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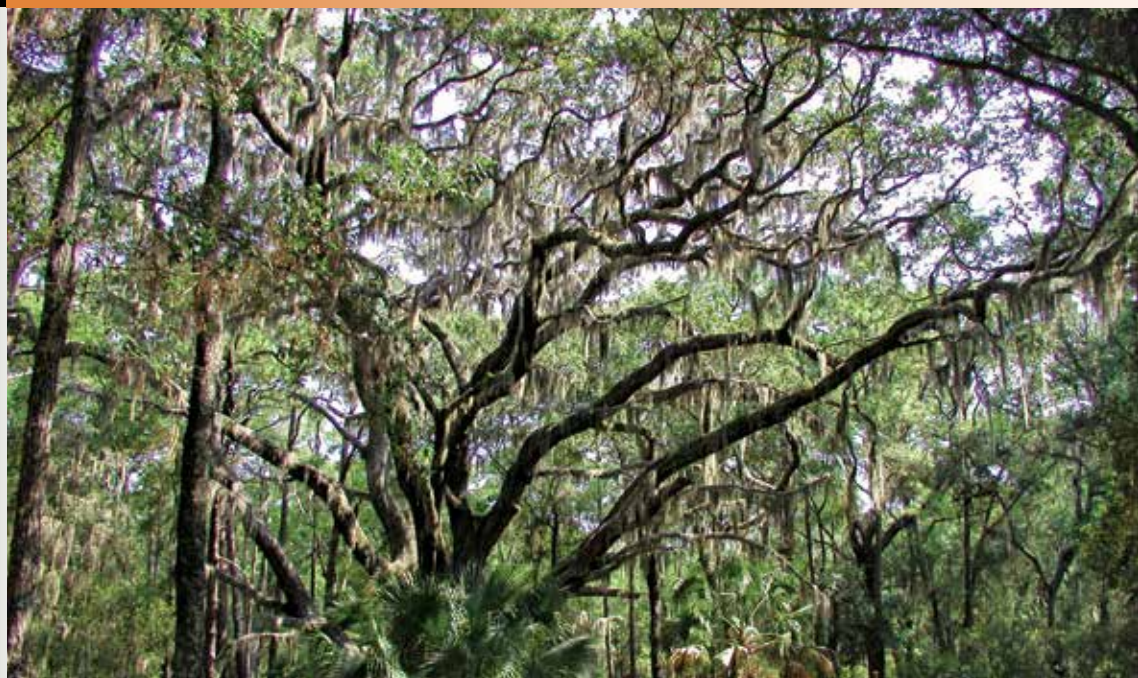
Georgia's Forests, 2014

Thomas J. Brandeis, Joseph M. McCollum, Andrew J. Hartsell,
Consuelo Brandeis, Anita K. Rose, Sonja N. Oswalt,
James T. Vogt, and Humfredo Marcano Vega



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Front cover: top left, bald eagles (*Haliaeetus leucocephalus*) require large trees near water for nesting. (photo courtesy of the Georgia Forestry Commission); top right, mountain laurel (*Kalmia latifolia*) in Georgia's forests. (photo by James Gray, U.S. Forest Service); bottom, southern live oaks (*Quercus virginiana*) in the Cumberland Island National Seashore. (photo by Thomas Brandeis, U.S. Forest Service). Back cover: top left, managed pine forest in Georgia. (photo courtesy of the Georgia Forestry Commission); top right, bald eagles (*Haliaeetus leucocephalus*) require large trees near water for nesting. (photo courtesy of the Georgia Forestry Commission); bottom, wild turkeys (*Meleagris gallopavo*) thrive and provide recreational opportunities in Georgia's forests. (photo courtesy of the Georgia Forestry Commission).

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Spanish moss (*Tillandsia usneoides*) in a southern live oak (*Quercus virginiana*) in the Cumberland Island National Seashore. (photo by Thomas Brandeis, U.S. Forest Service)

FOREWORD

The Forest Service, U.S. Department of Agriculture, Southern Research Station's (SRS) Forest Inventory and Analysis (FIA) research work unit and cooperating State forestry agencies conduct annual forest inventories of resources in the 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia), the Commonwealth of Puerto Rico, and the U.S. Virgin Islands. In order to provide more frequent and nationally consistent information on America's forest resources, all research stations and their respective FIA work units conduct annual surveys with a common sample design. These surveys are mandated by law through the Agricultural Research Extension and Education Reform Act of 1998 (Farm Bill).

The primary objective in conducting these inventories is to gather the multiresource information needed to formulate sound forest policies, provide information for economic development, develop forest programs, and provide a scientific basis to monitor forest ecosystems. These data are used to provide an overview of forest resources that may include, but is not limited to, forest area, forest ownership, forest type, stand structure, timber volume, growth, removals, mortality, management activity, down woody material, carbon storage and sequestration, and invasive species. The information presented is applicable at the State and survey unit level; although it provides the background for more intensive studies of critical situations, it is not designed to reflect resource conditions at small scales.

More information about Forest Service resource inventories is available in "Forest Resource Inventories: An Overview" (U.S. Department of Agriculture 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).

Data tables included in FIA reports are designed to provide an array of forest resource estimates, but additional tables can be obtained at http://fia.fs.fed.us/tools-data/default.asp. Additional information about the FIA Program can be obtained at http://fia.fs.fed.us/.

