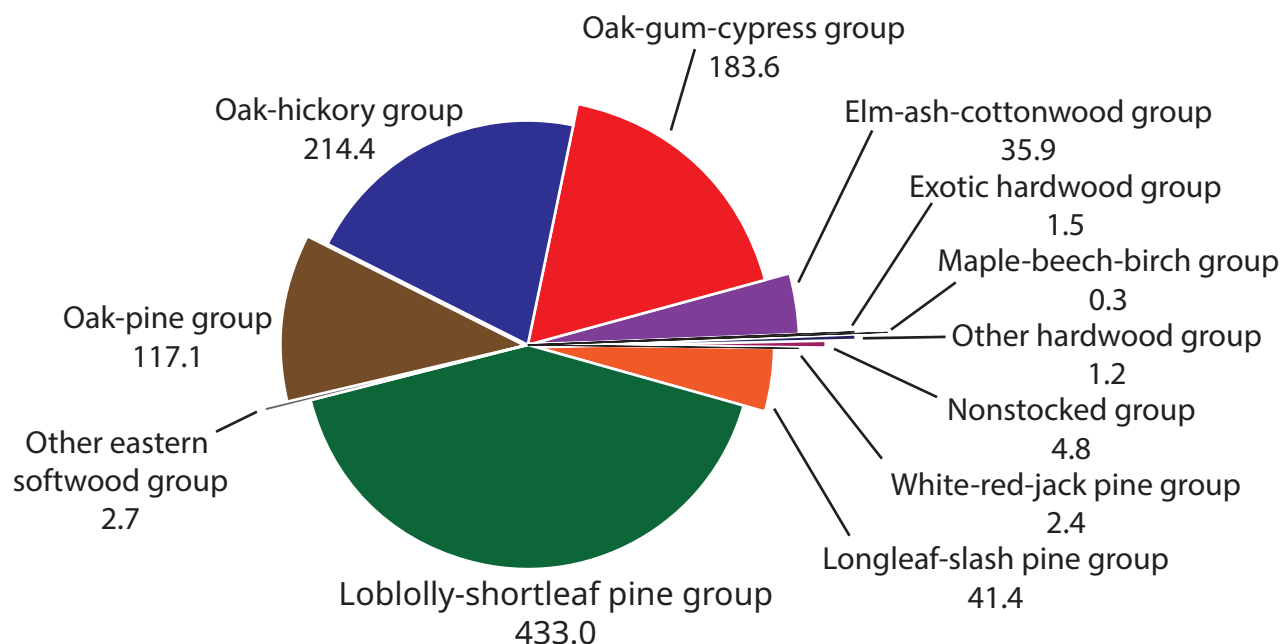


Figure 28—Total carbon, in short tons, by forest-type group, on forest land, South Carolina, 2021.

carbon produced by the models. For example, the model-based carbon estimate falls into a larger group that includes coarse tree roots and stumps. The distribution of carbon among the pools is similar, despite differences in exact amounts. Approximately half of forest carbon is stored in

forest soil and about a third of carbon is stored in aboveground portions of living trees (Brandeis et al. 2018). South Carolina's forests sequester approximately 1.04 billion short tons of carbon (table 15) with over 40 percent in the loblolly-shortleaf pine forest-type group (fig. 28).

Table 15—Total carbon in short tons on forest land by forest-type group and survey unit, South Carolina, 2021

Forest-type group	Total	Survey unit		
		Unit 1–Southern Coastal Plain	Unit 2–Northern Coastal Plain	Unit 3–Piedmont
short tons				
Eastern white pine	2,056,660	0	0	2,056,660
Eastern white pine/eastern hemlock	257,183	0	0	257,183
Eastern hemlock	46,004	0	0	46,004
Longleaf pine	35,843,168	15,190,241	20,117,141	535,786
Slash pine	5,548,145	3,359,448	2,188,696	0
Loblolly pine	415,552,977	119,322,684	159,824,797	136,405,496
Shortleaf pine	3,950,682	0	534,742	3,415,941
Virginia pine	6,536,026	0	0	6,536,026
Pond pine	6,634,324	3,499,874	3,134,449	0
Pitch pine	309,321	0	0	309,321
Eastern redcedar	2,670,180	95,189	452,092	2,122,899
Eastern white pine/northern red oak/white ash	3,096,003	0	0	3,096,003
Eastern redcedar/hardwood	2,880,833	0	116,620	2,764,213
Longleaf pine/oak	4,273,812	3,171,354	915,326	187,131
Shortleaf pine/oak	8,450,402	489,049	0	7,961,353
Virginia pine/southern red oak	4,057,041	0	0	4,057,041
Loblolly pine/hardwood	87,841,907	25,292,195	37,180,680	25,369,032
Slash pine/hardwood	856,314	0	856,314	0
Other pine/hardwood	5,656,600	1,945,431	3,501,665	209,505
Post oak/blackjack oak	7,978,832	858,940	1,129,324	5,990,569
Chestnut oak	3,556,697	0	0	3,556,697
White oak/red oak/hickory	37,548,854	2,955,113	4,852,015	29,741,726
White oak	18,890,637	1,556,533	1,179,985	16,154,118
Northern red oak	1,194,854	0	431,000	763,854
Yellow-poplar/white oak/northern red oak	21,566,780	163,949	661,858	20,740,973
Sassafras/persimmon	1,623,512	580,158	831,828	211,526

SOUTH CAROLINA'S FORESTS, 2021

Table 15—Total carbon in short tons on forest land by forest-type group and survey unit, South Carolina, 2021 (continued)

Forest-type group	Total	Survey unit		
		Unit 1–Southern Coastal Plain	Unit 2–Northern Coastal Plain	Unit 3–Piedmont
		short tons		
Sweetgum/yellow-poplar	35,138,400	5,184,739	11,391,801	18,561,861
Scarlet oak	1,003,772	0	0	1,003,772
Yellow-poplar	8,289,214	426,709	1,880,294	5,982,211
Black walnut	137,411	0	0	137,411
Black locust	268,177	0	0	268,177
Southern scrub oak	3,483,115	1,871,506	1,611,610	0
Chestnut oak/black oak/scarlet oak	8,979,172	984,580	0	7,994,592
Cherry/white ash/yellow-poplar	2,096,402	493,899	320,527	1,281,977
Elm/ash/black locust	673,543	0	128,273	545,270
Red maple/oak	1,514,774	80,254	1,098,807	335,714
Mixed upland hardwoods	60,440,602	14,074,046	16,986,951	29,379,604
Swamp chestnut oak/cherrybark oak	5,568,779	270,064	3,638,062	1,660,653
Sweetgum/Nuttall oak/willow oak	93,586,784	42,790,762	43,185,072	7,610,949
Overcup oak/water hickory	645,634	117,492	528,143	0
Baldcypress water tupelo	20,606,506	5,330,785	15,275,721	0
Sweetbay/swamp tupelo red maple	60,781,611	19,691,847	40,752,622	337,142
Baldcypress/pondcypress	2,403,557	1,839,123	564,434	0
River birch/sycamore	6,664,378	738,477	2,477,368	3,448,533
Cottonwood	96,015	0	96,015	0
Willow	2,117,161	737,673	1,126,099	253,389
Sycamore/pecan/American elm	16,350,094	1,626,833	6,983,693	7,739,568
Sugarberry/hackberry/elm/green ash	8,532,593	768,499	5,436,567	2,327,527
Red maple lowland	1,617,135	69,049	989,361	558,725
Cottonwood/willow	481,591	113,982	367,609	0
Sugar maple beech/yellow birch	230,579	0	0	230,579
Black cherry	90,156	68,719	0	21,437
Other hardwoods	1,222,975	589,273	633,702	0
Other exotic hardwoods	1,464,956	758,297	436,892	269,767
Nonstocked	4,824,845	870,481	3,348,650	605,714
Total	1,038,187,677	277,977,245	397,166,806	363,043,626

Numbers in columns do not sum to totals due to rounding.

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

Nonnative Invasive Plants

It has been acknowledged that the growing number of invasive nonnative plants may have long-term ecological effects on the forest ecosystems in the Southern United States, including South Carolina. Table 16 lists by frequency those invasive species of trees, shrubs, vines, grasses, and herbs encountered on FIA plots in South Carolina during the 2021 survey period. The list includes two distinct samples, recorded as 4.0 and 6.0, to reflect a change from FIA field manual version 4.0 guidelines (USDA Forest Service 2012) to field manual version 6.0 guidelines (USDA Forest Service 2014) between the previous and current survey cycles. The primary distinction between the two manuals is the inclusion of additional nonnative invasive species in field manual version 6.0.

Chinese tallow (*Triadica sebifera*) and Chinaberry tree (*Melia azedarach*) were the most frequently encountered nonnative tree species on sampled forested plots. Chinese/European privets (*Ligustrum* spp.) were the most common shrub species and Japanese honeysuckle (*Lonicera japonica*) was the most common vine. The most frequently detected invasive grass was Nepalese browntop (*Microstegium vimineum*) and Chinese or Sericea lespedeza (*Lespedeza cuneata*) was the most commonly encountered invasive herb on forested plots.

TIMBER PRODUCT OUTPUT AND UTILIZATION

Timber Products

A diverse forest products industry in South Carolina is made up by a variety of mills, ranging from small- to large-sized softwood and hardwood sawmills (including pole, veneer, composite, bioenergy and other miscellaneous mills) to very large pulp mills. In 2017, there were 98 primary

Table 16—Area of forest land and timberland per invasive species, South Carolina, 2021

Invasive species	Area	
	Forest land	Timberland
<i>thousand acres</i>		
Privet	207.07	206.89
Japanese honeysuckle	185.1	184.91
Nepalese browntop	103.02	101.37
Sericea lespedeza	40.64	40.62
Wisteria	22.97	22.97
Thorny olive	18.14	18.14
Chinese tallow	15.37	15.34
Oleaster	9.62	9.62
Callery pear	9.54	9.5
Japanese privet	9.23	9.23
Kudzu	8.69	8.69
Chinaberrytree	8.49	8.49
Ivy	8.13	8.13
Silktree	8.05	8.05
Tree of heaven	6.23	6.23
Lespedeza	3.48	3.48
Rose	2.68	2.68
Periwinkle	2.32	2.32
Bamboo	1.6	1.6
Sacred bamboo	1.41	1.41
Hardy orange	1.25	1.25
Princesstree	1.23	1.23
Japanese climbing fern	0.89	0.89
Lilyturf	0.45	0.45
Beale's barberry	0.13	0.13
Paper mulberry	0.07	0.07
Honeysuckle	0.01	0.01

wood using mills, 101 in 2018, 98 in 2019, 87 in 2020, and 84 in 2021. Since 2017, the total number of sawmills, pulpwood mills, and other primary wood-processing plants distributed across the State has moderately decreased (fig. 29).

This section presents estimates from industry surveys conducted in 2017, 2018, 2019, 2020, and 2021 used to determine the output for timber products and plant byproducts. Data used for this section were compiled from the National Resource Use and Monitoring (NRUM) Tools-Timber Products Output (TPO) Interactive Reporting Tool (USDA Forest Service 2023a) and National Resource Use and Monitoring-Data Download (USDA Forest Service 2023b).

Also, this section presents estimates from Forest Inventory and Analysis (FIA) Resource Use Monitoring, which includes data from South Carolina's Timber Products Output (TPO) surveys

and Harvest Utilization studies, covering the 2017–2021 period. Timber Products Output surveys are used to determine the types and amount of roundwood products (i.e., saw logs, pulpwood, plywood and veneer logs, poles, etc.) received by primary wood using mills, the county of origin, species used, and how the mills disposed of wood residues produced. Prior to 2018, FIA collected TPO information through a biennial survey of all active primary mills. From 2018 forward, data collection has been based on an annual mill sample where roughly 40 percent of active mills are sampled using a stratified sample design (Westfall et al. 2022). The sample design was implemented to provide for annualized TPO data, both to meet user needs and the requirements of the 2014 Farm Bill provisions for FIA (AREERA 1998). The surveys are used to determine the types and amount of roundwood or timber (i.e., saw logs, pulpwood, plywood and veneer, poles,

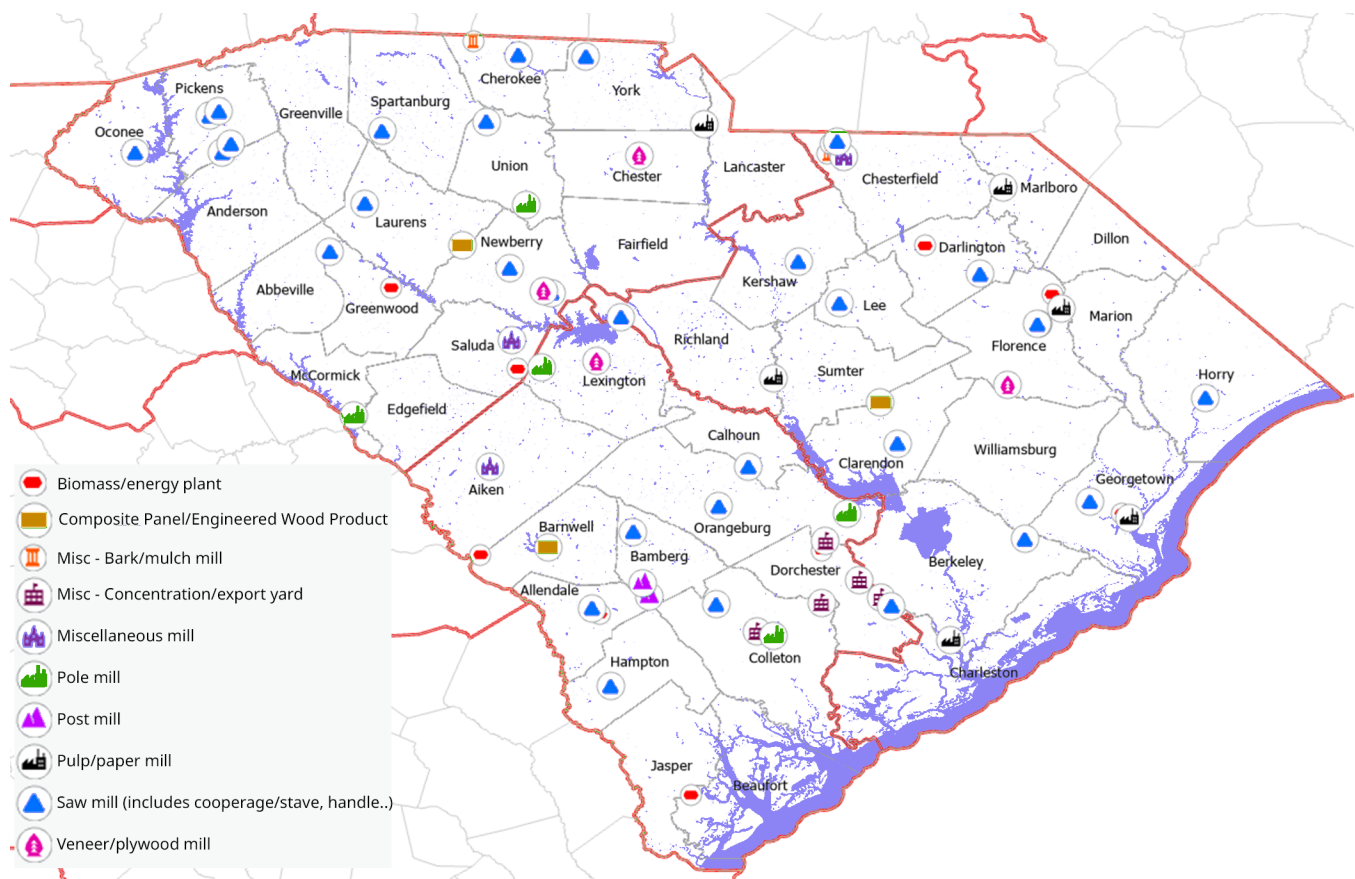


Figure 29—Timber product output primary mill map, South Carolina, 2021.

etc.) received by each mill, the county of origin, the species used, and how the mills disposed of the bark and wood residues produced. The surveys and harvest and utilization studies were conducted by SRS and SCFC personnel. These data are used to augment the FIA annual inventory of all-live timber removals to derive 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.

In 2017, volume harvested and delivered for products (including residential fuelwood) from all sources totaled 818.0 million cubic feet (29.1 million green tons) (table 17). Output volumes slightly declined in 2018 to 810.5 million cubic feet (28.9 million green tons) then slightly increased in 2019 to 825.3 million cubic feet (29.4 million green tons). Output volumes moderately decreased in 2020 to 769.9 million cubic feet (27.3 million green tons) and moderately increased in 2021 to 894.0 million cubic feet (31.6 million green tons). Volume harvested for softwood products in 2017 totaled 696.0 million cubic feet (24.4 million green tons) and accounted for 85 percent of the total industrial product volume and the volume slightly decreased in 2018 to 690.2 million cubic feet (24.3 million green tons). In 2019, there was a slight increase from the 2018 output softwood volume totals to 696.8 million cubic feet (24.4 million green tons). Volume harvested for softwood products decreased in 2020 to 669.4 million cubic feet (23.4 million green tons). Volume harvested for softwood products rebounded to a reporting period high in 2021 to 792.0 million cubic feet (27.7 million green tons). The percentage of softwood roundwood harvested increased to a high of 89 percent in 2021. Volume of total roundwood harvested for products generally increased over the report period for softwood roundwood. Hardwood output volume showed more volatility for the report period, but trended downward overall, from 111.6 million cubic feet (4.3 million green tons) in 2017 to 91.7 million cubic feet (3.5 million green tons) in 2021.

The total number of sawmills moderately declined (36 to 31) from 2017 to 2020, and there was no change from 2020 to 2021 with 31 sawmills. Saw-log output increased each year, from 264.4 million cubic feet in 2017 to 390.2 million cubic feet in 2021. Saw-log output increased 32 percent over the 2017–2021 report period and 86 percent from 2013 to 2021. At 369.9 million cubic feet (12.9 million green tons) softwoods accounted for 95 percent of saw-log output volume and hardwood output volume totaled 20.3 million cubic feet (763.3 million green tons) in 2021 (table 17). Sawn products were the leading product produced in the State for 2020 and 2021. The 31 sawmills in the State accounted for 41 percent and 44 percent of the total product output in 2020 and 2021, respectively.