Additional information about any aspect of this or other FIA surveys may be obtained from:

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

ACKNOWLEDGMENTS

The SRS gratefully acknowledges the Georgia Forestry Commission for their cooperation and input during this survey. FIA field personnel, Information Management, and Technical Publications staff are all due thanks for their dedication, hard work, and assistance. We also appreciate the cooperation of other public agencies and private landowners for providing access to measurement plots. In particular, I would like to thank Vince Few, Greg Smith, and Jim Gray of the SRS FIA Quality Assurance/Quality Control staff; Dan Chappell, Chad Northcutt, Mark Freeman, Chris Dowdy, Nathan Wheat, Luke Montgomery, Brian Allen, Morgan Cook, Tim Karchner, Keith Moss, Chad Sutton, Zachary Ledbetter, Chris Howell, Ryan Adamczak and David Dickinson of the Georgia Forestry Commission; and David Dickinson and Dru Preston for reviewing this manuscript.

Contents

List of Figures

Page

Text Figures

List of Figures

Appendix Figures

List of Text Tables

Page

Text Tables

List of Appendix Tables

Page

Appendix Tables

List of Appendix Tables

HIGHLIGHTS

• There are 24.7 million acres of forest in Georgia. Sixty-five percent of the State is forested, while 32 percent is nonforest, and 3 percent is classified as surface water. Ninety-eight percent of this forest land is considered timberland, that is, not reserved by legal statute and sufficiently productive to support sustainable harvesting of forest products.

• Among nonforest land, agricultural land is most prevalent. Ten percent of Georgia's surface area is cropland, with another 5 percent being pasture, and 2 additional percent split among miscellaneous agricultural types. Roughly 3 percent of Georgia is developed due to rights of way, with another 11 percent otherwise developed. The remaining 1 percent of Georgia's surface area is wetland or beach.

• Forest ownership is changing as the divestiture of timberland by traditional forest industry, defined as companies that own wood processing facilities, has continued, as has concurrent acquisition of these lands by other corporate owners, in particular Timber Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs). Still, more than half (58 percent) of Georgia's forests belong to nonindustrial private landowners.

• Georgia's forests are a diverse mix of hardwood and softwood tree species typical of the South. Hardwood forests account for 53 percent of the forested area versus 45 percent for softwood types. Loblolly-shortleaf is the most prevalent softwood group, consisting of 30 percent of all forest land. Oak-hickory is the most prevalent hardwood forest-type group, consisting of 26 percent of all forest land, followed by oak-gum-cypress and the mixed oak-pine forest-type group.

• Pine plantations account for 62 percent of all softwood forests. After decades of decreasing natural pine acreage and increasing plantation acreage, the balance between the two has stabilized at 6.9 and 4.1 million acres for planted and natural pine, respectively, roughly the same as in 2009.

• Two land use change trends stand out in Georgia from 2004 to 2014. The rate at which the State gained forest land acreage from converted agricultural land decreased until 2009 and after that time remained stable. The rate at which forest was lost to development decreased steadily since about 2007.

• The population of planted pine acres has been getting older. Two features are outstanding in the stand age distribution of planted pine timberland acreage. First is the relatively abrupt drop in acreage more than 25 years old that indicates the typical age at which plantations are harvested and replanted. Second, we can see that in more recent years the number of acres older than 25 years has been increasing.

• Georgia's forest resources are considerable and increasing. In 2014, there were 15.2 billion trees with a diameter at breast height (d.b.h.) of ≥1.0 inch. In trees with a d.b.h. of ≥5.0 inches, there were 22.0 billion cubic feet of wood volume in softwoods and 21.7 billion cubic feet in hardwoods, for a total of 43.7 billion cubic feet.

• Net growth, removals and mortality volumes trended slightly upwards across the softwood resource, while hardwood species displayed declining net growth with decreasing removals and a slight increase in mortality.

• We calculate a growth to removals rate of 1.4 for softwoods and 1.8 for hardwoods. This can be interpreted as the net growth volume being around 40 percent above the volume of removals for softwoods and hardwood growth to be approximately 80 percent above the volume of removals. For softwood plantation forest land, we estimated a growth to removals rate of 1.3, or growth exceeding removals by approximately 30 percent.

• Fire was the most frequently recorded disturbance on forest land in Georgia, affecting an estimated 572,600 acres of forest land per year between 2009 and 2014. This was a 39-percent increase over the previous survey. The next most frequently recorded disturbance was disease, affecting an estimated 148,300 acres of forest land per year.

• Several tree species in Georgia have serious issues at this time. Redbay is under attack from laurel wilt disease, and between 2004 and 2014 the number of live redbay trees ≥ 5.0 inch d.b.h. dropped by 84 percent. Sassafras is also attacked by laurel wilt disease and is starting to show an increase in mortality as well. Flowering dogwood is another species with a rather high rate of mortality, most likely due to a number of factors, including drought stress, dogwood anthracnose, and powdery mildew.

• The emerald ash borer is an exotic pest insect that rapidly spreads to infest native ash trees, threatens nearly 24 million ash trees ≥ 5 inches in diameter in Georgia. The future of Georgia's ash resource is uncertain—in areas where the emerald ash borer has been present for a number of years, mortality can exceed 99 percent. This pest has recently been discovered in Georgia and quarantine and education efforts targeting the spread of infested wood are underway, with the aid of Federal grants.