Volume harvested for pulpwood production in 2017 totaled 360.4 million cubic feet (13.2 million green tons) and ranged from a high of 361.7 million cubic feet (13.2 million green tons) in 2019 to a low of 291.5 million cubic feet (10.6 million green tons) in 2020 (table 17). Over the 2017–2021 report period, the amount of roundwood used for pulp generally decreased and the State maintained seven pulp mills during the reporting period. From 2017 to 2019, pulpwood was the leading product produced in the State, supplanted by sawn products in 2020 and 2021. From 2017 through 2019 pulpwood accounted for 44 percent of the total product output for the State, dropping to 38 and 35 percent for 2020 and 2021, respectively. Softwood pulpwood production peaked at 294.1 million cubic feet (10.6 million green tons) in 2017. From 2018 to 2021, softwood pulpwood production generally decreased from 291.5 million cubic feet (10.5 million green tons) in 2018 to 257.4 million cubic feet (9.2 million green tons) in 2021. Softwood pulpwood production was lowest in 2020 at 234.0 million cubic feet (8.4 million green tons). The proportion of softwood roundwood used for pulpwood production was stable for the 2017–2021 report period, ranging from 79 to 82 percent. Hardwood pulpwood production in 2017 totaled 66.3 million cubic feet (2.6 million green tons) and generally decreased during the 2017–2021 period.

SOUTH CAROLINA'S FORESTS, 2021

Table 17—Output of industrial roundwood products by product, species group, and year, South Carolina, 2017–2021

Product	Species group	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
<i>thousand cubic feet</i>						<i>green tons</i>					
Saw logs	Softwood	241,833	256,439	265,025	298,929	369,924	8,407,363	8,912,727	9,207,728	10,384,739	12,860,524
	Hardwood	22,583	20,524	19,998	16,733	20,270	855,593	774,118	753,511	632,450	763,334
	Total	264,416	276,963	285,023	315,662	390,194	9,262,956	9,686,845	9,961,239	11,017,189	13,623,858
Veneer logs	Softwood	29,994	32,951	26,793	28,786	33,768	1,036,936	1,139,172	926,279	995,146	1,167,408
	Hardwood	2,468	2,482	1,076	520	255	94,771	94,869	41,061	20,021	9,816
	Total	32,462	35,433	27,869	29,306	34,023	1,131,707	1,234,041	967,340	1,015,167	1,177,224
Pulpwood	Softwood	294,059	291,454	285,011	233,988	257,355	10,550,798	10,454,934	10,219,698	8,381,297	9,222,610
	Hardwood	66,345	66,070	76,734	57,544	55,424	2,609,075	2,590,013	3,006,135	2,250,785	2,172,890
	Total	360,404	357,524	361,745	291,532	312,779	13,159,873	13,044,947	13,225,833	10,632,082	11,395,500
Composite panel	Softwood	61,831	47,392	63,396	55,051	58,932	2,148,537	1,646,996	2,202,979	1,913,069	2,048,016
	Hardwood	266	555	312	55	104	10,444	21,595	12,134	2,011	3,787
	Total	62,097	47,947	63,708	55,106	59,036	2,158,981	1,668,591	2,215,113	1,915,080	2,051,803
Bioenergy/ fuelwood	Softwood	50,889	46,641	35,996	31,871	51,959	1,784,408	1,635,471	1,262,200	1,117,559	1,821,931
	Hardwood	19,373	18,903	19,362	14,108	14,246	718,462	701,056	718,061	523,221	528,342
	Total	70,262	65,544	55,358	45,979	66,205	2,502,870	2,336,527	1,980,261	1,640,780	2,350,273
Poles, Posts, Pilings	Softwood	11,465	12,935	18,444	18,819	18,110	343,945	388,028	553,304	564,554	543,272
	Hardwood	0	0	0	0	0	0	0	0	0	0
	Total	11,465	12,935	18,444	18,819	18,110	343,945	388,028	553,304	564,554	543,272
Miscellaneous ¹	Softwood	5,934	2,410	2,179	1,993	1,907	163,611	84,341	76,249	69,742	66,737
	Hardwood	599	1,380	617	1,187	1,405	22,478	51,761	23,140	44,495	52,677
	Total	6,533	3,790	2,796	3,180	3,312	186,089	136,102	99,389	114,237	119,414
Total (Industrial)	Softwood	696,005	690,222	696,844	669,437	791,955	24,435,598	24,261,669	24,448,437	23,426,106	27,730,498
	Hardwood	111,634	109,914	118,099	90,147	91,704	4,310,823	4,233,412	4,554,042	3,472,983	3,530,846
	Total	807,639	800,136	814,943	759,584	883,659	28,746,421	28,495,081	29,002,479	26,899,089	31,261,344
Residential fuelwood ²	Undifferentiated	10,336	10,336	10,336	10,336	10,336	387,600	387,600	387,600	387,600	387,600
	Total	10,336	10,336	10,336	10,336	10,336	387,600	387,600	387,600	387,600	387,600
Total	Softwood	696,005	690,222	696,844	669,437	791,955	24,435,598	24,261,669	24,448,437	23,426,106	27,730,498
	Hardwood	111,634	109,914	118,099	90,147	91,704	4,310,823	4,233,412	4,554,042	3,472,983	3,530,846
	Undifferentiated	10,336	10,336	10,336	10,336	10,336	387,600	387,600	387,600	387,600	387,600
	Total	817,975	810,472	825,279	769,920	893,995	29,134,021	28,882,681	29,390,079	27,286,689	31,648,944

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

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

¹ Includes mulch, shavings, and other miscellaneous products.² Residential fuelwood volume from the latest U.S. Dept. of Energy estimates.

Hardwood pulpwood production decreased 16 percent from 2017 to 55.4 million cubic feet (2.2 million green tons) in 2021.

Volume harvested for veneer products in 2017 totaled 32.5 million cubic feet (1.1 million green tons). Veneer production was relatively flat during the 2017–2021 period, from a high of 35.4 million cubic feet in 2018 to a low of 27.9 million cubic feet in 2019. In 2021, volume harvested for veneer increased 5 percent from 2017 and increased 16 percent from the previous year's totals to 34.0 million cubic feet (1.2 million green tons) and accounted for 4 percent of total products for the State.

Volume harvested for composite panel products in 2017 totaled 62.1 million cubic feet (2.2 million green tons) and was generally flat from 2017 through 2021. The peak year for composite panel production was 2019 at 63.7 million cubic feet (2.2 million green tons). In 2021, volume harvested for composite panels decreased 5 percent from 2017 totals to 59.0 million cubic feet (2.1 million green tons) and accounted for 7 percent of total roundwood products for the State.

Volume harvested for poles, posts, and pilings in 2017 totaled 11.5 million cubic feet (344,000 green tons), or 1 percent of the State's total product output. For the 2017–2021 report period, posts, poles, and pilings product volume increased to a peak of 18.8 million cubic feet (565,000 green tons) in 2020 and decreased 4 percent from 2020 to 2021 to 18.1 million cubic feet (543,000 green tons). The volume harvested for poles, posts, and pilings increased 37 percent over the 2017–2021 period and increased 76 percent from 2013 to 2021. From 2018 through 2021, volume harvested for posts, poles, and pilings accounted for 2 percent of total roundwood products for the State.

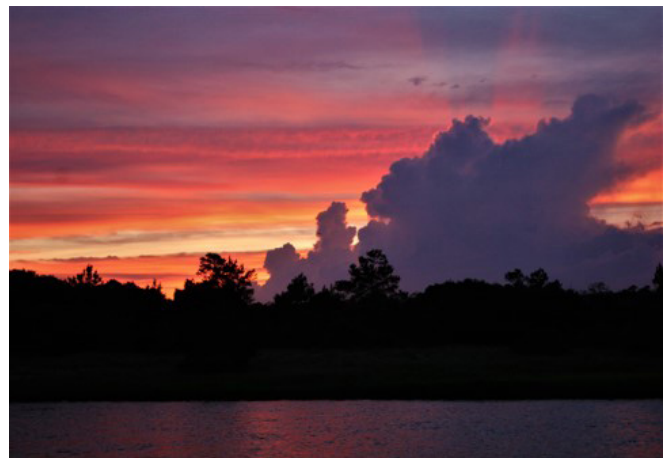
Volume used for bioenergy and commercial fuelwood totaled 70.3 million cubic feet (2.5 million green tons) and accounted for 9 percent of total product output in 2017, the peak for the 2017–2021 report period. Bioenergy and commercial

fuelwood production slightly decreased over the 2017–2021 report period. In 2020, biofuel and commercial fuelwood production was the lowest for the report period at 46.0 million cubic feet (1.6 million green tons) and 6 percent of total product output. Use of roundwood for bioenergy and commercial fuelwood production decreased 6 percent from 2017 to 2021.

Volume harvested for other roundwood products, including mulch and shavings, totaled 6.5 million cubic feet (186,000 green tons) and accounted for <1 percent of total product output in 2017. Other industrial production was 3.3 million cubic feet (119,000 green tons) and <1 percent of total product output in 2021. Other industrial production decreased 49 percent from 2017 to 2021.

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, 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.



Marsh sunset on Pawley's Island SC 2020, Georgetown County, SC. (USDA Forest Service photo by Sam Lambert)

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

Figure 30 depicts mill residue volume by roundwood and residue type. Data on mill residue production and disposal generated from the 2017 through 2021 forest industry surveys indicated 68.6 million cubic feet of wood residue was generated from primary processors in 2017. This total gradually decreased each year to 61.0 million cubic feet in 2020, but rebounded to 70.9 million cubic feet in 2021. The most recent survey in 2021 showed sawmills generated most of the mill residue produced totaling 207.9 million cubic feet. In 2021, bark accounted for 70.9 million cubic feet (27 percent), coarse residues accounted for 103.2 million cubic feet (39 percent), and sawdust and shavings accounted for 90.5 million cubic feet (34 percent) of mill residue produced. Residue totals show the largest increase, 17 percent, for all residue types from 2020 to 2021. Overall roundwood residue increased 23 percent from the 2017 total of 204.5 million cubic feet to 264.6 million cubic feet in 2021 (table 18).

In 2017, 108.0 million cubic feet (53 percent) of mill residue produced was used for industrial fuel either at pulp mills for boiler fuel or at sawmills for dry kiln operations, pellets, or residential fuelwood (table 19). From 2017 to 2020 this total was stable, with 107.3 million cubic feet used for industrial fuel in 2020. There was a significant increase of 19 percent from the 2020 total (107.3 million cubic feet) to the 2021 total (132.9 million cubic feet). Bark and fine residues, at 56.0 and 70.4 million cubic feet, respectively, accounted for 95 percent of mill residue utilized for industrial fuel in 2021 which aligns with the average of 95 percent for the 2017–2020 period. In 2021, 79 percent of bark residue produced was utilized for fuel, with the remainder of the utilized bark going for miscellaneous products or not used. During 2017, 2018, 2019, 2020 and 2021; 91, 91, 88, 96 and 90 percent of the coarse residue produced was utilized for fiber products, respectively. Bark and wood residues not utilized accounted for <2 percent of all residues produced in the 2017–2021 report period.

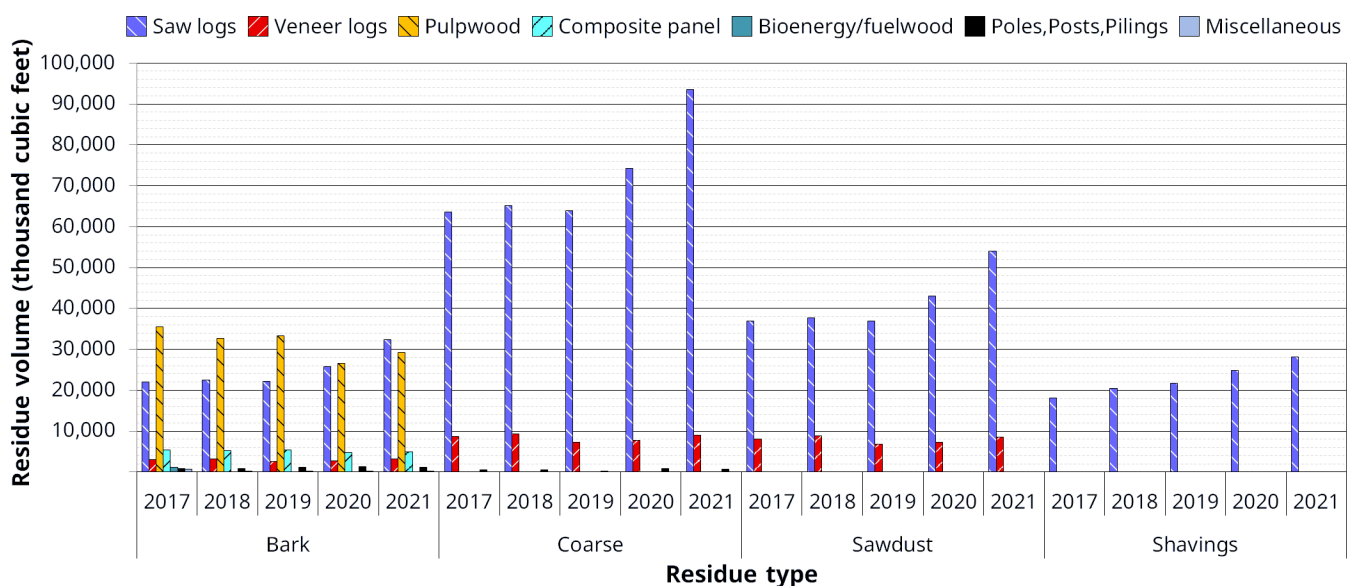


Figure 30—Timber product output, primary mill residue volume by roundwood and residue type, South Carolina, 2017–2021.

Table 18—Primary mill residue volume by roundwood type, species group, and residue type, South Carolina, 2017–2021

Roundwood type and species group	All types					Residue type																				
						Bark					Coarse					Sawdust					Shavings					
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	
thousand cubic feet																										
Saw logs	Softwood	131,732	139,572	139,305	159,292	203,254	20,461	21,462	21,192	24,222	31,569	59,096	61,986	61,206	69,959	91,177	34,051	35,717	35,267	40,311	52,453	18,124	20,407	21,640	24,800	28,055
	Hardwood	8,922	6,198	5,256	8,552	4,657	1,565	1,087	922	1,500	817	4,483	3,114	2,641	4,297	2,340	2,874	1,997	1,693	2,755	1,500	0	0	0	0	0
	Total	140,654	145,770	144,561	167,844	207,911	22,026	22,549	22,114	25,722	32,386	63,579	65,100	63,847	74,256	93,517	36,925	37,714	36,960	43,066	53,953	18,124	20,407	21,640	24,800	28,055
Veneer logs	Softwood	18,141	20,243	16,137	17,504	20,490	2,743	3,061	2,440	2,647	3,098	7,922	8,840	7,047	7,644	8,948	7,476	8,342	6,650	7,213	8,444	0	0	0	0	0
	Hardwood	1,602	1,218	378	267	78	248	189	59	41	12	712	541	168	119	35	642	488	151	107	31	0	0	0	0	0
	Total	19,743	21,461	16,515	17,771	20,568	2,991	3,250	2,499	2,688	3,110	8,634	9,381	7,215	7,763	8,983	8,118	8,830	6,801	7,320	8,475	0	0	0	0	0
Pulpwood	Softwood	27,495	25,200	24,941	20,147	22,653	27,495	25,200	24,941	20,147	22,653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardwood	7,949	7,437	8,427	6,455	6,619	7,949	7,437	8,427	6,455	6,619	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	35,444	32,637	33,368	26,602	29,272	35,444	32,637	33,368	26,602	29,272	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Composite panel	Softwood	5,419	5,213	5,403	4,684	4,938	5,419	5,213	5,403	4,684	4,938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardwood	26	55	27	0	0	26	55	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5,445	5,268	5,430	4,684	4,938	5,445	5,268	5,430	4,684	4,938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bioenergy/fuelwood	Softwood	1,013	0	0	0	0	1,013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardwood	107	0	0	0	0	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	1,120	0	0	0	0	1,120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poles, Posts, Pilings	Softwood	1,407	1,363	1,441	2,094	1,890	818	829	1,219	1,275	1,146	589	534	222	819	744	0	0	0	0	0	0	0	0	0	0
	Hardwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	1,407	1,363	1,441	2,094	1,890	818	829	1,219	1,275	1,146	589	534	222	819	744	0	0	0	0	0	0	0	0	0	0
Miscellaneous ¹	Softwood	717	71	113	13	58	717	71	113	13	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	717	71	113	13	58	717	71	113	13	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	Softwood	185,924	191,662	187,340	203,734	253,283	58,666	55,836	55,308	52,988	63,462	67,607	71,360	68,475	78,422	100,869	41,527	44,059	41,917	47,524	60,897	18,124	20,407	21,640	24,800	28,055
	Hardwood	18,606	14,908	14,088	15,274	11,354	9,895	8,768	9,435	7,996	7,448	5,195	3,655	2,809	4,416	2,375	3,516	2,485	1,844	2,862	1,531	0	0	0	0	0
	Total	204,530	206,570	201,428	219,008	264,637	68,561	64,604	64,743	60,984	70,910	72,802	75,015	71,284	82,838	103,244	45,043	46,544	43,761	50,386	62,428	18,124	20,407	21,640	24,800	28,055

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

¹ Includes mulch, shavings, and other industrial products.

Table 19—Disposal of residue at primary wood-using plants by product, species group, and type of residue, South Carolina, 2017–2021

Product and species group	All types					Bark					Coarse					Fines (Sawdust & Shavings)					
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	
thousand cubic feet																					
Fiber products	Softwood	72,141	76,076	72,292	86,595	101,175	0	0	0	0	0	61,711	64,795	60,387	75,597	92,229	10,430	11,281	11,905	10,998	8,946
	Hardwood	4,392	3,432	2,575	4,282	500	0	0	0	0	0	4,392	3,432	2,575	4,282	500	0	0	0	0	0
	Total	76,533	79,508	74,867	90,877	101,675	0	0	0	0	0	66,103	68,227	62,962	79,879	92,729	10,430	11,281	11,905	10,998	8,946
Industrial fuel	Softwood	96,118	100,588	98,269	99,208	125,895	46,757	47,682	46,098	45,656	49,348	5,658	5,454	6,863	1,648	6,524	43,703	47,452	45,308	51,904	70,023
	Hardwood	11,887	10,406	10,379	8,098	7,018	8,440	7,916	8,672	6,499	6,631	365	223	89	119	35	3,082	2,267	1,618	1,480	352
	Total	108,005	110,994	108,648	107,306	132,913	55,197	55,598	54,770	52,155	55,979	6,023	5,677	6,952	1,767	6,559	46,785	49,719	46,926	53,384	70,375
Miscellaneous	Softwood	17,527	14,965	16,398	17,422	26,164	11,779	8,122	9,065	7,289	14,065	153	1,111	1,042	785	2,115	5,595	5,732	6,291	9,348	9,984
	Hardwood	1,863	1,070	918	2,872	174	1,382	852	738	1,495	174	228	0	0	0	0	253	218	180	1,377	0
	Total	19,390	16,035	17,316	20,294	26,338	13,161	8,974	9,803	8,784	14,239	381	1,111	1,042	785	2,115	5,848	5,950	6,471	10,725	9,984
Not used	Softwood	229	32	383	509	50	131	32	145	44	50	85	0	185	392	0	13	0	53	73	0
	Hardwood	464	0	217	22	3,662	73	0	25	3	642	209	0	145	14	1,840	182	0	47	5	1,180
	Total	693	32	600	531	3,712	204	32	170	47	692	294	0	330	406	1,840	195	0	100	78	1,180
All products	Softwood	186,015	191,661	187,342	203,734	253,284	58,667	55,836	55,308	52,989	63,463	67,607	71,360	68,477	78,422	100,868	59,741	64,465	63,557	72,323	88,953
	Hardwood	18,606	14,908	14,089	15,274	11,354	9,895	8,768	9,435	7,997	7,447	5,194	3,655	2,809	4,415	2,375	3,517	2,485	1,845	2,862	1,532
	Total	204,621	206,569	201,431	219,008	264,638	68,562	64,604	64,743	60,986	70,910	72,801	75,015	71,286	82,837	103,243	63,258	66,950	65,402	75,185	90,485

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

Land-Use Removals

Land removals (land clearing or set aside forest land), or removal volume attributed to land-use change, accounted for 1–3 percent of total removals for each year surveyed 2017–2021 (table 20). The volume of land use removals declined each year during the report period, ranging from 26.9 million cubic feet in 2017 to 14.5 million cubic feet in 2021. The nonmerchantable (nongrowing stock) portion of live trees accounted for 65 percent of land-use change removals for the entire 2017–2021 reporting period. The hardwood species group accounted for 47 to 64 percent of the land-use change removals from 2017 to 2021.

Logging Residue

The merchantable (growing stock) portions of trees cut and left onsite are underutilized removals by FIA merchantability standards, while the nonmerchantable (nongrowing stock) 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. Under-utilization and over-utilization factors used to determine average annual logging residue estimates used in this section were derived from estimates in the South Carolina harvest and utilization studies conducted from 2017 through 2021. Logging residue was considered a possible source for bioenergy and other timber products during recent years. It is important to keep in mind that logging residue, traditionally, had no 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.

Woody material typically left on a logging site includes whole trees ≥ 5 inches diameter at breast height (d.b.h.), or portions of the merchantable boles of severed trees broken and left during the felling operation (merchantable); small trees, <5 inches d.b.h., damaged or killed during harvesting operations (nonmerchantable); and residual stump portions, tops, and limbs or forks not

utilized because of insufficient size or quality to fit on the trailers (nonmerchantable). 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, FIA field crews identify the volume of whole trees cut and not utilized during the remeasurement phase of the inventory. A removal volume is derived for trees that are classified in this category. Second, under-utilization 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.

The total removal volume is made up of volume from the merchantable and nonmerchantable portions of removal trees. Over-utilization 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.

The logging residue volume in South Carolina for 2017 totaled 164.6 million cubic feet showing an increase to 169.8 million cubic feet in 2018, increasing to 173.6 million cubic feet in 2019, decreasing to 164.5 million cubic feet in 2020, and decreasing to 158.3 million cubic feet in 2021 (table 20). This volume accounted for <17 percent of total timber removals for the previously stated survey years. During 2017, logging residue from the merchantable portion of all-live removals totaled 55.9 million cubic feet, or 34 percent of total logging residue. Logging residue from the

SOUTH CAROLINA'S FORESTS, 2021

Table 20—Volume of timber removals by year, species group, removals class, and source, South Carolina, 2017–2021

Year	Units	Species group	Roundwood products			Logging residues			Other removals			All removals		
			Growing stock	Non-growing stock	All sources	Growing stock	Non-growing Stock	All sources	Growing stock	Non-growing Stock	All sources	Growing stock	Non-growing Stock	All sources
2017	<i>thousand cubic feet</i>	Softwood	627,235	68,770	696,005	35,942	74,800	110,742	3,738	7,779	11,517	666,915	151,349	818,264
		Hardwood	105,816	5,819	111,635	20,007	33,849	53,856	5,732	9,697	15,429	131,555	49,365	180,920
		Total	733,051	74,589	807,640	55,949	108,649	164,598	9,470	17,476	26,946	798,470	200,714	999,184
	<i>green tons</i>	Softwood	22,010,078	2,425,520	24,435,598	1,257,980	2,617,983	3,875,963	130,821	272,251	403,072	23,398,879	5,315,754	28,714,633
		Hardwood	4,086,352	224,471	4,310,823	750,149	1,269,325	2,019,474	214,940	363,650	578,590	5,051,441	1,857,446	6,908,887
		Total	26,096,430	2,649,991	28,746,421	2,008,129	3,887,308	5,895,437	345,761	635,901	981,662	28,450,320	7,173,200	35,623,520
	<i>thousand cubic feet</i>	Softwood	625,489	64,732	690,221	35,417	73,707	109,124	4,029	8,386	12,415	664,935	146,825	811,760
		Hardwood	104,153	5,760	109,913	22,532	38,121	60,653	6,395	10,820	17,215	133,080	54,701	187,781
		Total	729,642	70,492	800,134	57,949	111,828	169,777	10,424	19,206	29,630	798,015	201,526	999,541
	<i>green tons</i>	Softwood	21,977,432	2,284,237	24,261,669	1,239,607	2,579,749	3,819,356	141,031	293,501	434,532	23,358,070	5,157,487	28,515,557
		Hardwood	4,011,643	221,768	4,233,411	844,950	1,429,547	2,274,497	239,812	405,731	645,543	5,096,405	2,057,046	7,153,451
		Total	25,989,075	2,506,005	28,495,080	2,084,557	4,009,296	6,093,853	380,843	699,232	1,080,075	28,454,475	7,214,533	35,669,008
2019	<i>thousand cubic feet</i>	Softwood	637,337	59,507	696,844	35,418	73,709	109,127	3,968	8,259	12,227	676,723	141,475	818,198
		Hardwood	111,720	6,379	118,099	23,937	40,498	64,435	4,584	7,756	12,340	140,241	54,633	194,874
		Total	749,057	65,886	814,943	59,355	114,207	173,562	8,552	16,015	24,567	816,964	196,108	1,013,072
	<i>green tons</i>	Softwood	22,349,174	2,099,263	24,448,437	1,239,640	2,579,816	3,819,456	138,893	289,051	427,944	23,727,707	4,968,130	28,695,837
		Hardwood	4,308,203	245,839	4,554,042	897,633	1,518,680	2,416,313	171,908	290,846	462,754	5,377,744	2,055,365	7,433,109
		Total	26,657,377	2,345,102	29,002,479	2,137,273	4,098,496	6,235,769	310,801	579,897	890,698	29,105,451	7,023,495	36,128,946
	<i>thousand cubic feet</i>	Softwood	616,669	52,768	669,437	33,592	69,909	103,501	3,568	7,426	10,994	653,829	130,103	783,932
		Hardwood	85,370	4,777	90,147	22,653	38,326	60,979	3,631	6,143	9,774	111,654	49,246	160,900
		Total	702,039	57,545	759,584	56,245	108,235	164,480	7,199	13,569	20,768	765,483	179,349	944,832
	<i>green tons</i>	Softwood	21,567,148	1,858,957	23,426,105	1,175,734	2,446,822	3,622,556	124,885	259,898	384,783	22,867,767	4,565,677	27,433,444
		Hardwood	3,289,049	183,934	3,472,983	849,493	1,437,233	2,286,726	136,151	230,350	366,501	4,274,693	1,851,517	6,126,210
		Total	24,856,197	2,042,891	26,899,088	2,025,227	3,884,055	5,909,282	261,036	490,248	751,284	27,142,460	6,417,194	33,559,654
2021	<i>thousand cubic feet</i>	Softwood	722,599	69,355	791,954	32,517	67,671	100,188	1,697	3,532	5,229	756,813	140,558	897,371
		Hardwood	86,987	4,716	91,703	21,584	36,517	58,101	3,429	5,801	9,230	112,000	47,034	159,034
		Total	809,586	74,071	883,657	54,101	104,188	158,289	5,126	9,333	14,459	868,813	187,592	1,056,405
	<i>green tons</i>	Softwood	25,288,627	2,441,871	27,730,498	1,138,092	2,368,486	3,506,578	59,399	123,616	183,015	26,486,118	4,933,973	31,420,091
		Hardwood	3,349,119	181,727	3,530,846	809,403	1,369,406	2,178,809	128,574	217,530	346,104	4,287,096	1,768,663	6,055,759
		Total	28,637,746	2,623,598	31,261,344	1,947,495	3,737,892	5,685,387	187,973	341,146	529,119	30,773,214	6,702,636	37,475,850

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

merchantable portion of all-live tree removals gradually increased each year of the reporting period from 57.9 million cubic feet (34 percent of total logging residue) in 2018 to 59.4 million cubic feet (34 percent of total logging residue) in 2019. Logging residue from the merchantable portion of all-live tree removals decreased to 56.2 million cubic feet (34 percent of total logging residue) in 2020 and 54.1 million cubic feet (34 percent of total logging residue) in 2021. The merchantable portion of logging residue for both softwood and hardwood combined accounted for about 6 percent of total live removals for those survey periods. For softwoods, the merchantable portion of logging residue accounted for 4 percent of

the total softwood all-live tree removals for the 2017–2021 surveys. The merchantable portion of hardwood logging residue proportion remained stable at 37 percent for 2017, 2018, 2019, 2020 and 2021 (20.0, 22.5, 23.9, 22.7, and 21.6 million cubic feet, respectively). Nonmerchantable sources (such as the residual stump, forks, tops, and limbs) accounted for 108.6 million cubic feet, or 66 percent of total logging residue in 2017. This percentage was steady at 66 percent each year from 2017 through 2021, and the amount produced increased to 111.8 million cubic feet in 2018, 114.2 million cubic feet in 2019, decreased to 108.2 million cubic feet in 2020, and 104.2 million cubic feet in 2021.

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GLOSSARY

Note: TPO definitions are indicated by an asterisk (*).

All-live tree—All living trees. All size classes, all tree classes, and both saw-log and nonsaw-log species are included. See: FIA tree species list in the field manual.

Average annual mortality—Average annual volume of trees ≥ 5.0 inches d.b.h. that died from human and natural causes during the intersurvey period, excluding those removed by harvesting, cultural operations, land clearing, or changes in land use.

Average annual removals—Average annual volume of trees ≥ 5.0 inches d.b.h. removed from the inventory by harvesting, cultural operations (such as timber-stand improvement), land clearing, or changes in land use during the intersurvey period.

Average net annual growth—Average annual net change in volume of trees ≥ 5.0 inches d.b.h./d.r.c. without taking into account losses from cutting (gross growth minus mortality) during the intersurvey period.

Biomass—For the southern region, total aboveground biomass is estimated using allometric equations and is defined as the aboveground weight of wood and bark in live trees ≥ 1.0 inch d.b.h./d.r.c. from the ground to the tip of the tree, excluding all foliage (leaves, needles, buds, fruit, and limbs < 0.5 inch in diameter). Biomass is expressed as oven-dry weight and the units are tons.

Note: The weight of wood and bark in limbs < 0.5 inch in diameter is included in the biomass of small-diameter trees.

Additionally, biomass in the merchantable stem is estimated regionally, where the main and merchantable stems are defined as follows.

Main stem—The central portion of the tree extending from the ground level to the tip

for timber species. Woodland species include from ground level to the tips of all branches of qualifying stems. For timber species trees that fork, the main stem refers to the fork that would yield the most merchantable volume.

Merchantable stem—That portion of the main stem of a timber species tree from a 1-foot stump to a minimum 4-inch top diameter inside or outside bark depending on species. That portion of a woodland species tree from the d.r.c. measurements to the 1.5-inch diameters of all the qualifying stems.

Nationally, aboveground and belowground biomass is estimated from each tree's sound volume using a Component Ratio Method that is consistently applied in all FIA regions.

Gross aboveground biomass—Total tree biomass excluding foliage and roots with no deductions made for rotten, missing, or broken-top cubic-foot cull.

Net aboveground biomass—Gross aboveground biomass minus deductions for missing cull, broken-top, and a reduction for a proportion of rotten cull for live or standing dead trees ≥ 5.0 inches d.b.h. (Rotten cull will have a factor to reduce specific gravity separately from sound wood.) Live and standing dead trees 1.0 to 4.9 inches only have deductions for broken-top cull. Additional deductions are made for dead trees ≥ 1.0 inch using decay class.

Belowground biomass—Coarse roots only.

Further, the total net aboveground biomass estimated using the Component Ratio Method is divided into the following components:

Top—That portion of the main stem of a timber species tree above the 4-inch top diameter. For woodland species, this component of the biomass is included with branches.

Branches—All the branches of a timber species tree excluding the main stem. That portion of all the branches of qualifying stems of woodland species above the 1.5-inch diameter ends.

Bole—See: Merchantable stem.

Stump—That portion of timber species below 1 foot to ground level. That portion of woodland species from all the d.r.c. measurements to ground level.

***Board foot**—A unit of measure applied to lumber that is 1-foot long, 1-foot wide, and 1-inch thick (or its equivalent) and associated with roundwood as to its potential yield of such products.

Bole—Trunk or main stem of a tree. (See: Main stem.)

***Byproducts**—Primary wood products, e.g., pulp chips, animal bedding, and fuelwood, recycled from mill residues.

Census water—See: Land use.

Coarse woody debris (CWD)—Downed, dead tree and shrub boles, large limbs, and other woody pieces with a minimum small-end diameter of ≥ 3 inches and a length of ≥ 3 feet not attached to a living or standing dead source.

Components of change—Volume increment and decrement values that explain the change in inventory between two points in time. Components of change are usually expressed in terms of growing-stock or all-live merchantable volume. These components can be expressed as average annual values by dividing the component by the number of years in the measurement cycle. FIA inventories are designed to measure net change over time, as well as the individual components of change that constitute net change (e.g., growth, removals, mortality). Change estimates are computed for two sequential measurements of each inventory panel. Upon remeasurement, a new initial inventory is

established for remeasurement at the next scheduled inventory. As such, computation of change components is not intended to span more than one inventory cycle. Rather, the change estimation process is repeated cycle by cycle. This simplifies field protocols and ensures that change estimation is based on short and relatively constant time intervals (e.g., 5 years). Change estimates for individual panels are combined across multiple panels in the same manner as panels are combined to obtain current inventory parameters such as total standing volume. FIA recognizes the following components of change as prescribed core variables; they usually are expressed in terms of growing-stock or all-live volume, where t is the initial inventory of a measurement cycle, and $t + 1$ is the terminal inventory:

Cut—The volume of trees cut between time t and time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval (includes cut growth). Tree size at the midpoint is modeled from tree size at time t . Trees felled or killed in conjunction with a harvest or silvicultural operation (whether they are utilized or not) are included, but trees on land diverted from forest to nonforest (diversions) are excluded.

Cut growth—The growth of cut trees between time t and the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time t . This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold prior to being cut.

Diversion—The volume of trees on land diverted from forest to nonforest (or, for some analyses, this may also include land diverted to reserved forest land and other forest land), whether utilized or not, between time t and time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval (includes diversion growth). Tree size at the midpoint is modeled from tree size at time t .

Diversion growth—The growth of diversion trees from time t to the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time t . This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold prior to diversion.

Growth on ingrowth—The growth on trees between the time they grow across the minimum d.b.h./d.r.c. threshold and time $t + 1$.

Ingrowth—The volume of trees at the time that they grow across the minimum d.b.h./d.r.c. threshold between time t and time $t + 1$. The estimate is based on the size of trees at the d.b.h./d.r.c. threshold which is 1.0 inch for all-live trees and 5.0 inches for growing-stock trees. This term also includes trees that subsequently die (i.e., ingrowth mortality), are cut (i.e., ingrowth, cut), or diverted to nonforest (i.e., ingrowth diversion), as well as trees that achieve the minimum threshold after an area reverts to a forest land use (i.e., reversion ingrowth).

Mortality—The volume of trees that die from human or natural causes between time t and time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval (includes mortality growth). Tree size at the midpoint is modeled from tree size at time t .

Mortality growth—The growth of trees that died from human or natural causes between time t and the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time t . This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold prior to mortality.

Reversion—The volume of trees on land that reverts from a nonforest land use to a forest land use (or, for some analyses, land that reverts from any source to timberland)

between time t and time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval. Tree size at the midpoint is modeled from tree size at time $t + 1$.

Reversion growth—The growth of reversion trees from the midpoint of the measurement interval to time $t + 1$. Tree size at the midpoint is modeled from tree size at time $t + 1$. This term also includes the subsequent growth on ingrowth trees that achieve the minimum diameter threshold after reversion.

Survivor growth—The growth on trees tallied at time t that survive until time $t + 1$.