• Japanese honeysuckle is the most prevalent invasive plant in Georgia forests, with observations on 46 percent of all forested plots. Chinese/European privets are also prevalent, and were encountered on 34 percent of forested plots in the State.

INTRODUCTION

Previous forest inventory reports (Brandeis 2015, Harper and others 2009) have emphasized the importance of Georgia's forest resources and their stability in recent years. We have seen relatively constant forest and timberland area, steady or slightly increasing amounts of wood volume, and a lack of serious disturbances, pests or diseases that would threaten forest health. But these outward signs of stability can mask changes that occur within the resource that don't affect overall totals. In this report, we will present a comprehensive overview of the State of the resource and focus on some of the dynamics behind the seemingly static numbers, such as the gains and losses of forest land to other land uses that are going on every year without changing total acreages, the maturing of the planted pine resource over time, the continual balancing of growth with natural mortality and harvest removals, and the emergence of forest pests and disease that are having serious impacts on Georgia's forests.

We begin with a general description of Georgia's forests followed by an in-depth examination of its forest types in relation to its geography. We then show the dynamic nature of land use change in the State, how economic factors are affecting the structure of the State's working pine plantations, and the net accrual of wood volume in the forest. Finally, we examine the health of the forests, with special focus on disturbances, non-native invasive pests and plants that currently are, or potentially will, negatively affect the forest's ability to deliver valuable ecosystem services to the people of Georgia.

The Georgia Forestry Commission conducts research on the State's forest resources. (photo courtesy of the Georgia Forestry Commission)

AREA

Forest Land Area and Nonforest Land Uses

There are 24.7 million acres of forest in Georgia (fig. 1). Sixty-five percent of the State is forested, while 32 percent is nonforest, and 3 percent is classified as surface water (table 1). Ninety-eight percent of this forest land is considered timberland, that is, not reserved by legal statute and sufficiently productive to support sustainable harvesting of forest products. With the FIA survey units as reference, the northern portions of the North unit along with the majority of the Central and Southeast units are dominated by forest cover, as at least 60 percent of the land area in most of these counties is in forest cover (figs. 2 and 3). Among nonforest land, agricultural land is most prevalent. Ten percent of Georgia's surface area is cropland, with another 5 percent being pasture, and 2 additional percent split among miscellaneous agricultural types. Cropland is especially prevalent in the southern part of the State, with pasture taking over in the northern two units. Roughly 3 percent of Georgia is developed due to rights of way, ranging from 2.7 percent in Unit 1 to 4.4 percent in Unit 4. Another 11 percent is otherwise developed. The remaining 1 percent of Georgia's surface area is wetland or beach. This land cover type is concentrated in the Southeast. Both TIGER (2010) and the National Hydrography Database (NHD) confirm 1.2 million acres of surface water. In the NHD, streams, rivers, canals, and ditches wider than 30 feet were selected; as were lakes, ponds, and reservoirs larger than 1 acre.