The following components of change may be used to further quantify changes in growing-stock (but not all-live) volume:

Cull decrement—The net gain in growing-stock volume due to reclassification of cull trees to growing-stock trees between two surveys. Cull decrement is the volume of trees that were cull at time t but growing stock at time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval. Tree size at the midpoint can be modeled from tree at time t , time $t + 1$, or both.

Cull decrement growth—The growth from the midpoint of the measurement interval to time $t + 1$ on trees that were cull at time t but growing stock at time $t + 1$. Tree size at the midpoint can be modeled from tree size at time t , time $t + 1$, or both.

Cull increment—The net reduction in growing-stock volume due to reclassification of growing-stock trees to cull trees between two surveys. Cull increment is the volume of trees that were growing stock at time t but cull at time $t + 1$. The estimate is based on tree size at the midpoint of the measurement interval (includes cull increment growth). Tree size at the midpoint can be modeled from tree size at time t , time $t + 1$, or both.

Cull increment growth—The growth to the midpoint of the measurement interval between time t and $t + 1$ of trees that were growing stock at time t but cull trees at time $t + 1$. Tree size at the midpoint can be modeled from tree size at time t , time $t + 1$, or both.

***Composite panel**—Roundwood products manufactured into chips, wafers, strands, flakes, shavings, or sawdust and then reconstituted into a variety of panel and engineered lumber products.

Condition class—The combination of discrete landscape and forest attributes that identify, define, and stratify the area associated with a plot. Examples of such attributes include condition status, forest type, stand origin, stand size, owner group, reserve status, and stand density.

***Consumption**—The quantity of a commodity, such as pulpwood, utilized by a particular mill or group of mills.

Cull—Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect. Cull is further categorized as the following:

Broken-top cubic-foot cull—The broken-top proportion of a timber species tree's merchantable portion from the break to the actual or projected 4-inch top diameter outside bark, or to where the central stem forks, where all forks are <4.0 inches diameter. For trees 1.0–4.9 inches diameter, this is the proportion of the main stem missing due to a broken top.

Form board-foot cull—The part of the tree's saw-log portion that is sound but not usable for sawn wood products due to sweep, crook, forking, or other physical culls.

Missing cubic-foot cull—The proportion of a tree's merchantable portion that is missing or absent. Does not include any cull deductions above actual length for broken-top timber trees. Does include cull deductions above actual length for broken-top woodland species.

Trees with d.b.h./d.r.c. <5.0 inches have a null value in this field.

Percent board-foot cull—Percentage of sound and unsound board-foot volume, to the nearest 1 percent.

Rotten cubic-foot cull—The proportion of a tree's merchantable portion that is in a decayed state. Does not include any cull deductions above actual length for broken-top timber trees. Does include cull deductions above actual length for broken-top woodland species. Trees <5.0 inches d.b.h. have a null value in this field.

Rotten/missing cull—The part of the tree's merchantable portion that is decayed and/or absent due to other factors.

Total board-foot cull—The proportion of a timber species tree's saw-log portion that is rotten, missing, or sound but not useable for sawn wood products due to sweep, crook, forking, or other physical defects (form board-foot cull). Nonsaw-log species and softwoods <9.0 inches d.b.h. and hardwoods <11.0 inches d.b.h. have a null value in this field.

Cull tree—Live trees that are unsuitable for the production of some roundwood products, now or prospectively. Cull trees can include those with decay (rotten cull) or poor form, limbiness, or splits (rough cull). Rough cull is suitable for pulpwood and other fiber products.

Cycle—One sequential and complete set of panels.

Diameter at breast height (d.b.h.)—The diameter for tree stem, located at 4.5 feet above the ground (breast height) on the uphill side of a tree. The point of diameter measurement may vary on abnormally formed trees.

Diameter class—A classification of trees based on diameter outside bark, measured at breast height (d.b.h.) above the ground or at root collar (d.r.c.). Note: Diameter classes are commonly in 2-inch increments, beginning with 2 inches.

Each class provides a range of values with the class name being the approximate midpoint. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

***Diameter inside bark (d.i.b.)**—Diameter measured at any point on a tree or log that excludes the bark.

Diameter at root collar (d.r.c.)—Diameter measured at the root collar or at the natural ground line, whichever is higher, outside the bark. Measure tree stems only, not branches.

Diameter outside bark (d.o.b.)—Diameters are measured outside the bark at 4.5 feet above the ground on the uphill side of the tree. This location, called diameter at breast height or d.b.h., is above most butt swell and brush. It is also at a comfortable arm position for most people.

Disturbance—Natural or human-caused disruption that is ≥ 1.0 acre in size and results in mortality and/or damage to 25 percent of all trees in a stand or 50 percent of an individual species' count or, in the case when the disturbance does not initially affect tree growth or health (e.g., grazing, browsing, flooding, etc.), affects 25 percent of the soil surface or understory vegetation. For initial forest plot establishment, the disturbance must be within the last 5 years. For remeasured plots only, those disturbances that have occurred since the previous inventory are recognized.

Diversion—See: Components of change.

***Domestic fuelwood**—The volume of roundwood harvested to produce heat for residential settings.

Down woody material (DWM)—DWM is dead material on the ground in various stages of decay. It includes coarse and fine woody material. Previously named down woody debris (DWD). The depth of duff layer, litter layer, and overall fuel bed; fuel loading on the microplot; and residue

piles are also measured as part of the DWM indicator for FIA.

***Drain**—The volume of roundwood removed from any geographic area where timber is grown.

Dry weight—The oven-dry weight of biomass.

***Exports**—The volume of domestic roundwood utilized by mills outside the State where timber was cut.

Federal land—An ownership class of public lands owned by the U.S. Government. See: Ownership.

***Fiber products**—Byproducts used in the manufacture of pulp, paper, paperboard, and composite products, such as chipboard.

Fine woody debris (FWD)—Downed, dead branches, twigs, and small tree or shrub boles <3 inches in diameter not attached to a living or standing dead source.

Fixed-radius plot—A circular sampled area with a specified radius in which all trees of a given size, shrubs, or other items are tallied.

Forest floor—The entire thickness of organic material overlying the mineral soil, consisting of the litter and the duff (humus).

Forest industry land—See: Ownership.

Forest land—Land that is at least 10 percent stocked by forest trees of any size, or land formerly having such tree cover, and is not currently developed for a nonforest use. The minimum area for classification as forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams and other bodies of water, or natural clearings in forested areas shall be classified as forest, if <120 feet in width or 1.0 acre in size. Forest land is divided into timberland, reserved forest land, and other forest land (such as woodland).

Forest type—A classification of forest land based upon and named for the tree species that form the plurality of live-tree stocking. A forest-type classification for a field location indicates the predominant live-tree species cover for the field location; hardwoods and softwoods are first grouped to determine predominant group, and forest type is selected from the predominant group.

Forest-type group—A combination of forest types that share closely associated species or site requirements.

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

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

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

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

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

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

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

***Growing-stock removals**—The growing-stock volume removed from poletimber and sawtimber trees in the timberland inventory. (Note: Includes volume removed for roundwood products, logging residues, and other removals.)

Growing-stock trees—Live large-diameter timber species (excludes nonsaw-log species) trees with one-third or more of the gross board-foot volume in the entire saw-log portion meeting grade, soundness, and size requirements or the potential to do so for medium-diameter and small-diameter trees. A growing-stock tree must have one 12-foot log or two noncontiguous 8-foot merchantable logs, now (large diameter) or prospectively (medium diameter and small diameter), to qualify as growing stock.

***Growing-stock volume**—The cubic-foot volume of sound wood in growing-stock trees at least 5.0 inches d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. of the central stem.

Hardwoods—Tree species belonging to the botanical divisions Magnoliophyta, Ginkgophyta, Cycadophyta, or Pteridophyta (PLANTS 2025), usually angiospermic, dicotyledonous, broad-leaved, and deciduous.

Soft hardwoods—Hardwood species with an average specific gravity of ≤ 0.50 , such as gums, yellow-poplar, cottonwoods, red maple, basswoods, and willows.

Hard hardwoods—Hardwood species with an average specific gravity >0.50, such as oaks, hard maples, hickories, and beech.

***Imports**—The volume of domestic roundwood delivered to a mill or group of mills in a specific State but harvested outside that State.

***Industrial fuelwood**—A roundwood product, with or without bark, used to generate energy at a manufacturing facility such as a wood-using mill.

***Industrial roundwood products**—Any primary use of the main stem of a tree, such as saw logs, pulpwood, veneer logs, intended to be processed into primary wood products such as lumber, wood pulp, and sheathing at primary wood-using mills.

***International 1/4-inch rule**—A log rule or formula for estimating the board-foot volume of logs, allowing 1/2 inch of taper for each 4-foot length. The rule appears in a number of forms that allow for kerf. In the form used by FIA, a 1/4 inch of kerf is assumed. This rule is used as the U.S. Forest Service standard log rule in the Eastern United States.

Land—The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains.

Land cover—The dominant vegetation or other kind of material that covers the land surface. A given land cover may have many land uses.

Land use—The purpose of human activity on the land; it is usually, but not always, related to land cover.

Southern regional present land use categories are as follows:

Accessible timberland—Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets the criteria for forest land (See: Forest land).

Accessible other forest land—Land that meets the definition of accessible forest land but is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions because of adverse site conditions. Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and soil rockiness.

Agricultural land—Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width). This land use includes cropland, pasture (improved through cultural practices), idle farmland, orchard, Christmas tree plantation, maintained wildlife opening, and windbreak/shelterbelt.

Rangeland—Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least ≥ 1.0 acre in size and ≤ 120 feet wide.

Developed—Land used primarily by humans for purposes other than forestry or agriculture. This land use includes cultural (business, industrial/commercial, residential, and other places of intense human activity), rights-of-way (improved roads, railway, power lines, maintained canal), recreation (parks, skiing, golf courses), and mining.

Other—Land parcels ≥ 1.0 acre in size and ≥ 120 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. This land use includes nonvegetated, wetland, beach, and nonforest-chaparral.

Census water—Rivers and streams that are >200 feet wide and bodies of water >4.5 acres in size.

Noncensus water—Rivers, streams and other bodies of water that do not meet the requirements for census water.

Nonsampled—Not sampled due to denied access, hazardous conditions, being outside the United States, or other reasons.

Large-diameter trees—Softwoods ≥ 9.0 inches d.b.h. and hardwoods ≥ 11.0 inches d.b.h. These trees were called sawtimber-sized trees in prior surveys. See: Stand-size class.

Litter—Undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs, etc.).

***Log**—8-foot (2.4-m) or longer tree segment suitable for processing into lumber, veneer, or other wood products.

***Logging residues**—The unused portions of trees cut or destroyed during harvest and left in the forest.

Main stem—The central portion of the tree extending from the ground level to the tip for timber species. For woodland species, the main stem extends from the ground level to the tips of all branches of qualifying stems. For timber species trees that fork, the main stem follows the fork that would yield the most merchantable volume.

Medium-diameter tree—Softwood timber species 5.0 to 8.9 inches d.b.h. and hardwood timber species 5.0 to 10.9 inches d.b.h. These trees were called poletimber-sized trees in prior surveys. See: Stand-size class.

***Merchantable portion**—The portion of the main stem of a timber species tree from a 1-foot stump to a minimum 4-inch top diameter inside or outside bark depending on species. The portion of a woodland species tree from the d.r.c. measurement to the 1.5-inch diameters of all the qualifying stems.

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

Microplot—A circular, fixed-radius plot with a radius of 6.8 feet (0.003 acre) that is used to sample trees < 5.0 inches d.b.h./d.r.c., as well as other vegetation. Point center is 90 degrees and 12 feet offset from point center of each subplot.

Mortality—See: Components of change.

National forest land—See: Ownership.

Noncensus water—See: Land use.

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

Nonforest land—Land that does not support or has never supported forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be ≥ 120 feet wide, and clearings, etc., ≥ 1.0 acre in size, to qualify as nonforest land.

***Nongrowing-stock sources**—The net volume removed from the nongrowing-stock portions of poletimber and sawtimber trees (stumps, tops, limbs, cull sections of central stem) and from any portion of a rough, rotten, sapling, dead, or nonforest tree.

Nonindustrial private forest land—See: Ownership.

Other forest land—Forest land other than timberland and reserved forest land. It includes available and reserved forest land that is incapable of producing 20 cubic feet per acre per year of wood under natural conditions because of

adverse site conditions such as sterile soils, dry climate, poor drainage, high elevation, steepness, or rockiness.

***Other products**—A miscellaneous category of roundwood products, e.g., cooperage, excelsior, shingles, and mill residue byproducts (charcoal, bedding, mulch, etc.).

Other public land—See: Ownership.

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

***Other sources**—See: Nongrowing-stock sources.

Ownership—A legal entity having control of a parcel or group of parcels of land. An ownership may be an individual; a combination of persons; a legal entity such as corporation, partnership, club, or trust; or a public agency.

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

Forest industry land—An ownership class of private lands owned by a company or an individual(s) operating a primary wood-processing plant.

Nonindustrial private forest (NIPF) land—Privately owned land excluding forest industry land.

Corporate—Owned by corporations, including incorporated farm ownerships.

Individual—All lands owned by individuals, including farm operators.

Other public—An ownership class that includes all public lands except national forests.

Miscellaneous Federal land—Federal land other than national forests.

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

Phase 1 (P1)—FIA activities related to remote sensing, the primary purpose of which is to label plots and obtain stratum weights for population estimates.

Phase 2 (P2)—FIA activities conducted on the network of ground plots. The primary purpose is to obtain field data that enable classification and summarization of area, tree, and other attributes associated with forest land uses.

Phase P2+—A subset of Phase 2 plots where additional attributes related to down woody material are measured.

Plantation—Stands that currently show evidence of being planted or artificially seeded.

***Plant byproducts**—Plant residues that are recovered and recycled during the manufacturing process into useful products, such as pulp chips, bark mulch, fuel, etc.

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

Bark.

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

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

Poletimber-size tree—Softwood timber species 5.0 to 8.9 inches d.b.h. and hardwood

timber species 5.0 to 10.9 inches d.b.h. Now referred to as medium-diameter trees.

***Posts, poles, and pilings**—Roundwood products milled (cut or peeled) into standard sizes (lengths and circumferences) to be put in the ground to provide vertical and lateral support in buildings, foundations, utility lines, and fences. May also include nonindustrial (unmilled) products.

***Primary wood-using plants**—Industries that convert roundwood products (saw logs, veneer logs, pulpwood, etc.) into primary wood products, such as lumber, veneer or sheathing, and wood pulp.

Private land—See: Ownership.

***Production**—The total volume of known roundwood harvested from land within a State, regardless of where it is consumed. Production is the sum of timber harvested and used within a State, and all roundwood exported to other States.

Productivity class—A classification of forest land in terms of potential annual cubic-foot volume growth per acre at culmination of mean annual increment (MAI) in fully stocked natural stands.

***Pulpwood**—A roundwood product that will be reduced to individual wood fibers by chemical or mechanical means. The fibers are used to make a broad generic group of pulp products that includes paper products, as well as fiberboard, insulating board, and paperboard.

Quality assurance (QA)—The total integrated program for ensuring that the uncertainties inherent in FIA data are known and do not exceed acceptable magnitudes, within a stated level of confidence. Quality assurance encompasses the plans, specifications, and policies affecting the collection, processing, and reporting of data. It is the system of activities designed to provide program managers and project leaders with independent assurance that total system quality control is being effectively implemented.

Quality control (QC)—The routine application of prescribed field and laboratory procedures (e.g., random check cruising, periodic calibration, instrument maintenance, use of certified standards, etc.) in order to reduce random and systematic errors and ensure that data are generated within known and acceptable performance limits. Quality control also ensures the use of qualified personnel; reliable equipment and supplies; training of personnel; good field and laboratory practices; and strict adherence to standard operating procedures.

***Receipts**—The quantity or volume of industrial roundwood received at a mill or by a group of mills in a State, regardless of the geographic source. Volume of roundwood receipts is equal to the volume of roundwood retained in a State plus roundwood imported from other States.

***Red oaks**—*Quercus* species in the subgenus *Erythrobalanus*. Among other characteristics, red oaks have leaves with bristles at the tips of the lobes and leaf apex, and their acorns require two growing seasons to mature. FIA divides the red oaks into two categories:

Select red oaks—Cherrybark, Shumard, and northern red oaks.

Other red oaks—All other red oak species.

Reserved forest land—Forest land where management for the production of wood products is prohibited through statute or administrative designation. Examples include national forest wilderness areas and national parks and monuments.

***Retained**—Roundwood volume harvested from and processed by mills within the same State.

Reversion—Land that reverts from a nonforest land use to a forest land use. See: Components of change.

***Rotten trees**—Live timber species (excludes nonsaw-log species) that do not contain at least

one 12-foot saw log or two noncontiguous 8-foot merchantable logs now or prospectively, primarily because of rotten cull. Less than 1/3 of its gross board-foot volume meets size, soundness, and grade requirements and <1/2 of the total board-foot cull is due to form board-foot cull.

***Rough trees**—Live timber species (excludes nonsaw-log species) that do not contain at least one 12-foot saw log or two noncontiguous 8-foot merchantable logs now or prospectively, primarily because of roughness or poor form. Less than 1/3 of its gross board-foot volume meets size, soundness, and grade requirements and <1/2 of the total board-foot cull is rotten or unsound.

***Roundwood products**—Any primary product, such as lumber, veneer, composite panels, poles, pilings, pulp, or fuelwood that is produced from roundwood.

Roundwood logs—Logs or other round sections cut from trees for industrial manufacture or consumer uses.

Roundwood chipped—Any timber cut primarily for industrial manufacture, delivered to nonpulpmills, chipped, and then sold to pulpmills for use as fiber. Includes tops, whole trees, and pulpwood sticks.

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

Sapling—Live trees 1.0–4.9 inches d.b.h./d.r.c.

***Saw log**—A roundwood product, usually ≥8 feet in length, processed into a variety of sawn products such as lumber, cants, pallets, railroad ties, and timbers.

***Saw-log portion**—That portion of the main stem of a timber species tree of large-diameter size from a 1-foot stump to a minimum top d.o.b. 7.0 inches for softwoods and 9.0 inches for hardwoods (equivalent 6.0 inches d.i.b. for softwoods, 8.0 inches d.i.b. for hardwoods).

***Saw-log top**—The point on the bole of sawtimber trees above which a conventional saw log cannot be produced. The minimum saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods for FIA standards.

***Sawtimber-size trees**—Softwood timber species ≥9.0 inches d.b.h., and hardwood timber species ≥11.0 inches d.b.h. Now referred to as large-diameter trees.

Seedling—Live trees <1.0 inch d.b.h./d.r.c. that are ≥6.0 inches in height for softwoods and ≥12.0 inches in height for hardwoods and >0.5 inch d.b.h./d.r.c. at ground level for longleaf pine.

Small-diameter trees—Trees 1.0–4.9 inches in d.b.h./d.r.c. These were called sapling-seedling sized trees in prior surveys. See: Stand-size class.

Softwoods—Tree species belonging to the botanical division Coniferophyta (PLANTS 2025), usually evergreen having needles or scale-like leaves.

Species group—A collection of species used for reporting purposes.

Stand—Vegetation or a group of plants occupying a specific area and sufficiently uniform in species composition, age arrangement, structure, and condition as to be distinguished from the vegetation on adjoining areas.

Stand age—A stand descriptor that indicates the average age of the live dominant and codominant trees in the predominant stand-size class of a condition.

Stand origin—A classification of forest stands describing their means of origin.

Planted—Planted or artificially seeded.

Natural—No evidence of artificial regeneration.

***Standard cord**—A unit of measure applied to roundwood, usually bolts or split wood. It is a stack of wood 4 feet high, 4 feet wide, and 8

feet long encompassing 128 cubic feet of wood, bark, and air space. This usually translates to approximately 75.0 to 81.0 cubic feet of solid wood for pulpwood, because pulpwood is more uniform.

***Standard unit**—A unit measure applied to roundwood timber products. Board feet (International 1/4-inch rule) are the standard unit used for saw logs and veneer; cords are used for pulpwood, composite panel, and fuelwood; hundred pieces for poles; thousand pieces for posts; and thousand cubic feet for all other miscellaneous forest products.

Standing dead tree—A dead tree ≥ 5.0 inches d.b.h. that has a bole which has an unbroken actual length of at least 4.5 feet, and lean < 45 degrees from vertical as measured from the base of the tree to 4.5 feet.

Stand-size class—A classification of forest land based on the diameter-class distribution of live trees in the stand. See definitions of large-, medium-, and small-diameter trees.

Large-diameter stands—Stands at least 10 percent stocked with live trees, with one-half or more of total stocking in large- and medium-diameter trees, and with large-diameter tree stocking at least equal to medium-diameter tree stocking.

Medium-diameter stands—Stands at least 10 percent stocked with live trees, with one-half or more of total stocking in medium- and large-diameter trees, and with medium-diameter tree stocking exceeding large-diameter tree stocking.

Small-diameter stands—Stands at least 10 percent stocked with live trees, in which small-diameter trees account for more than one-half of total stocking.

Nonstocked stands—Stands < 10 percent stocked with live trees.

Stand structure—The predominant canopy structure for the condition, only considering the

vertical position of the dominant and codominant trees in the stand and not considering trees that are intermediate or overtopped. As a general rule, a different story should comprise 25 percent of the stand.

Nonstocked—The condition is < 10 percent stocked.

Single-storied—Most of the dominant/codominant tree crowns form a single canopy (i.e., most of the trees are approximately the same height).

Multistoried—Two or more recognizable levels characterize the crown canopy. Dominant/codominant trees of many sizes (diameters and heights) for a multilevel canopy.

State, county, and municipal land—See: Ownership.

Stocking—(1) At the tree level, stocking is the density value assigned to a sampled tree (usually in terms of numbers of trees or basal area per acre), expressed as a percent of the total tree density required to fully utilize the growth potential of the land. (2) At the stand level, stocking refers to the sum of the stocking values of all trees sampled.

Subplot—A circular area with a fixed horizontal radius of 24.0 feet (1/24 acre), primarily used to sample trees ≥ 5.0 inches d.b.h./d.r.c.

Survivor tree—A sample tree alive at both the current and previous inventories.

Timberland—Forest land that is producing or capable of producing 20 cubic feet per acre or more per year of wood at culmination of MAI. Timberland excludes reserved forest lands.

***Timber product output**—A unit measure applied to roundwood timber products. Board feet (International 1/4-inch rule) are the standard unit used for saw logs and veneer; cords are used for pulpwood, composite panel, and fuelwood; hundred pieces for poles; thousand pieces for

posts; and thousand cubic feet for all other miscellaneous forest products.

***Timber products**—Roundwood products and byproducts.

***Timber removals**—The total volume of trees removed from the timberland inventory by harvesting, cultural operations such as stand improvement, land clearing, or changes in land use. (Note: Includes roundwood products, logging residues, and other removals.)

Treatment—Forestry treatments are a form of human disturbance. The term treatment further implies that a silvicultural application has been prescribed. This does not include occasional stumps of unknown origin or sparse removals for firewood, Christmas trees, or other miscellaneous purposes. The area affected by any treatment must be at least 1.0 acre in size.

None—No observable treatment.

Cutting—The removal of one or more trees from a stand. SRS FIA categories are the following:

Clearcut harvest—The removal of the majority of the merchantable trees in a stand; residual stand stocking is under 50 percent.

Partial harvest—Removal primarily consisting of highest quality trees. Residual consists of lower quality trees because of high grading or selection harvest (e.g., uneven aged, group selection, high grading, species selection).

Seed-tree/shelterwood harvest—Crop trees are harvested leaving seed source trees either in a shelterwood or seed tree. Also includes the final harvest of the seed trees.

Commercial thinning—The removal of trees (usually of medium diameter) from

medium-diameter stands leaving sufficient stocking of growing-stock trees to feature in future stand development. Also included are thinning in large-diameter stands where medium-diameter trees have been removed to improve quality of those trees featured in a final harvest.

Timber stand improvement (cut trees only)—The cleaning, release, or other stand improvement involving noncommercial cutting applied to an immature stand that leaves sufficient stocking.

Salvage cutting—The harvesting of dead or damaged trees or of trees in danger of being killed by insects, disease, flooding, or other factors in order to save their economic value.

Site preparation—Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.

Artificial regeneration—Following a disturbance or treatment (usually cutting), a new stand where at least 50 percent of the live trees present resulted from planting or direct seeding.

Natural regeneration—Following a disturbance or treatment (usually cutting), a new stand where at least 50 percent of the live trees present (of any size) were established through the growth of existing trees and/or natural seeding or sprouting.

Other silvicultural treatment—The use of fertilizers, herbicides, girdling, pruning, or other activities designed to improve the commercial value of the residual stand, or chaining, which is a practice used on woodlands to encourage wildlife forage.

Tree—A woody perennial plant, typically large, with a single well-defined stem carrying a more

or less definite crown; sometimes defined as attaining a minimum diameter of 3 inches and a minimum height of 15 feet at maturity. For FIA, any plant on the tree list in the current field manual is measured as a tree.

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

***Utilization studies**—Studies conducted on active logging operations to develop factors for merchantable portions of trees left in the woods (logging residues), logging damage, and utilization of the unmerchantable portion of growing-stock trees and nongrowing-stock trees.

Variable Radius Plot—The variable radius plot method avoids the use of a fixed plot radius and instead relies on the DBH of the trees and the distance between those trees and the plot center.

***Veneer log**—A roundwood product either rotary cut, sliced, stamped, or sawn into a variety of veneer products such as plywood, finished panels, veneer sheets, or sheathing.

Volume—A measure of the solid content of the tree stem used to measure wood quantity.

Gross board-foot volume—Total board-foot volume of wood inside bark without deductions for total board-foot cull.

Gross cubic-foot volume—Total cubic-foot volume of wood inside bark without deductions for rotten, missing, or broken-top cull.

Net board-foot volume—Gross board-foot volume minus deductions for total board-foot cull.

Net cubic-foot volume—Gross cubic-foot volume minus deductions for rotten, missing, and broken-top cull.

***Weight**—A unit of measure for mill residues, expressed as oven-dry tons (2,000 oven-dry pounds).

***White oaks**—*Quercus* species in the subgenus *Leucobalanus*. Among other characteristics, white oaks have leaves lacking bristles on the lobes or leaf apex, and their acorns require one growing season to mature. FIA divides the white oaks into two categories:

Select white oaks—White, swamp chestnut, swamp white, chinkapin, Durand, and bur oaks.

Other white oaks—All other white oak species.

Metric equivalents

1 acre = 4046.87 m² or 0.404687 ha

1 cubic foot = 0.028317 m³

1 inch = 2.54 cm or 0.0254 m

Breast height (4.5 feet) = 1.4 m above the ground

1 square foot = 929.03 cm² or 0.0929 m²

1 square foot of basal area per acre = 0.229568 m²/ha

1 cubic foot per acre = 0.0699722 m³/ha

1 pound = 0.454 kg

1 ton = 0.908 metric ton

APPENDIX 1—INVENTORY METHODS

The South Carolina 2021 inventory was a three phase, fixed-radius plot design conducted on an annual basis. Phase 1 (P1) provides the area estimates for the inventory. Phase 2 (P2) involves on-the-ground measurements of sample plots by Forest Inventory and Analysis (FIA) field personnel. Phase 2+ (P2+, formerly identified as Phase 3 [P3]) is a subset of the P2 plot system, where additional measurements are made by field personnel to aid in the assessment of forest health (fig. A1.1). The diagram shows the transects on each subplot (P2+); only the Pacific Northwest FIA region uses the macroplot (fig. A1.2). The three phases of the sampling method are based on a hexagonal grid design, with successive phases being sampled with less intensity. There are 16 P2 hexagons for every P2+ hexagon, 20 percent per subcycle. P2 and P2+ hexagons represent about 6,000 and 96,000 acres, respectively. Under the annual inventory system, 20 percent (1 panel) of

the total number of plots in a State are measured every year over a 5-year period (1 cycle). Each panel of plots is selected on a subgrid that 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 (5 years) of data is available for the 5-year report. The 2021 inventory accounted for a total of 3,676 plots where 2,684 were forested across the State. There were 657, 1,027, and 1,000 plots measured in the Southern Coastal Plain, Northern Coastal Plain, and Piedmont units, respectively. A total of 2,694 plots measured for the 2016 inventory most were remeasured during the 2021 inventory. The remeasured plots were used to calculate estimates of growth, removals, and mortality, commonly referred to as GRM.

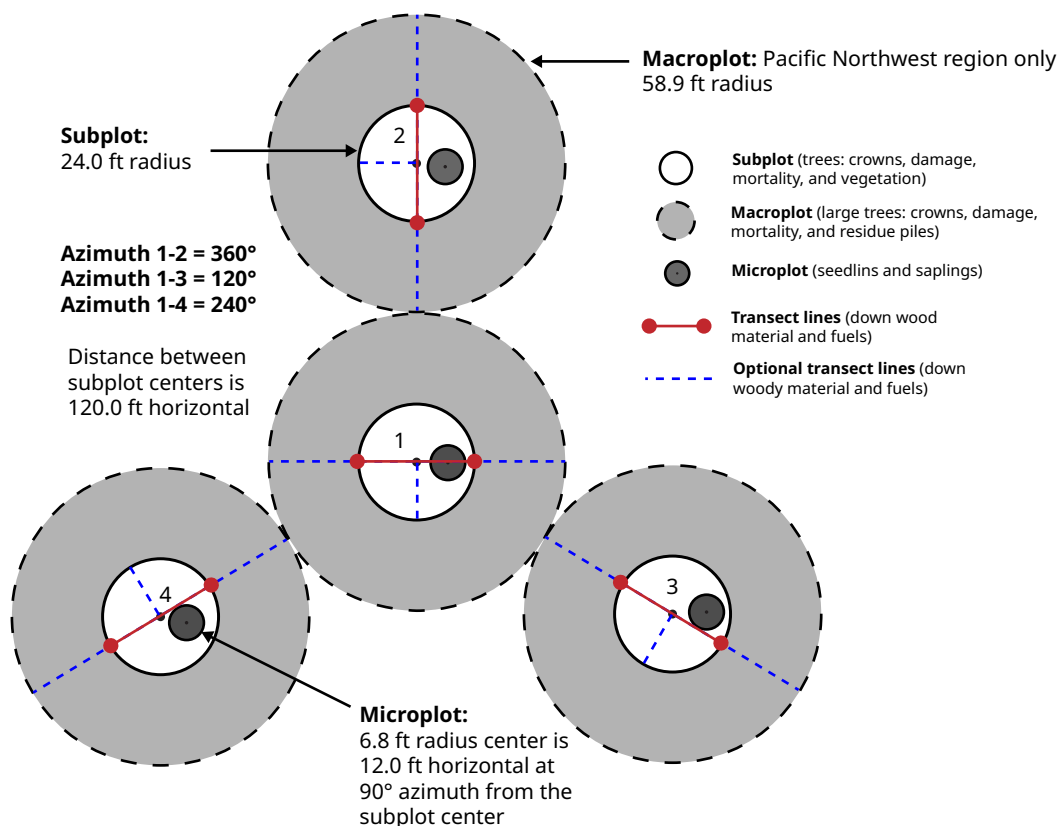


Figure A1.1—National and regional fixed-plot design, 2021.

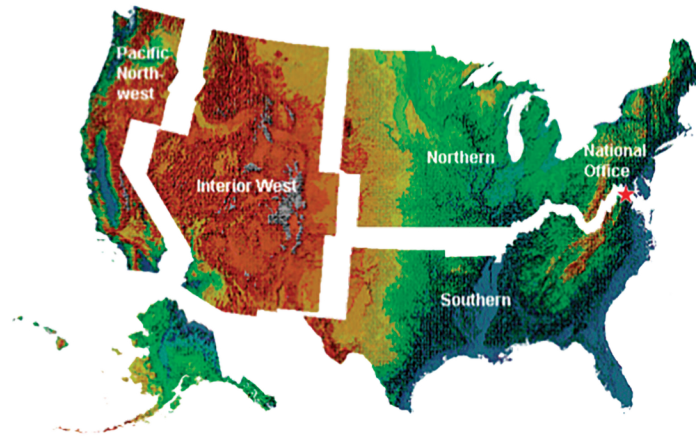


Figure A1.2—National Forest Inventory and Analysis regions.

These data were accessed and compiled from the FIA database (FIADB) in October and November 2023 and February 2024. Publicly available data from the FIADB are regularly updated when data collection or processing anomalies are found and corrected. Additionally, new data are added on a regular basis which may be reflected by small changes in the past or current estimates.

Phase 1

For the 2021 inventory of South Carolina, the P1 forest area estimate was based on classifying National Land Cover Database points collected in 2016. Stratification of forest and nonforest was performed at the unit level. Area estimation of all lands and ownerships was based on the probability of selection of P2 plot locations. 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 of the U.S. Department of Agriculture, Forest Service, will not agree exactly with the statistical estimate of national forest land derived by FIA. These numbers could differ substantially for very small areas.

Phase 2

Bechtold and Patterson (2005) describe P2 and P2+ 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. A1.1). Each point is the center of a circular subplot with a fixed 24-foot radius. Trees ≥ 5.0 inches diameter at breast height (d.b.h.) are measured in these subplots. Each subplot in turn contains a circular microplot with a fixed 6.8-foot radius. Trees 1.0–4.9 inches d.b.h. and seedlings (<1.0 inch d.b.h.) are measured in these microplots (USDA Forest Service 2014).

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: (1) land use, (2) forest type, (3) stand size, (4) ownership, (5) stand density, (6) regeneration status, and (7) reserved status. A new condition is defined and mapped each time one of these variables changes during plot measurement.

Phase 2+

Data on forest health variables (P2+) are collected on about $\frac{1}{16}$ of the P2 sample plots. P2+ data are coarse descriptions and are meant to be used as general indicators of overall forest health over large geographic areas. P2+ data collection has included variables pertaining to tree crown health, down woody material, and foliar ozone injury in the past. In recent years, however, the forest health monitoring data collection has evolved with some of the protocols changing and others being put on hiatus pending renovation. Down woody materials data were collected for the past cycle of South Carolina forest health monitoring.

That data collection took place under a more simplified set of field protocols that can be implemented on a greater number of plots to improve the sample size. This and other forest health monitoring data collection will continue to evolve as these protocols are refined.

Summary

Users wishing to perform thorough data comparisons between surveys should be aware of any changes in measuring methodology and the evolving nature of the FIA program. The same plots are analyzed and quantified consistently throughout surveys to yield the most insightful and potent trend information. When sampling techniques change over time, as they did with this data in the late 1990s, assessing the intensity of a trend or the degree of confidence associated with the trend becomes challenging or impossible.

Literature Cited

- Bechtold, W.A.; Patterson, P.L., eds. 2005.** The enhanced forest inventory and analysis program-national sampling design and estimation procedures. Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p. <https://doi.org/10.2737/SRS-GTR-80>.
- U.S. Department of Agriculture, Forest Service. [USDA Forest Service]. 2014.** Forest inventory and analysis national core field guide. Volume 1: field data collection procedures for phase 2 plots. Version 6.11. Internal report. Washington, DC. 305 p. https://srsfia2.fs.fed.us/data_acquisition/FINAL%20611%20Complete%20LEGAL.pdf. [Date accessed: 27 February 2025].

APPENDIX 2—DATA RELIABILITY

A relative standard of accuracy has been incorporated into the forest inventory in all regions. This standard satisfies user demands, minimizes human and instrumental sources of error, and keeps costs within prescribed limits. The two primary types of error are measurement error and sampling error.

Measurement Error

There are three elements of measurement error: (1) biased error, caused by instruments that are not properly calibrated; (2) compensating error, caused by instruments of moderate precision; and (3) accidental error, caused by human error in measuring and compiling. All of these are held to a minimum by the Forest Inventory and Analysis (FIA) quality assurance (QA) program. The goal of the QA program is to provide a framework of quality control procedures to assure the production of complete, accurate, and unbiased forest assessments for given standards. These methods include the use of nationally standardized field manuals, the use of portable data recorders, thorough entry-level training, periodic review training, supervision, the use of check plots, editing checks, and an emphasis on careful work. Additionally, data quality is assessed and documented using performance measurements and postsurvey assessments. These assessments are then used to identify areas of the data collection process that need improvement or refinement in order to meet the program's quality objectives.