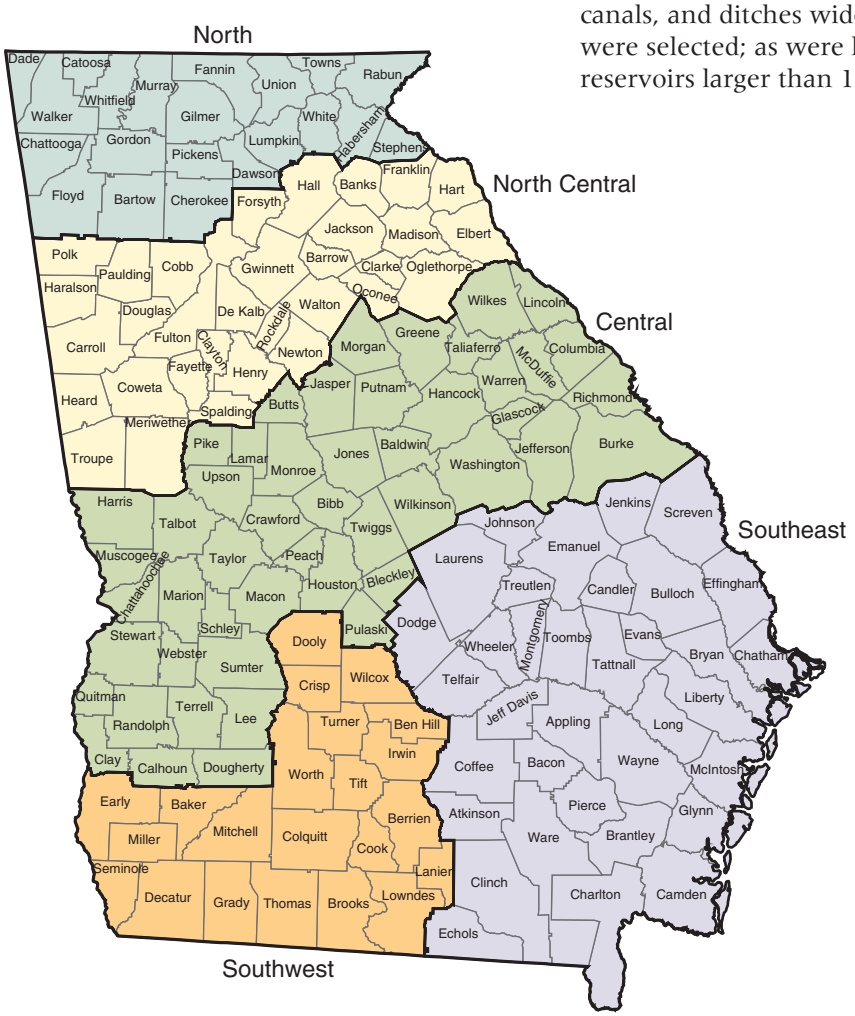

Figure 1—Counties and forest survey units, Georgia.

Table 1—Area by survey unit and land status, Georgia, 2014

Survey unit	Total area	All forest	Unreserved			Reserved			Nonforest land	Census water
			Total	Timberland	Unproductive	Total	Productive	Unproductive		
	thousand acres									
Southeast	11,183.30	7,928.90	7,573.70	7,573.70	0	355.2	355.2	0	2,769.10	485.4
Southwest	5,652.30	2,959.20	2,959.20	2,959.20	0	0	0	0	2,592.90	100.2
Central	10,612.30	7,660.80	7,615.40	7,615.40	0	45.5	45.5	0	2,788.60	162.8
North Central	6,315.60	3,244.10	3,244.10	3,244.10	0	0	0	0	2,941.80	129.7
North	4,268.40	2,935.30	2,765.60	2,765.60	0	169.8	169.8	0	1,257.40	75.7
All units	38,031.90	24,728.40	24,158.00	24,158.00	0	570.4	570.4	0	12,349.90	953.6

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

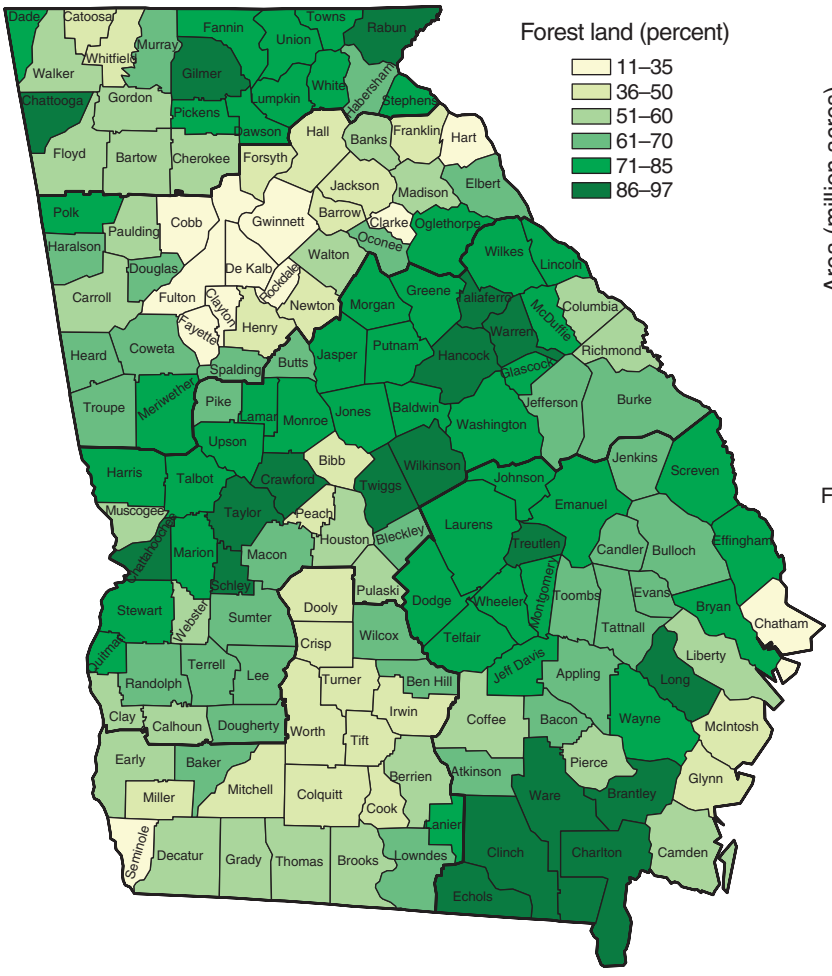

Figure 2—Percentage of county in forest land, Georgia, 2014.

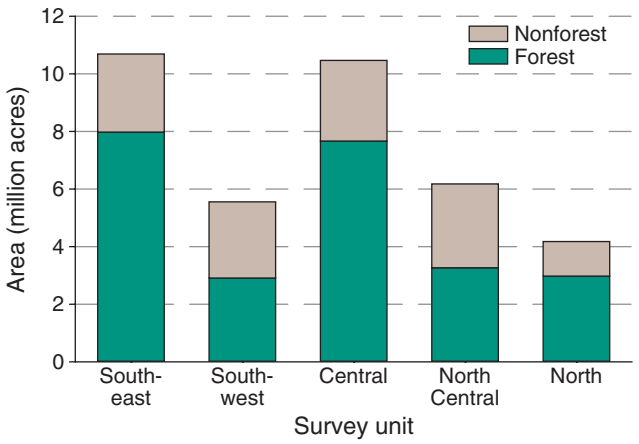

Figure 3—Forest land area by survey unit, Georgia, 2014.