Each variable collected by FIA is assigned a measurement quality objective (MQO) and a measurement tolerance level. The MQOs are documented in the FIA national core field guide (USDA Forest Service 2023a). In some instances, the MQOs are a “best guess” of what experienced field crews should be able to consistently achieve. Tolerances are somewhat arbitrary and are based on the crews' ability to make repeatable

measurements or observations within the assigned MQO.

Evaluation of field crew performance is accomplished by calculating the differences between data collected by the field crew and data collected by the QA crew on blind-check plots. Results of these calculations are compared to the established MQOs. In the analysis of blind-check data, an observation is within tolerance when the difference between the field crew observation and the QA crew observation does not exceed the assigned tolerance for that variable. For many categorical variables, the tolerance is “no error” allowed, so only observations that are identical are within the tolerance level.

Sampling Error

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. That is, there is a 68.27-percent probability that the confidence interval given for each sample estimate will cover the true population mean.

The size of the sampling error generally increases as the size of the area examined decreases. In addition, as area or volume totals are stratified by forest type, species, diameter class, ownership, or other subunits, the sampling error may increase and be greatest for the smallest divisions. However, there may be instances where a smaller component does not have a proportionately larger sampling error. This can happen when the post-defined strata are more homogeneous than the larger strata, thereby having a smaller variance. For specific post-defined strata, the sampling error can be calculated using the following formula. Sampling errors obtained by 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 survey unit or State total

SE_t = sampling error for survey unit or State total

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

X_t = total area or volume for survey unit or State

For example, the estimate of sampling error for net-bole live-tree volume on forest land in the Southern Coastal Plain survey unit is computed as:

$$SE_s = 1.47 \left[\frac{\sqrt{5,413,480,005}}{\sqrt{1,452,439,743}} \right] = 2.84\%$$

Thus, the estimated sampling error is 2.84 percent, and the resulting 68.27-percent confidence interval for total volume in the Southern Coastal Plain survey unit is 1,452.4 ± 41.25 million cubic feet.

Literature Cited

U.S. Department of Agriculture, Forest Service [USDA Forest Service]. 2023a. Forest inventory and analysis national core field guide for the nationwide forest inventory. Version 9.3. Internal Report. Washington, DC. 539 p. <https://research.fs.usda.gov/understory/nationwide-forest-inventory-field-guide>. [Date accessed: 26 August 2024].

APPENDIX 3—SUPPLEMENTAL TABLES

Table A3.1—Area of forest land by ownership class and land status, South Carolina, 2021

Ownership class		All forest land	Unreserved			Reserved		
			Total	Timberland	Unproductive	Total	Productive	Unproductive
thousand acres								
USDA Forest Service	National forest	617.1	594.1	592.2	1.9	23.0	23.0	0.0
	Total	617.1	594.1	592.2	1.9	23.0	23.0	0.0
Other Federal	National Park Service	35.4	0.0	0.0	0.0	35.4	35.4	0.0
	U.S. Fish and Wildlife Service	75.1	0.0	0.0	0.0	75.1	75.1	0.0
	U.S. Dept. of Defense/Dept. of Energy	306.9	301.1	301.1	0.0	5.8	5.8	0.0
	Other Federal	3.4	3.4	3.4	0.0	0.0	0.0	0.0
	Total	420.9	304.5	304.5	0.0	116.4	116.4	0.0
State and local government	State	445.2	445.2	445.2	0.0	0.0	0.0	0.0
	Local	214.1	190.8	190.8	0.0	23.3	23.3	0.0
	Total	659.3	636.0	636.0	0.0	23.3	23.3	0.0
Forest industry	Corporate	444.7	444.7	443.2	1.6	0.0	0.0	0.0
	Individual	18.1	18.1	18.1	0.0	0.0	0.0	0.0
	Total	462.8	462.8	461.3	1.6	0.0	0.0	0.0
Nonindustrial private	Corporate	3,748.6	3,748.6	3,734.4	14.2	0.0	0.0	0.0
	Conservation/natural resources organization	76.0	76.0	76.0	0.0	0.0	0.0	0.0
	Unincorporated local partnership/association/club	102.9	102.9	102.9	0.0	0.0	0.0	0.0
	Individual	6,729.3	6,729.3	6,723.3	5.9	0.0	0.0	0.0
	Total	10,656.8	10,656.8	10,636.7	20.1	0.0	0.0	0.0
All classes		12,816.9	12,654.2	12,630.6	23.6	162.7	162.7	0.0

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.2—Area of forest land by forest-type group and ownership group, South Carolina, 2021

Forest-type group		Ownership group					
		All ownerships	USDA Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
		thousand acres					
Softwood types	White-red-jack pine	17.9	10.6	0.0	5.8	0.0	1.5
	Longleaf-slash pine	602.7	28.9	101.5	78.4	0.0	393.9
	Loblolly-shortleaf pine	5,505.7	328.0	144.1	138.2	280.8	4,614.6
	Other eastern softwoods	41.8	0.0	0.0	4.3	0.0	37.5
	Total softwoods	6,168.1	367.5	245.6	226.7	280.8	5,047.5
Hardwoods types	Oak-pine	1,529.9	76.6	34.9	99.2	64.8	1,254.4
	Oak-hickory	2,672.3	81.8	53.8	142.0	16.3	2,378.4
	Oak-gum-cypress	1,862.5	77.9	79.2	144.4	67.6	1,493.4
	Elm-ash-cottonwood	435.3	9.1	5.8	33.0	31.7	355.8
	Maple-beech-birch	2.2	2.2	0.0	0.0	0.0	0.0
	Other hardwoods	19.0	0.0	0.0	4.4	0.0	14.6
	Exotic hardwoods	24.2	0.0	1.6	3.1	0.0	19.5
	Total hardwoods	6,545.4	247.7	175.2	426.0	180.5	5,516.0
Nonstocked		103.4	1.9	0.0	6.6	1.6	93.3
All groups		12,816.9	617.1	420.9	659.3	462.8	10,656.8

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.3—Area of forest land by forest-type group and stand-size class, South Carolina, 2021

Forest-type group		All classes	Stand-size class			
			Large diameter	Medium diameter	Small diameter	Nonstocked
		thousand acres				
Softwood types	White-red-jack pine	17.9	15.9	1.9	0.0	0.0
	Longleaf-slash pine	602.7	319.9	161.4	121.4	0.0
	Loblolly-shortleaf pine	5,505.7	3,307.6	1,191.1	1,007.0	0.0
	Other eastern softwoods	41.8	14.0	1.6	26.3	0.0
	Total softwoods	6,168.1	3,657.4	1,356.0	1,154.8	0.0
Hardwood types	Oak-pine	1,529.9	733.4	341.9	454.6	0.0
	Oak-hickory	2,672.3	1,470.3	508.5	693.6	0.0
	Oak-gum-cypress	1,862.5	1,181.9	360.7	320.0	0.0
	Elm-ash-cottonwood	435.3	219.5	75.9	140.0	0.0
	Maple-beech-birch	2.2	2.2	0.0	0.0	0.0
	Other hardwoods	19.0	0.0	1.6	17.4	0.0
	Exotic hardwoods	24.2	0.0	16.8	7.4	0.0
	Total hardwoods	6,545.4	3,607.3	1,305.3	1,632.9	0.0
Nonstocked		103.4	0.0	0.0	0.0	103.4
All groups		12,816.9	7,264.6	2,661.3	2,787.6	103.4

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.

Table A3.4—Area of forest land by forest-type group and stand origin, South Carolina, 2021

Forest-type group		Total	Stand origin	
			Natural stands	Artificial regeneration
thousand acres				
Softwood types	White-red-jack pine	17.9	17.9	0.0
	Longleaf-slash pine	602.7	316.3	286.4
	Loblolly-shortleaf pine	5,505.7	2,729.0	2,776.8
	Other eastern softwoods	41.8	41.8	0.0
	Total softwoods	6,168.1	3,105.0	3,063.1
Hardwood types	Oak-pine	1,529.9	1,305.1	224.8
	Oak-hickory	2,672.3	2,593.6	78.7
	Oak-gum-cypress	1,862.5	1,846.1	16.4
	Elm-ash-cottonwood	435.3	435.3	0.0
	Maple-beech-birch	2.2	2.2	0.0
	Other hardwoods	19.0	14.6	4.4
	Exotic hardwoods	24.2	22.6	1.6
Total hardwoods		6,545.4	6,219.5	326.0
Nonstocked		103.4	100.3	3.1
All groups		12,816.9	9,424.7	3,392.2

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.5—Area of forest land disturbed annually by forest-type group and disturbance class, South Carolina, 2021

Forest-type group ²		Disturbance class ¹							
		Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
<i>thousand acres</i>									
Softwood types	White-red-jack pine	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
	Longleaf-slash pine	1.2	1.1	1.5	29.3	0.0	0.0	11.9	1.1
	Loblolly-shortleaf pine	20.0	18.2	23.5	94.4	1.1	1.0	4.0	6.0
	Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total softwoods	21.2	19.3	25.0	124.0	1.1	1.0	15.9	7.1
Hardwood types	Oak-pine	2.3	6.6	8.9	14.6	0.0	0.0	3.6	0.0
	Oak-hickory	3.9	4.2	16.1	14.5	1.1	1.4	8.5	1.0
	Oak-gum-cypress	1.1	15.4	56.6	6.1	0.0	4.3	1.6	1.1
	Elm-ash-cottonwood	0.0	1.2	7.0	1.1	0.0	3.4	0.4	0.0
	Other hardwoods	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
	Tropical hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Exotic hardwoods	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0
	Total hardwoods	7.2	27.4	88.6	37.6	1.1	9.2	14.1	2.1
Nonstocked		1.1	0.0	0.0	1.3	0.0	1.2	1.0	0.0
All groups		29.5	46.7	113.6	162.8	2.2	11.4	31.0	9.2

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.

¹ Based on current conditions.² Based on past conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.6—Area of forest land treated annually by forest-type group and treatment class (cutting), South Carolina, 2021

Forest-type group ²		Treatment class						
		Cutting ¹						
		Total treated	Final harvest	Partial harvest	Seed-tree/ shelterwood harvest	Commercial thinning	Timber stand improvement	Salvage cutting
		thousand acres						
Softwood types	White-red-jack pine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Longleaf-slash pine	16.9	5.9	0.5	0.0	4.8	5.7	0.0
	Loblolly-shortleaf pine	339.2	143.7	15.2	5.0	169.1	6.0	0.3
	Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total softwoods	356.0	149.5	15.7	5.0	173.9	11.6	0.3
Hardwood types	Oak-pine	34.5	18.7	9.1	0.3	3.6	2.7	0.0
	Oak-hickory	40.4	22.9	9.3	1.3	4.3	1.8	0.7
	Oak-gum-cypress	20.5	19.3	0.0	0.0	0.2	1.0	0.0
	Elm-ash-cottonwood	5.3	4.7	0.0	0.1	0.2	0.3	0.0
	Other hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tropical hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Exotic hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods		100.6	65.6	18.4	1.6	8.4	5.9	0.7
Nonstocked		0.0	0.0	0.0	0.0	0.0	0.0	0.0
All groups		456.6	215.2	34.1	6.6	182.2	17.6	1.0

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.

HARVEST_TYPE[1,2,3]_SRS code 16 (Salvage Cutting) started with Field Guide 4.0.

¹ Based on current conditions.² Based on past conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.7—Number of live trees on forest land by species group and diameter class, South Carolina, 2021

Species group	Diameter class (inches)															
	All classes	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+
<i>million trees</i>																
Softwood types																
Loblolly and shortleaf pines	2,081.5	794.7	424.7	278.7	207.6	144.5	99.3	62.5	33.3	18.0	8.7	6.7	2.0	0.7	0.0	0.0
Other yellow pines	90.8	44.4	15.9	10.5	7.1	4.3	2.9	2.2	1.6	1.0	0.4	0.2	0.1	0.0	0.0	0.0
Eastern white and red pines	10.6	5.3	1.2	0.8	0.5	0.3	0.6	0.6	0.4	0.4	0.2	0.1	0.2	0.0	0.0	0.0
Eastern hemlock	3.2	1.2	1.0	0.2	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Cypress	55.5	16.8	12.8	6.3	3.9	4.6	3.7	2.9	1.8	1.3	0.7	0.7	0.1	0.1	0.0	0.0
Other eastern softwoods	203.1	138.5	33.4	16.9	8.3	3.4	1.5	0.7	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Total softwoods	2,670.7	1,081.5	548.6	345.9	250.6	169.6	115.0	73.5	40.9	22.6	10.9	8.2	2.4	0.8	0.0	0.0
Hardwood types																
Select white oaks	134.0	63.5	25.5	13.2	7.6	5.7	4.6	4.0	3.3	2.3	1.4	2.0	0.5	0.3	0.1	0.1
Select red oaks	33.8	14.9	6.3	3.1	2.0	1.6	1.5	0.8	0.9	0.8	0.4	0.8	0.4	0.3	0.1	0.1
Other white oaks	138.4	79.9	25.5	10.2	7.6	4.5	3.4	2.4	1.6	1.2	0.8	0.9	0.2	0.1	0.1	0.0
Other red oaks	982.0	628.3	169.8	69.7	40.2	22.7	16.7	11.2	7.3	5.9	3.4	4.2	1.5	0.7	0.2	0.2
Hickory	200.4	128.9	30.2	14.5	9.9	6.7	3.9	2.5	2.1	1.1	0.4	0.1	0.1	0.0	0.0	0.0
Hard maple	43.1	37.3	3.8	1.2	0.4	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soft maple	711.3	484.4	125.3	48.0	22.5	12.3	8.0	4.5	2.6	1.4	1.0	1.1	0.2	0.0	0.0	0.0
Beech	35.6	23.1	7.5	2.1	1.2	0.7	0.4	0.3	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Sweetgum	1,757.4	1,236.7	307.8	99.9	49.1	26.3	14.6	8.9	5.4	4.1	2.2	1.8	0.5	0.1	0.0	0.1
Tupelo and blackgum	354.9	179.1	80.4	31.8	19.1	14.3	10.9	8.2	5.5	2.8	1.5	0.8	0.3	0.1	0.1	0.0
Ash	175.6	117.1	35.8	9.7	5.2	2.6	1.9	1.5	0.6	0.5	0.4	0.2	0.1	0.0	0.0	0.0
Cottonwood and aspen	9.6	5.2	1.3	1.2	0.6	0.4	0.2	0.1	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Basswood	1.1	0.6	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	140.3	69.5	24.4	12.1	9.5	6.5	5.0	3.2	2.9	2.5	1.5	2.0	0.9	0.3	0.0	0.1
Black walnut	4.4	2.7	0.4	0.5	0.2	0.2	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	602.2	419.1	98.8	41.1	20.9	9.6	5.6	2.6	1.8	1.0	0.7	0.7	0.2	0.1	0.0	0.0
Other eastern hard hardwoods	366.0	284.0	59.0	15.5	5.0	1.5	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	534.4	408.8	84.6	25.1	8.8	4.2	1.9	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tropical and subtropical hardwoods	29.7	27.5	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Urban-specific hardwoods	37.0	32.9	2.8	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	6,291.2	4,243.5	1,091.0	400.2	210.1	120.1	79.6	51.6	34.6	24.0	13.9	14.6	4.8	2.0	0.7	0.6
All species	8,961.9	5,325.1	1,639.7	746.1	460.7	289.7	194.6	125.1	75.4	46.5	24.8	22.8	7.3	2.8	0.7	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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.8—Net volume of live trees on forest land by ownership class and land status, South Carolina, 2021

Ownership class		All forest land	Unreserved			Reserved		
			Total	Timberland	Unproductive	Total	Productive	Unproductive
million cubic feet								
USDA Forest Service	National forest	2,006.8	1,942.7	1,942.5	0.2	64.0	64.0	0.0
	Total	2,006.8	1,942.7	1,942.5	0.2	64.0	64.0	0.0
Other Federal	National Park Service	95.3	0.0	0.0	0.0	95.3	95.3	0.0
	U.S. Fish and Wildlife Service	241.2	0.0	0.0	0.0	241.2	241.2	0.0
	U.S. Dept. of Defense/U.S. Dept. of Energy	941.2	905.6	905.6	0.0	35.6	35.6	0.0
	Other Federal	3.1	3.1	3.1	0.0	0.0	0.0	0.0
	Total	1,280.9	908.8	908.8	0.0	372.1	372.1	0.0
State and local government	State	1,199.2	1,199.2	1,199.2	0.0	0.0	0.0	0.0
	Local	674.6	557.0	557.0	0.0	117.6	117.6	0.0
	Total	1,873.8	1,756.2	1,756.2	0.0	117.6	117.6	0.0
Forest Industry	Corporate	585.6	585.6	585.6	0.0	0.0	0.0	0.0
	Individual	23.1	23.1	23.1	0.0	0.0	0.0	0.0
	Total	608.7	608.7	608.7	0.0	0.0	0.0	0.0
Nonindustrial private	Corporate	7,537.6	7,537.6	7,535.8	1.8	0.0	0.0	0.0
	Conservation/natural resources organization	147.4	147.4	147.4	0.0	0.0	0.0	0.0
	Unincorporated local partnership/association/club	232.8	232.8	232.8	0.0	0.0	0.0	0.0
	Individual	14,240.7	14,240.7	14,240.5	0.2	0.0	0.0	0.0
	Total	22,158.4	22,158.4	22,156.4	2.0	0.0	0.0	0.0
All classes		27,928.6	27,374.8	27,372.6	2.2	553.8	553.8	0.0

Volume excludes rotten, missing, and form cull defects volume.