Forest Ownership, Forest Types, and Stand Origins

Forest ownership—Forest ownership patterns have changed over time. As reported previously in Harper and others (2009) and Brandeis (2015), divestiture of timberland by traditional forest industry, defined as companies that own wood processing facilities, has continued, as has concurrent acquisition of these lands by other corporate owners, in particular Timber Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs) (fig. 4). Still, more than half (58 percent) of Georgia's forests belong to nonindustrial private landowners.

Forest types—Georgia's forests are a diverse mix of hardwood and softwood tree species typical of the South. Hardwood forests are the dominant type, as hardwood forests account for 53 percent of the forested area versus 45 percent for softwood types. Oak-hickory is the most prevalent hardwood forest-type group, consisting of 26 percent of all forest land (fig. 5). It is an upland hardwood forest-type group prevalent in the northern part of the State. Among oak-hickory forest types, mixed upland hardwoods are most prevalent.

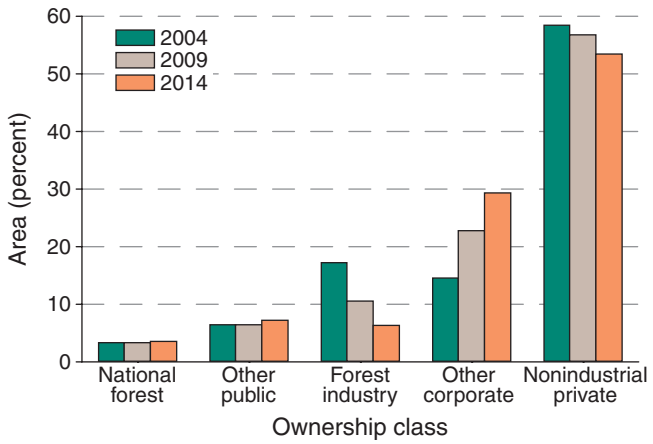

Figure 4—Percentage of forest land area by inventory year and ownership class, Georgia, 2004–14.

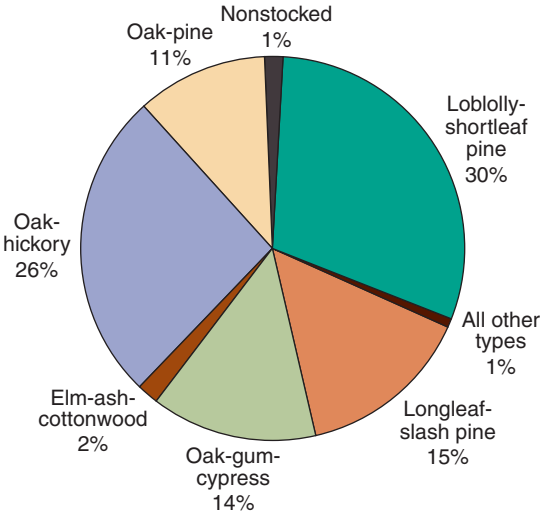

Figure 5—Percentage of forest land area by forest-type group, Georgia, 2014.

The second most common forest-type group among hardwoods is oak-gum-cypress at 14 percent statewide. It is a lowland hardwood forest-type group prevalent in the southern part of the State. After oak-gum-cypress comes the mixed oak-pine forest-type group. This is a mesic hardwood type spread across the State almost evenly at 11 percent statewide. The loblolly pine (*Pinus taeda*) hardwood is the most common forest type within this group. After the oak-pine comes another lowland forest-type group, elm-ash-cottonwood. At 2 percent statewide, it is most prevalent in the Piedmont, more so than oak-gum-cypress. It appears on meso-hydric sites. Minor hardwood types include other hardwoods, characterized by eastern hophornbeam (*Ostrya virginiana*) and peach (*Prunus persica*), as well as exotic hardwoods, characterized by chinaberry (*Melia azedarach*) and chinese tallowtree (*Triadica sebifera*), and tropical hardwoods characterized by cabbage palmetto (*Sabal palmetto*).

Loblolly-shortleaf (*Pinus echinata*) is the most prevalent softwood group, consisting of 30 percent of all forest land. Although it isn't called that, it is the upland softwood, most prevalent in the Piedmont. Loblolly

comprises 95 percent of this group. After loblolly-shortleaf comes longleaf-slash (*Pinus elliottii*), prevalent in the lowlands of the Coastal Plain. It consists of 15 percent of all forest land statewide. Slash pine comprises 84 percent of this group. Minor softwoods include eastern white pine (*Pinus strobus*), appearing in the mountains, and eastern redcedar (*Juniperus virginiana*) throughout the State.

Finally, 1 percent of forest land is considered nonstocked. Nonstocked sites average fewer than 20 trees per acre and fewer than 20 seedlings per acre, compared to over 600 trees and 1,400 seedlings for stocked sites. However, field crews classify nonstocked sites into forest types. Nonstocked sites are disproportionately in the Coastal Plain, and disproportionately on meso-hydric sites. While the proportion of nonstocked hardwood and softwood stands mirrors that of stocked sites, nonstocked oak-gum-cypress stands were more commonly found than oak-hickory ones, and longleaf-slash stands were more common than loblolly-shortleaf ones on nonstocked sites.

Pine forest stand origins and ownership—Currently, pine plantations account for 62 percent of all softwood forests (table 2). Sixty-five percent of the softwood forests controlled by private land owners are classified as originating from artificial regeneration. This differs greatly from forests owned by the Federal government. Planted stands in National forests and other federally controlled lands represent only 21 percent and 10 percent of their forests respectively. State and local lands are almost evenly split between natural and planted stands, as roughly 46 percent of these forests are planted.

Another area change in the recent past that now appears to be stabilizing is the balance between naturally regenerated pine timberlands and artificially regenerated (planted) ones. In 1972, there were roughly 9.3 million acres of natural pine stands and 2.8 million acres of pine plantations (fig. 6).

Table 2—Area of softwood stands by ownership group and stand origin on Georgia forests, 2014

Ownership group	Total	Stand origin	
		Natural	Planted
	thousand acres		
National forest	169	133	36
Other Federal	394	353	41
State and local	318	171	147
Private	10,276	3,564	6,712
Total	11,157	4,220	6,937
	percentage		
National forest	0	79	21
Other Federal	0	90	10
State and local	0	54	46
Private	0	35	65
Total	0	38	62

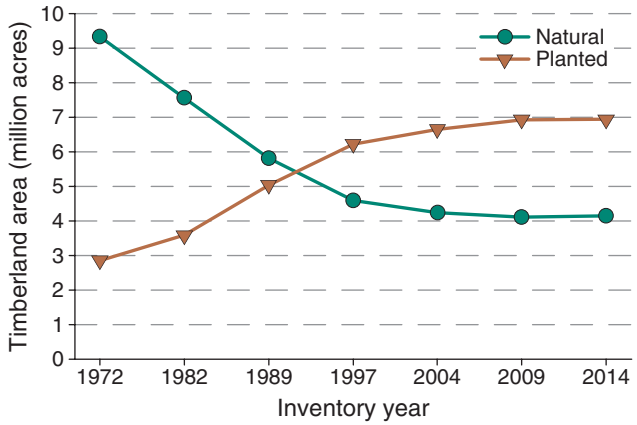

Figure 6—Natural and artificially regenerated softwood timberland area, Georgia, 1972–2014.

Thirty-seven years later, these numbers have largely reversed, such that in 2009 there were 4.1 million acres of natural pine stands and 6.9 million acres of planted pine. These trends have tapered off—as of 2014 these estimates are still at 6.9 and 4.1 million acres for planted and natural pine, the same as in 2009.

Forest and Land Use by Survey Unit

The following section describes in detail the land uses, both forested and nonforest, in the State of Georgia. Elevations are taken from the National Elevation Dataset (U.S. Geological Survey 2009). Ecological subsection information is taken from the ECOMAP ecological sections of the U.S. geographic database (Fenneman 1917, McNab and others 2007), agricultural information is taken from the National Agricultural Statistics Service (NASS 2014), population information is taken from the Topologically Integrated Geographic Encoding and Referencing (TIGER) database (U.S. Census Bureau 2010), watershed information is taken from the National Hydrography Dataset, and names are taken from the Geographic Names Information Service of the U.S. Geological Survey.

Georgia, as well as the Southeastern unit, begins at the Atlantic Ocean. To the west, the ocean turns to estuary and estuary turns to river. The easternmost land in Georgia is Tybee Island, at the mouth of the Savannah River. On the mainland, small lakes dot the coastline between the Savannah and the St. Marys Rivers. These and other rivers have a large burst of tributaries near the coast. All told, surface water totals over 400,000 acres east of Interstate 95. All along the coast is a narrow strip of beach. Beyond the beach are the wetlands that can be forested swamps, but more commonly they are herbaceous marshes or nonvegetated mud flats. Non-forested wetlands account for over 400,000 acres east of Interstate 95. This oceanfront provides recreation, consequently, over 30 percent of the forest land east of Interstate 95 is publicly owned compared to <10 percent for the rest of the unit. At the north end of Interstate 95 is Savannah, the unit's largest city, although the primary nonforest land use in Chatham County is wetland. Overall, about 5 percent of the unit's land is developed. West of Interstate 95 is a band of forest ranging from 20 to 90 miles wide. Just south of Savannah on the west side of Interstate 95 is Fort Stewart, one of the State's largest tracts of public ownership. Liberty County is nominally 55 percent forested, but its western side is very heavily forested due to the fort.

From north to south along the 112-mile Interstate, the forest type vacillates from mesic hardwoods to loblolly pine to lowland hardwoods to slash pine, although there is relatively little change in altitude. Just north of the Florida line, 30 miles to the west of Interstate 95, is the Okefenokee National Wildlife Refuge. This is the largest tract of public ownership in the unit. Most of the Southeastern unit is in Atlantic watersheds, but there is a slight ridge around the north and east of the Refuge which drains to the Gulf of Mexico. This ridge contributes to the swampy character of the Refuge. With few roads and difficult terrain, much of the Refuge is hard to access. The southeastern corner of the Refuge is the source of the St. Marys River, which curls around the southern tip of Georgia before emptying into the Atlantic and it is also the headwaters of the famous Suwanee River, which flows out the west side of the Refuge. The forests in the Refuge are in the oak-gum-cypress forest-type group and nonstocked. Outside the Refuge, the longleaf-slash pine forest-type group is the most common forest type, especially to the west. Dixon Memorial State Forest, located southeast of Waycross and on the northern border of the refuge is the largest State forest.