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.9—Net volume of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021

Forest-type group		All classes	Stand-size class			Nonstocked
			Large diameter	Medium diameter	Small diameter	
		million cubic feet				
Softwood types	White-red-jack pine	103.6	99.7	3.8	0.0	0.0
	Longleaf-slash pine	935.1	720.5	192.2	22.4	0.0
	Loblolly-shortleaf pine	12,596.7	10,482.8	1,940.5	173.5	0.0
	Other eastern softwoods	30.5	22.1	1.2	7.1	0.0
	Total softwoods	13,665.9	11,325.1	2,137.7	203.0	0.0
Hardwood types	Oak-pine	2,837.7	2,186.4	502.7	148.7	0.0
	Oak-hickory	5,370.9	4,538.9	664.8	167.2	0.0
	Oak-gum-cypress	5,190.4	4,464.0	618.5	107.9	0.0
	Elm-ash-cottonwood	836.2	706.1	105.5	24.7	0.0
	Maple-beech-birch	8.7	8.7	0.0	0.0	0.0
	Other hardwoods	5.4	0.0	0.5	4.9	0.0
	Exotic hardwoods	11.3	0.0	11.3	0.0	0.0
	Total hardwoods	14,260.6	11,904.1	1,903.2	453.4	0.0
Nonstocked		2.1	0.0	0.0	0.0	2.1
All classes		27,928.6	23,229.2	4,040.9	656.4	2.1

Volume excludes rotten, missing, and form cull defects volume.

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.10—Net volume of live trees on forest land by species group and ownership group, South Carolina, 2021

Species group		Ownership group					
		All ownerships	USDA Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
<i>million cubic feet</i>							
Softwood types	Longleaf and slash pines	1,005.2	61.5	196.4	131.6	3.9	611.8
	Loblolly and shortleaf pines	12,526.7	1,087.5	503.2	432.3	381.2	10,122.6
	Other yellow pines	460.9	36.3	15.5	38.3	1.2	369.5
	Eastern white and red pines	142.1	55.9	0.0	43.6	0.0	42.6
	Eastern hemlock	21.3	11.0	0.0	6.7	0.0	3.6
	Cypress	542.5	32.3	16.5	82.2	16.6	395.0
	Other eastern softwoods	174.7	8.5	6.1	13.3	4.3	142.5
	Total softwoods	14,873.4	1,293.1	737.7	747.9	407.2	11,687.5
Hardwood types	Select white oaks	1,095.0	66.6	19.0	116.9	17.3	875.2
	Select red oaks	446.9	25.9	12.1	40.8	2.3	365.8
	Other white oaks	504.9	32.3	30.9	67.8	1.6	372.3
	Other red oaks	2,896.7	108.4	125.9	216.5	31.6	2,414.3
	Hickory	528.2	25.4	17.0	34.9	4.4	446.4
	Hard maple	13.8	1.4	0.0	0.6	0.0	11.9
	Soft maple	993.8	84.8	26.4	127.5	11.7	743.5
	Beech	63.9	8.8	0.0	6.3	0.3	48.6
	Sweetgum	2,493.7	109.0	109.8	134.7	67.5	2,072.7
	Tupelo and blackgum	1,373.1	114.8	82.9	141.6	15.9	1,017.9
	Ash	287.9	9.3	21.9	40.3	8.0	208.4
	Cottonwood and aspen	70.5	0.0	15.5	6.5	1.6	46.9
	Basswood	5.3	1.0	0.0	0.0	0.0	4.3
	Yellow-poplar	1,205.3	66.8	41.4	106.7	13.8	976.7
	Black walnut	16.6	1.8	1.5	0.3	0.0	13.0
	Other eastern soft hardwoods	775.4	32.9	26.8	46.7	18.6	650.4
	Other eastern hard hardwoods	100.5	4.2	3.5	11.2	4.7	76.8
	Eastern noncommercial hardwoods	179.7	20.4	8.2	26.0	2.2	123.0
	Tropical and subtropical hardwoods	0.1	0.0	0.0	0.0	0.0	0.0
	Urban-specific hardwoods	3.8	0.0	0.3	0.8	0.0	2.8
	Total hardwoods	13,055.1	713.7	543.2	1,125.9	201.4	10,470.9
All species		27,928.6	2,006.8	1,280.9	1,873.8	608.7	22,158.4

Volume excludes rotten, missing, and form cull defects volume.

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.11—Net volume of live trees on forest land by species group and diameter class, South Carolina, 2021

Species group		All classes	Diameter class (inches)												
			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 types	Longleaf and slash pines	1,005.2	87.2	146.7	145.9	136.9	145.3	157.5	97.0	55.5	28.8	4.4	0.0	0.0	0.0
	Loblolly and shortleaf pines	12,526.7	730.2	1,407.0	1,881.0	2,110.1	1,993.4	1,472.3	1,063.1	673.6	711.2	306.0	153.7	12.1	12.9
	Other yellow pines	460.9	34.8	51.0	57.4	61.3	67.4	70.0	52.9	30.1	17.3	12.8	6.1	0.0	0.0
	Eastern white and red pines	142.1	2.7	4.0	4.6	11.8	16.3	15.4	23.6	16.1	10.3	25.4	8.5	3.3	0.0
	Eastern hemlock	21.3	0.4	1.3	2.3	2.9	2.8	1.1	1.0	1.9	7.7	0.0	0.0	0.0	0.0
	Cypress	542.5	19.4	27.7	61.4	77.4	84.0	71.6	63.3	42.0	66.9	14.9	13.9	0.0	0.0
	Other eastern softwoods	174.7	41.7	45.0	32.1	22.5	14.4	5.7	6.7	4.1	0.0	2.7	0.0	0.0	0.0
	Total softwoods	14,873.4	916.5	1,682.6	2,184.7	2,422.9	2,323.5	1,793.5	1,307.6	823.3	842.2	366.1	182.2	15.4	12.9
Hardwood types	Select white oaks	1,095.0	37.3	49.3	68.5	91.4	118.8	139.5	127.9	107.3	189.0	57.9	65.8	16.5	25.8
	Select red oaks	446.9	10.5	14.8	22.3	29.9	23.7	33.1	41.8	28.2	74.5	52.2	53.5	19.0	43.2
	Other white oaks	504.9	27.6	42.6	48.0	56.1	57.2	55.1	52.0	43.7	65.8	19.7	20.5	8.2	8.5
	Other red oaks	2,896.7	206.7	263.2	266.7	307.3	298.3	264.8	286.2	223.8	361.1	183.5	120.0	51.6	63.5
	Hickory	528.2	36.9	61.4	78.8	77.8	74.4	82.8	62.2	25.6	17.0	11.2	0.0	0.0	0.0
	Hard maple	13.8	3.1	2.2	1.4	2.8	0.0	0.8	1.6	2.1	0.0	0.0	0.0	0.0	0.0
	Soft maple	993.8	150.7	146.2	139.4	142.6	111.1	88.6	57.5	59.4	70.1	24.2	0.0	3.9	0.0
	Beech	63.9	6.0	7.6	8.3	9.3	7.8	3.0	8.7	7.3	4.4	1.4	0.0	0.0	0.0
	Sweetgum	2,493.7	252.9	329.9	346.9	313.1	290.8	240.4	245.7	168.7	188.2	79.4	14.1	0.0	23.6
	Tupelo and blackgum	1,373.1	91.7	127.9	173.7	208.7	222.8	201.7	137.8	96.2	58.6	26.0	7.7	17.7	2.5
	Ash	287.9	29.6	34.8	32.9	36.2	44.9	26.5	32.0	28.8	14.4	7.9	0.0	0.0	0.0
	Cottonwood and aspen	70.5	2.8	3.1	4.3	4.2	4.0	6.3	5.3	0.0	3.7	18.8	7.5	10.4	0.0
	Basswood	5.3	0.3	0.5	1.4	2.4	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
	Yellow-poplar	1,205.3	38.0	71.5	88.3	107.6	102.8	125.8	146.7	111.6	193.5	131.8	56.8	13.1	17.8
	Black walnut	16.6	1.3	1.4	2.4	1.4	3.7	1.9	1.4	3.1	0.0	0.0	0.0	0.0	0.0
	Other eastern soft hardwoods	775.4	115.5	126.6	105.8	97.1	65.4	63.5	48.9	41.8	57.6	17.8	16.4	8.2	10.7
	Other eastern hard hardwoods	100.5	35.6	26.9	16.3	7.5	10.1	0.0	1.7	0.0	2.4	0.0	0.0	0.0	0.0
	Eastern noncommercial hardwoods	179.7	57.6	43.3	35.0	23.7	11.6	6.8	1.7	0.0	0.0	0.0	0.0	0.0	0.0
	Tropical and subtropical hardwoods	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Urban-specific hardwoods	3.8	1.8	1.4	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	13,055.1	1,106.4	1,354.5	1,440.6	1,519.7	1,447.5	1,340.6	1,259.6	947.6	1,300.4	631.8	362.2	148.6	195.5	
All species		27,928.6	2,022.8	3,037.2	3,625.4	3,942.6	3,771.0	3,134.1	2,567.2	1,770.9	2,142.6	997.9	544.5	164.1	208.4

Volume excludes rotten, missing, and form cull defects volume.

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.12—Net volume of live trees on forest land by forest-type group and stand origin, South Carolina, 2021

Forest-type group		Total	Stand origin	
			Natural stands	Artificial regeneration
		million cubic feet		
Softwood types	White-red-jack pine	103.6	103.6	0.0
	Longleaf-slash pine	935.1	623.0	312.1
	Loblolly-shortleaf pine	12,596.7	7,107.1	5,489.6
	Other eastern softwoods	30.5	30.5	0.0
	Total softwoods	13,665.9	7,864.1	5,801.8
Hardwood types	Oak-pine	2,837.7	2,679.9	157.9
	Oak-hickory	5,370.9	5,333.6	37.3
	Oak-gum-cypress	5,190.4	5,178.6	11.8
	Elm-ash-cottonwood	836.2	836.2	0.0
	Maple-beech-birch	8.7	8.7	0.0
	Other hardwoods	5.4	5.4	0.0
	Exotic hardwoods	11.3	10.1	1.3
	Total hardwoods	14,260.6	14,052.4	208.2
Nonstocked		2.1	0.6	1.5
All groups		27,928.6	21,917.1	6,011.5

Volume excludes rotten, missing, and form cull defects volume.

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.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.13—Aboveground dry weight¹ of live trees on forest land by ownership class and land status, South Carolina, 2021

Ownership class		All forest land	Unreserved			Reserved		
			Total	Timberland	Unproductive	Total	Productive	Unproductive
thousand tons								
USDA Forest Service	National forest	48,224.7	46,625.4	46,618.1	7.3	1,599.3	1,599.3	0.0
	Total	48,224.7	46,625.4	46,618.1	7.3	1,599.3	1,599.3	0.0
Other Federal	National Park Service	2,789.0	0.0	0.0	0.0	2,789.0	2,789.0	0.0
	U.S. Fish and Wildlife Service	6,039.4	0.0	0.0	0.0	6,039.4	6,039.4	0.0
	U.S. Dept. of Defense/Dept. of Energy	22,933.2	22,133.8	22,133.8	0.0	799.3	799.3	0.0
	Other Federal	74.6	74.6	74.6	0.0	0.0	0.0	0.0
	Total	31,836.2	22,208.4	22,208.4	0.0	9,627.8	9,627.8	0.0
State and local government	State	31,007.8	31,007.8	31,007.8	0.0	0.0	0.0	0.0
	Local	17,251.8	14,190.1	14,190.1	0.0	3,061.6	3,061.6	0.0
	Total	48,259.6	45,197.9	45,197.9	0.0	3,061.6	3,061.6	0.0
Forest Industry	Corporate	15,289.2	15,289.2	15,289.2	0.0	0.0	0.0	0.0
	Individual	635.4	635.4	635.4	0.0	0.0	0.0	0.0
	Total	15,924.6	15,924.6	15,924.6	0.0	0.0	0.0	0.0
Nonindustrial private	Corporate	192,683.3	192,683.3	192,592.8	90.5	0.0	0.0	0.0
	Conservation/natural resources organization	3,972.7	3,972.7	3,972.7	0.0	0.0	0.0	0.0
	Unincorporated local partnership/association/club	5,979.8	5,979.8	5,979.8	0.0	0.0	0.0	0.0
	Individual	372,977.4	372,977.4	372,944.6	32.8	0.0	0.0	0.0
	Total	575,613.2	575,613.2	575,489.9	123.3	0.0	0.0	0.0
All classes		719,858.2	705,569.5	705,438.9	130.6	14,288.7	14,288.7	0.0

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.

¹ Calculations of dry weight based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.14—Total carbon¹ of live trees on forest land by ownership class and land status, South Carolina, 2021

Ownership class		All forest land	Unreserved			Reserved		
			Total	Timberland	Unproductive	Total	Productive	Unproductive
thousand tons								
USDA Forest Service	National forest	24,112.4	23,312.7	23,309.1	3.6	799.7	799.7	0.0
	Total	24,112.4	23,312.7	23,309.1	3.6	799.7	799.7	0.0
Other Federal	National Park Service	1,394.5	0.0	0.0	0.0	1,394.5	1,394.5	0.0
	U.S. Fish and Wildlife Service	3,019.7	0.0	0.0	0.0	3,019.7	3,019.7	0.0
	U.S. Dept. of Defense/Dept. of Energy	11,466.6	11,066.9	11,066.9	0.0	399.7	399.7	0.0
	Other Federal	37.3	37.3	37.3	0.0	0.0	0.0	0.0
	Total	15,918.1	11,104.2	11,104.2	0.0	4,813.9	4,813.9	0.0
State and local government	State	15,503.9	15,503.9	15,503.9	0.0	0.0	0.0	0.0
	Local	8,625.9	7,095.1	7,095.1	0.0	1,530.8	1,530.8	0.0
	Total	24,129.8	22,599.0	22,599.0	0.0	1,530.8	1,530.8	0.0
Forest Industry	Corporate	7,644.6	7,644.6	7,644.6	0.0	0.0	0.0	0.0
	Individual	317.7	317.7	317.7	0.0	0.0	0.0	0.0
	Total	7,962.3	7,962.3	7,962.3	0.0	0.0	0.0	0.0
Nonindustrial private	Corporate	96,341.7	96,341.7	96,296.4	45.3	0.0	0.0	0.0
	Conservation/natural resources organization	1,986.3	1,986.3	1,986.3	0.0	0.0	0.0	0.0
	Unincorporated local partnership/association/club	2,989.9	2,989.9	2,989.9	0.0	0.0	0.0	0.0
	Individual	186,488.7	186,488.7	186,472.3	16.4	0.0	0.0	0.0
	Total	287,806.6	287,806.6	287,744.9	61.7	0.0	0.0	0.0
All classes		359,929.1	352,784.7	352,719.5	65.3	7,144.4	7,144.4	0.0

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.

¹ Estimates of carbon calculated by multiplying aboveground dry tree biomass by 0.5. Calculations of dry weight based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.15—Average annual net growth of live trees by ownership class and land status, South Carolina, 2021

Ownership class ¹		Land status	
		Timberland	Forest land
<i>million cubic feet</i>			
USDA Forest Service	National forest	55.4	56.5
	Total	55.4	56.5
Other Federal	National Park Service	0.0	-1.3
	U.S. Fish and Wildlife Service	0.0	2.9
	U.S. Dept. of Defense/ Dept. of Energy	15.6	16.5
	Other Federal	0.0	0.0
	Total	15.7	18.1
State and local government	State	34.5	34.5
	Local	18.0	18.4
	Total	52.5	52.9
Forest Industry	Corporate	53.5	53.5
	Individual	2.0	2.0
	Total	55.6	55.6
Nonindustrial private	Corporate	405.5	405.6
	Conservation/natural resources organization	5.8	5.8
	Unincorporated partnership/association/club	10.7	10.7
	Individual	664.9	665.0
	Total	1,086.9	1,087.0
All classes		1,266.1	1,270.1

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.

¹ Based on current conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.16—Average annual net growth of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021

Forest-type group ¹		All classes	Stand-size class			
			Large diameter	Medium diameter	Small diameter	Nonstocked
million cubic feet						
Softwood types	White-red-jack pine	2.1	2.0	0.1	0.0	0.0
	Longleaf-slash pine	41.5	10.8	25.0	5.7	0.0
	Loblolly-shortleaf pine	836.1	440.7	306.0	89.4	0.0
	Other eastern softwoods	1.6	0.4	0.3	0.9	0.0
	Total Softwoods	881.4	453.9	331.3	96.1	0.0
Hardwood types	Oak-pine	124.6	59.5	35.8	29.3	0.0
	Oak-hickory	141.3	77.0	35.7	28.6	0.0
	Oak-gum-cypress	104.1	59.6	30.3	14.2	0.0
	Elm-ash-cottonwood	17.0	6.9	4.6	5.5	0.0
	Other hardwoods	0.2	0.0	0.0	0.1	0.0
	Tropical hardwoods	-0.2	-0.2	0.0	0.0	0.0
	Exotic hardwoods	1.6	0.9	0.1	0.6	0.0
	Total Hardwoods	388.5	203.8	106.5	78.3	0.0
Nonstocked		0.2	0.0	0.0	0.0	0.2
All groups		1,270.1	657.7	437.9	174.3	0.2

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.

¹ Based on past conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.17—Average annual net growth of live trees on forest land by species group and ownership group, South Carolina, 2021

Species group		Ownership group ¹					
		All ownerships	USDA Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
<i>million cubic feet</i>							
Softwood type	Longleaf and slash pines	42.7	1.8	4.3	5.7	0.6	30.4
	Loblolly and shortleaf pines	862.6	37.8	11.5	23.3	42.1	747.9
	Other yellow pines	12.6	0.7	0.1	0.2	0.1	11.5
	Eastern white and red pines	4.3	0.8	0.0	1.4	0.0	2.1
	Eastern hemlock	-1.1	-0.1	0.0	-0.9	0.0	-0.1
	Cypress	12.9	0.6	0.2	2.7	0.9	8.4
	Other eastern softwoods	5.9	0.2	0.1	0.5	0.0	5.1
	Total softwoods	940.0	41.8	16.2	32.8	43.8	805.3
Hardwood types	Select white oaks	25.3	1.4	0.3	2.1	0.5	21.1
	Select red oaks	9.2	0.5	0.1	0.8	0.1	7.7
	Other white oaks	3.7	0.7	-2.0	-1.5	0.2	6.3
	Other red oaks	80.7	2.7	0.4	5.2	1.5	70.9
	Hickory	10.6	0.6	0.4	0.2	0.4	8.9
	Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
	Hard maple	0.5	0.0	0.0	0.0	0.0	0.5
	Soft maple	19.1	2.6	-0.6	1.8	0.7	14.5
	Beech	2.0	0.2	0.0	0.2	0.0	1.6
	Sweetgum	90.0	2.1	2.1	3.4	4.7	77.7
	Tupelo and blackgum	20.7	1.5	0.8	2.3	0.5	15.6
	Ash	7.6	-0.1	0.6	1.1	0.7	5.4
	Cottonwood and aspen	1.2	0.0	0.3	0.2	0.3	0.3
	Basswood	0.2	0.0	0.0	0.0	0.0	0.1
	Yellow-poplar	34.8	1.4	-0.4	2.5	0.7	30.5
	Black walnut	0.4	0.1	0.0	0.0	0.0	0.3
	Other eastern soft hardwoods	16.7	0.7	-0.2	0.9	1.0	14.2
	Other eastern hard hardwoods	3.1	-0.1	0.1	0.4	0.1	2.6
	Eastern noncommercial hardwoods	3.9	0.3	-0.1	0.4	0.1	3.0
	Tropical and subtropical hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
	Urban-specific hardwoods	0.5	0.0	0.0	0.1	0.0	0.4
	Total hardwoods	330.1	14.7	1.9	20.1	11.8	281.7
All groups		1,270.1	56.5	18.1	52.9	55.6	1,087.0

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.

¹ Groups based on current conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.18—Average annual mortality of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021

Forest-type group ¹		Stand-size class ¹				
		All classes	Large diameter	Medium diameter	Small diameter	Nonstocked
<i>million cubic feet</i>						
Softwood type	White-red-jack pine	0.9	0.9	0.0	0.0	0.0
	Longleaf-slash pine	6.8	3.7	2.6	0.5	0.0
	Loblolly-shortleaf pine	75.1	55.6	17.3	2.3	0.0
	Other eastern softwoods	0.2	0.1	0.0	0.1	0.0
	Total softwoods	83.0	60.2	19.8	2.9	0.0
Hardwood type	Oak-pine	26.7	20.6	5.1	1.1	0.0
	Oak-hickory	47.5	40.4	5.5	1.6	0.0
	Oak-gum-cypress	74.7	63.3	10.4	1.0	0.0
	Elm-ash-cottonwood	15.1	13.3	1.3	0.5	0.0
	Other hardwoods	0.0	0.0	0.0	0.0	0.0
	Tropical hardwoods	0.3	0.3	0.0	0.0	0.0
	Exotic hardwoods	0.4	0.0	0.3	0.1	0.0
	Total hardwoods	164.7	137.9	22.6	4.2	0.0
Nonstocked		0.6	0.0	0.0	0.0	0.6
All groups		248.3	198.2	42.4	7.1	0.6

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¹ Based on past conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.19—Average annual mortality of live trees on timberland by species group and ownership group, South Carolina, 2021

Species group			Ownership group ¹				
			All ownerships	USDA Forest Service	Other Federal	State and local government	Forest industry
million cubic feet							
Softwoods	Longleaf and slash pines	6.7	0.1	1.5	0.8	0.2	4.2
	Loblolly and shortleaf pines	80.4	8.0	2.5	3.4	2.4	64.0
	Other yellow pines	8.1	0.4	0.3	1.2	0.0	6.3
	Eastern white and red pines	0.8	0.7	0.0	0.1	0.0	0.0
	Eastern hemlock	0.6	0.3	0.0	0.0	0.0	0.2
	Cypress	2.1	0.1	0.0	0.1	0.0	2.0
	Other eastern softwoods	1.4	0.1	0.1	0.0	0.1	1.1
	Total	100.1	9.7	4.4	5.6	2.7	77.8
Hardwoods	Select white oaks	7.0	0.2	0.0	0.3	0.0	6.4
	Select red oaks	3.2	0.1	0.0	0.0	0.0	3.0
	Other white oaks	6.3	0.1	0.1	3.0	0.0	3.1
	Other red oaks	40.3	1.1	3.4	2.4	0.2	33.2
	Hickory	3.6	0.0	0.0	0.7	0.0	2.9
	Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
	Hard maple	0.0	0.0	0.0	0.0	0.0	0.0
	Soft maple	19.1	0.5	0.3	2.1	0.0	16.2
	Beech	0.0	0.0	0.0	0.0	0.0	0.0
	Sweetgum	17.9	1.4	0.2	1.8	0.1	14.4
	Tupelo and blackgum	9.8	0.6	0.1	0.6	0.0	8.4
	Ash	3.1	0.4	0.2	0.2	0.1	2.3
	Cottonwood and aspen	1.4	0.0	0.0	0.0	0.0	1.4
	Basswood	0.0	0.0	0.0	0.0	0.0	0.0
	Yellow-poplar	6.1	0.4	0.7	0.1	0.0	4.9
	Black walnut	0.2	0.0	0.0	0.0	0.0	0.2
	Other eastern soft hardwoods	18.1	0.2	0.4	1.0	0.4	16.1
	Other eastern hard hardwoods	1.4	0.3	0.1	0.1	0.0	0.9
	Eastern noncommercial hardwoods	3.8	0.2	0.1	0.3	0.1	3.1
	Tropical and subtropical hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
	Urban-specific hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
	Total	141.4	5.6	5.7	12.5	0.9	116.7
All groups		241.5	15.3	10.1	18.1	3.7	194.4

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¹ Based on current conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.20—Average annual net removals of live trees by ownership class and land status, South Carolina, 2021

Ownership class ¹		Land status	
		Timberland	Forest land
		<i>million cubic feet</i>	
USDA Forest Service	National forest	14.1	14.1
	Total	14.1	14.1
Other Federal	U.S. Dept. of Defense/U.S. Dept. of Energy	12.3	12.3
	Total	12.3	12.3
State and local government	State	5.1	5.1
	Local	2.2	2.2
	Total	7.2	7.2
Forest industry	Corporate	70.4	70.4
	Total	70.4	70.4
Nonindustrial private	Corporate	375.9	375.7
	Conservation/natural resources organization	1.2	1.2
	Unincorporated partnership/association/club	0.9	0.9
	Individual	388.4	388.4
	Total	766.4	766.2
All classes		870.5	870.2

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¹ Based on current conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.21—Average annual removals of live trees on forest land by forest-type group and stand-size class, South Carolina, 2021

Forest-type group ¹		All classes	Stand-size class			Nonstocked
			Large diameter	Medium diameter	Small diameter	
million cubic feet						
Softwoods	White-red-jack pine	0.0	0.0	0.0	0.0	0.0
	Longleaf-slash pine	11.5	7.3	4.2	0.0	0.0
	Loblolly-shortleaf pine	648.6	481.8	159.9	6.9	0.0
	Other eastern softwoods	0.0	0.0	0.0	0.0	0.0
	Total softwoods	660.1	489.1	164.1	6.9	0.0
Hardwoods	Oak-pine	57.0	37.0	16.8	3.2	0.0
	Oak-hickory	74.1	49.6	19.9	4.6	0.0
	Oak-gum-cypress	59.2	40.6	17.5	1.0	0.0
	Elm-ash-cottonwood	19.7	19.3	0.2	0.3	0.0
	Other hardwoods	0.0	0.0	0.0	0.0	0.0
	Tropical hardwoods	0.0	0.0	0.0	0.0	0.0
	Exotic hardwoods	0.2	0.0	0.2	0.0	0.0
Total hardwoods	210.2	146.5	54.6	9.1	0.0	
Nonstocked		0.0	0.0	0.0	0.0	0.0
All groups		870.3	635.6	218.7	16.0	0.0

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

¹ Based on current conditions.

SOUTH CAROLINA'S FORESTS, 2021

Table A3.22—Average annual removals of live trees on forest land by species group and ownership group, South Carolina, 2021

Species group			Ownership group				
			All ownerships	USDA Forest Service	Other Federal	State and local government	Forest industry
million cubic feet							
Softwoods	Longleaf and slash pines	18.4	0.0	1.8	0.8	0.3	15.5
	Loblolly and shortleaf pines	636.5	13.3	8.6	5.6	51.8	557.2
	Other yellow pines	10.6	0.0	0.0	0.0	0.1	10.5
	Eastern white and red pines	0.0	0.0	0.0	0.0	0.0	0.0
	Eastern hemlock	0.0	0.0	0.0	0.0	0.0	0.0
	Cypress	0.7	0.0	0.0	0.0	0.3	0.4
	Other eastern softwoods	1.3	0.1	0.0	0.1	0.0	1.1
	Total softwoods	667.6	13.4	10.4	6.5	52.5	584.8
Hardwoods	Select white oaks	15.9	0.0	0.0	0.0	0.0	15.8
	Select red oaks	4.2	0.0	0.0	0.0	0.0	4.1
	Other white oaks	6.7	0.0	0.0	0.0	0.1	6.6
	Other red oaks	50.2	0.0	0.8	0.2	2.0	47.2
	Hickory	5.4	0.0	0.0	0.0	0.6	4.7
	Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
	Hard maple	0.2	0.0	0.0	0.0	0.0	0.2
	Soft maple	12.2	0.1	0.0	0.1	1.3	10.8
	Beech	0.2	0.0	0.0	0.0	0.0	0.2
	Sweetgum	55.0	0.3	0.9	0.3	3.0	50.4
	Tupelo and blackgum	6.3	0.0	0.1	0.0	0.8	5.4
	Ash	8.3	0.0	0.0	0.0	4.2	4.0
	Cottonwood and aspen	2.3	0.0	0.0	0.0	2.2	0.1
	Basswood	0.0	0.0	0.0	0.0	0.0	0.0
	Yellow-poplar	15.3	0.1	0.0	0.0	0.2	15.0
	Black walnut	1.0	0.0	0.0	0.0	0.0	1.0
	Other eastern soft hardwoods	13.0	0.1	0.0	0.0	3.1	9.8
	Other eastern hard hardwoods	1.5	0.0	0.0	0.0	0.1	1.4
	Eastern noncommercial hardwoods	4.9	0.1	0.0	0.1	0.1	4.6
	Tropical and subtropical hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
	Urban-specific hardwoods	0.0	0.0	0.0	0.0	0.0	0.0
	Total hardwoods	202.7	0.8	1.9	0.7	17.9	181.4
All groups		870.2	14.1	12.3	7.2	70.4	766.2

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SOUTH CAROLINA'S FORESTS, 2021

Table A3.23—List of tree species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021

Common name	Number
Loblolly pine	7,015
Sweetgum	2,301
Red maple	1,309
Water oak	969
Swamp tupelo	517
Longleaf pine	488
Laurel oak	405
Yellow-poplar	401
Eastern redcedar	398
White oak	363
Winged elm	269
Sourwood	258
Black cherry	247
Southern red oak	208
American holly	206
Green ash	201
Shortleaf pine	195
Blackgum	182
Mockernut hickory	164
Post oak	153
Water tupelo	152
Baldcypress	146
Willow oak	144
Slash pine	138
Virginia pine	124
American elm	109
American hornbeam, musclewood	108
Flowering dogwood	102
Scarlet oak	98
Redbay	93

Table A3.23—List of tree species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021 (continued)

Common name	Number
Morella cerifera	90
Pignut hickory	88
Black willow	87
Turkey oak	77
Sweetbay	70
River birch	68
Northern red oak	66
Common persimmon	65
Live oak	63
Pond pine	62
Shagbark hickory	61
American beech	61
Dwarf post oak	54
Eastern white pine	50
Swamp chestnut oak	48
Sugarberry	47
Carolina ash	47
American sycamore	46
Black oak	46
Blackjack oak	45
Florida maple	40
Sand hickory	38
Chestnut oak	38
Loblolly-bay	37
Cherrybark oak	36
White ash	33
Eastern hophornbeam	33
Pondcypress	31
Boxelder	30
Darlington oak	30

SOUTH CAROLINA'S FORESTS, 2021

Table A3.23—List of tree species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021 (continued)

Common name	Number
Water-elm, planertree	29
Farkleberry	28
Bluejack oak	27
Swamp cottonwood	23
Pecan	21
Slippery elm	20
Eastern redbud	18
Overcup oak	18
Red mulberry	16
Callery pear	16
Water hickory	15
Bitternut hickory	15
Chinese tallowtree	15
Black walnut	14
Ailanthus	13
Sassafras	13
Southern redcedar	11
Southern magnolia	10
Eastern hemlock	9
Cabbage palmetto	9
Pawpaw	8
Black locust	8
Hawthorn spp.	5
Chinaberry	5
Spruce pine	4
Sweet birch	4
Cucumbertree	4
Eastern cottonwood	4
American basswood	4
Carolina laurelcherry	4

Table A3.23—List of tree species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021 (continued)

Common name	Number
Southern shagbark hickory	3
White basswood	3
Eastern baccharis	3
Swamp bay	3
Carolina hemlock	2
Silver maple	2
Honeylocust	2
White mulberry	2
Carolina basswood	2
Glossy privet	2
Pitch pine	1
Mimosa, silktree	1
Pumpkin ash	1
Mountain or Fraser magnolia	1

SOUTH CAROLINA'S FORESTS, 2021

Table A3.24—List of seedling species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021

Common name	Number
Sweetgum	525
Loblolly pine	434
Water oak	273
Red maple	235
Morella cerifera	193
American holly	174
Eastern redcedar	168
Common persimmon	151
Redbay	140
Willow oak	124
Winged elm	124
White oak	92
Southern red oak	78
Farkleberry	72
Pignut hickory	60
Sweetbay	60
Black cherry	57
Blackgum	54
Green ash	52
Mockernut hickory	49
Laurel oak	40
Flowering dogwood	38
American hornbeam, musclewood	37
Sassafras	37
Post oak	34
Live oak	33
Yellow-poplar	31
American beech	28
Dwarf palmetto	28
Turkey oak	26

Table A3.24—List of seedling species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021 (continued)

Common name	Number
Sugarberry	24
Sourwood	22
Black oak	22
Shagbark hickory	21
Eastern baccharis	19
Pawpaw	18
Eastern hophornbeam	17
Shortleaf pine	16
Longleaf pine	16
Hawthorn spp.	16
Swamp tupelo	15
Cherrybark oak	15
Florida maple	14
Eastern redbud	14
Dwarf post oak	14
Eastern white pine	13
Baldcypress	13
Boxelder	13
Sand hickory	13
Callery pear	13
Virginia pine	12
Northern red oak	12
Scarlet oak	11
Chinese tallowtree	11
Chickasaw plum	9
Blackjack oak	9
Bluejack oak	9
Darlington oak	9
Bitternut hickory	8
Mountain or Fraser magnolia	7

SOUTH CAROLINA'S FORESTS, 2021

Table A3.24—List of seedling species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021 (continued)

Common name	Number
Chestnut oak	7
Swamp bay	7
White ash	6
Slash pine	5
Mimosa, silktree	5
Red mulberry	5
Swamp chestnut oak	5
Black willow	5
Loblolly-bay	4
Southern magnolia	4
American plum	4
Cabbage palmetto	4
Smallflower pawpaw	4
American snowbell	4
Ailanthus	3
Carolina ash	3
American elm	3
Glossy privet	3
Hardy orange	3
Carolina laurelcherry	3
Pondcypress	2
Eastern hemlock	2

Table A3.24—List of seedling species ≥ 1.0 -inch d.b.h. occurring in the FIA sample and number measured, South Carolina, 2021 (continued)

Common name	Number
Common serviceberry	2
River birch	2
Pecan	2
Carolina silverbell	2
American sycamore	2
Overcup oak	2
Slippery elm	2
Sweet birch	1
American chestnut	1
Chinese chestnut	1
Cockspur hawthorn	1
Fanleaf hawthorn	1
Cucumbertree	1
Water tupelo	1
Water-elm, planertree	1
Eastern cottonwood	1
Black locust	1
Cherry laurel	1
Yaupon	1

Lambert, S.G.; Gray, J.; McCollum, J.; Brandeis, T.J.; Brown, M.J. 2025. South Carolina's Forests, 2021. Resour. Bull. SRS-248. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 96 p. <https://doi.org/10.2737/SRS-RB-248>.

South Carolina's 12.8 million acres of forest cover 66 percent of the State. This forest land area has remained relatively stable for the past 20 years. The most notable change in ownership has primarily been forest industry's acquisition of timberland acres from nonindustrial corporate entities. In 2016, forest industry owned 227,800 acres in South Carolina, and by 2021 it increased to 468,600 acres (more than doubled). Loblolly-shortleaf pine (*Pinus taeda-echinata*) remains the predominant forest type group followed by oak-hickory (*Quercus-Carya*) forest. These forests hold slightly more than 26 billion cubic feet of wood volume and 720 million oven-dry tons of aboveground live-tree biomass. Softwood annual net growth and removals trended upwards while mortality declined from previously observed levels, giving a growth-to-removals ratio (a measure used to assess resource sustainability) of 1.4. Conversely, hardwood growth and removals were slightly down while their mortality increased, giving a growth-to-removals ratio of 1.6. Wildland forest fires were the most frequently recorded disturbance on forest land, followed by weather events and forest diseases. There was an average 68.0 million tons of down woody material carbon and 144.6 million tons on the forest floor in duff and litter. Chinaberry (*Melia azedarach*), Chinese tallow (*Triadica sebifera*), Chinese/European privets (*Ligustrum* spp.), Japanese honeysuckle (*Lonicera japonica*), Nepalese browntop (*Microstegium vimineum*), and Chinese or sericea lespedeza (*Lespedeza cuneata*) were the most commonly encountered nonnative invasive plants on forested plots. A diverse forest products industry in South Carolina is made up of a variety of mills, ranging from small to large-sized softwood and hardwood sawmills, pole, veneer, composite, bioenergy, and other miscellaneous mills to very large pulp mills. The total number of sawmills, pulpwood mills, and other primary wood-processing plants distributed across the State has moderately increased.

Keywords: Forest inventory, FIA, forest survey, tree species, forest trends, biomass, carbon, TPO.



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