Seventy-one percent of the Southeastern unit is forested, but a band of counties stretching across the middle of the unit, from Atkinson County northeast to Jenkins County averages 64 percent forest. This is an agricultural belt, and as elsewhere in

the State, top crops are cotton and peanuts. Along the 150 mile gradient, forests shift from slash pine to lowland hardwoods to loblolly pine, then to mesic hardwoods, then to more loblolly pine, and finally to upland hardwoods. In this part of the State, elevations increase to the northwest. Further west of the agricultural belt is another cluster of counties heavy in forest, mostly softwoods. The highest point in the unit is 450 feet, in Johnson County. To the southwest is the Oconee River followed by a rise, then the Ocmulgee River which marks the boundary between the Southeastern Unit (Dodge County) and the Southwestern Unit (Wilcox County). These two rivers join to form the Altamaha River. The bottomlands of these rivers are particularly heavy in forest and home to several Wildlife Management Areas.

In the middle of Wilcox is another rise, beyond which streams drain to the Gulf of Mexico. This ridge roughly parallels Interstate 75 north to Atlanta. Along this ridge to the northwest is the Southwestern unit's highest point, 490 feet in Dooly County. The Southwestern unit is 52 percent forest but otherwise the unit is very heavy in agriculture with cotton and peanuts as the major crops. Overall, the unit's forests are mostly softwoods, but Interstate 75 going south from Dooly County passes through some counties where hardwood forests predominate. Along the way, the softwood forest changes from loblolly pine to slash pine, while hardwood forests change from the oak-pine forest type group to oak-gum-cypress. The southernmost county before the Florida line is Lowndes, home to Valdosta, the largest city in the unit. This is the only county in the unit where the principal nonforest land use is developed land, at about 13 percent compared to 6 percent for the entire unit. The southernmost tier of counties is more heavily forested (57 percent) than the unit as a whole, and possesses stands of old growth pine managed as quail plantations throughout this area. Here are the river bottomlands. Despite this southern tier of counties being lowland, loblolly-shortleaf pine acres nearly equal longleaf-slash pine acres. The lowest point in the unit is along the Withlacoochee River, about 50 feet above sea level. To the west are the Ochlockonee, the Flint, and the Chattahoochee rivers. The Chattahoochee is the longest river in the State, followed by the Flint. They meet at Lake Seminole in the very southwestern corner of the State. As with most of the larger lakes and reservoirs in Georgia, public forest land adjoins the lake, maintained by either the U.S. Army Corps of Engineers (USACE), or State, county, or local government. Eastward from Lake Seminole, Georgia's southern boundary juts about 4 degrees south of east, eventually intersecting the St. Marys River 160 miles away. The Chattahoochee River forms the western boundary of the State throughout the Southwestern and Central units, widening to the Walter F. George Reservoir for a stretch of 30 miles in the Central unit.

To the northeast of Lake Seminole on the Flint is Albany, the 4th largest city in the Central unit. Seven percent of the land in this unit is developed. The Central unit is 72 percent forest, but the southwestern corner is less heavily forested than the rest. It also has a greater proportion of hardwood forests. Dougherty County has reduced forest cover due to urbanization, but the surrounding counties, and the counties around them, have reduced forest due to agricultural effects, specifically cropland. Cropland is the major nonforest land use throughout the southern part of the unit, stretching all the way to Jefferson and Burke Counties on the eastern side of the State. Throughout the central part of the unit is a band of urban development, stretching from the cities of Columbus to Macon to Augusta, with some smaller cities

in between. This is the fall line, and the line where ECOMAP divides the Piedmont from the Coastal Plain. Loblolly pine becomes the most prevalent forest type and pasture becomes the predominant nonforest land use on the north side of the line.

Northwest of Albany is Fort Benning, the largest tract of public ownership in the unit. It is immediately south of Columbus, the 2nd largest city in the unit. Consequently, Muscogee County has reduced forest. To the north of Columbus is Dowdell Knob, the highest point in the unit at 1,400 feet. It is the home of Franklin Roosevelt State Park, Georgia's largest State park. Overall, Georgia's State parks and historic sites comprise just 85,000 acres (Georgia Department of Natural Resources 2015), less than one fifth of the State-owned forest land. State-owned forests form another small chunk (Georgia Forestry Commission 2016). The bulk of State-owned forest comes from Wildlife Management Areas (Housman 2010). Dowdell Knob is an outlier; elevations generally increase to the north and to the east is 50 miles of more forest. There is a major area that has been cleared of forest in the center of the State. Two counties have less forest than the unit average due to urban effects: Bibb, home to Macon, the 3rd largest city in the unit, and Houston, home to Warner Robins, the 5th largest city in the unit. Nearby are Peach, Macon, Pulaski, and Bleckley Counties, but nonforest in these counties is due primarily to agriculture. Peach County's major nonforest land use is orchards. The National Agricultural Statistics Service confirms that Peach County is a leading producer of pecans and peaches. To the northeast is more forest. There are several large public ownerships, including Oconee National Forest, Piedmont National Wildlife Refuge, and Fort Gordon. Between Oconee National Forest and Fort Gordon is a band of thick forest, most of which is privately held. Wilkinson County is the most heavily forested county in the State, and several other very heavily forested counties are nearby. Fort Gordon is just outside Augusta, the unit's largest city. Columbia and Richmond Counties have reduced forest due to urbanization. The unit's lowest point is coincident with the easternmost point along the Savannah River in Burke County, about 70 feet above sea level.

Further upstream are Thurmond Dam and Lake Thurmond. This is a large public ownership managed by USACE. At the north end of Lake Thurmond is Elbert County and the North Central Unit. This is the unit's lowest and easternmost point, at 320 feet. Further upstream are Russell Dam and Lake Russell, followed by Hartwell Dam and Lake Hartwell, with additional forest land managed by USACE along the way.

The North Central unit is 51 percent forest and nearly all of it is in the Piedmont ecosection. It is the most urban of Georgia's survey units with 27 percent of the land developed. Per mile, the North Central unit has the busiest highways in the State (Georgia Department of Transportation 2014). At the top of the list is Interstate 285, Atlanta's Perimeter Highway. In second place is Interstate 85. It enters the State at Lake Hartwell on the South Carolina line. For the first 50 miles, between small commercial centers at each exit, there are oak-hickory stands interlaced with poultry farms. Seven of Georgia's top 10 poultry-producing counties are in the eastern part of this unit. In the distance, in Hall County, is the unit's highest point, the south face of Wauka Mountain. Wauka Mountain drains to Lake Lanier, through which flows the Chattahoochee River. The Chattahoochee River continues to the southwest, eventually flowing through West Point Lake and continuing south along the Georgia-Alabama line. Around both Lake Lanier and West Point Lake is additional USACE forest.

For the second 50 miles of Interstate 85, the landscape becomes more urban, starting with exurban residential, peaking to a ring of development around Atlanta, the State capital and the unit's largest city. Shortly before the Perimeter Highway, Interstate 85 enters heavily developed DeKalb County, then enters Fulton County a few miles down the road. Beyond the skyscrapers in downtown Atlanta, it grazes Clayton County, another heavily developed county, before re-entering Fulton County. From there, for the next 70 miles, Interstate 85 continues to the southwest, entering Alabama at the Chattahoochee River. Meanwhile, the western leg of Interstate 20 heads west from Atlanta. It crosses into heavily developed Cobb County at the Chattahoochee River. This is the least forested county in the State. Interstate 20 continues west and exits the State near the northwestern corner of the unit in Haralson County. Along both interstates, the landscape fades back to exurban residential before turning to forest, with decidedly greater amounts of pine forest than in the east.

Forty miles north of Interstate 20's western terminus is Rome, the largest city in the Northern unit. However, the counties with the largest percentage of developed land are Cherokee, in exurban Atlanta, and Whitfield, in exurban Chattanooga. Overall, 12 percent of the unit is developed, and 69 percent is forested. In terms of ECOMAP sections, Rome is the base of the Southern Ridge and Valley. To the northwest of Rome is the Southern Cumberland Plateau, rising to 2,340 feet at the southern end of Lookout Mountain before dipping to the Georgia-Alabama-Tennessee tri-point. Georgia's western boundary juts 10 degrees to the east, eventually intersecting the Chattahoochee River 150 miles to the south. Eastward from the tri-point, the northern boundary juts about half a degree north of east, intersecting the Chattooga River 140 miles away. To the northeast of Rome are the Blue Ridge Mountains, which roll down to the Upper Piedmont. To the north of the Blue Ridge Mountains, streams drain to the Tennessee River. To the south, they drain mostly to the Gulf of Mexico, with only the eastern border counties draining to the Atlantic Ocean.

The lowest elevation in this unit tends to be nonforest, with pasture common in the Valley and low density residential throughout the rest of the unit. At somewhat higher elevation is privately owned forest. The privately owned forest in this unit is 57 percent oak-hickory and 26 percent softwood. At even higher elevation, along the crests of the Blue Ridge, is the Chattahoochee National Forest. Here the forests are 70 percent oak-hickory and only 13 percent softwood. The Chattahoochee National Forest is the largest public ownership in the State. Consequently, only 74 percent of the forest in the Northern unit is privately owned.

Wilderness or otherwise reserved areas surround a number of the highest peaks; for example, Brasstown Bald (the very highest peak in Georgia, at roughly 4,780 feet), Blood Mountain and Tray Mountain. The Tray Mountain Wilderness Area, at the tri-point of Habersham, Rabun, and Towns Counties, forms an inflection point. To the southeast, streams drain to the Atlantic Ocean. The one Wilderness Area in a valley is the Ellicott Rock Wilderness Area, at the tri-point of Georgia, North Carolina, and South Carolina. It is the northernmost point in Georgia. This corner of Georgia is also reserved as the Chattooga Wild and Scenic River. The Chattooga connects to the Tugaloo which empties into Hartwell Lake, from which the Savannah River flows to the point of beginning.

Land Use Change

Two land use change trends stand out in Georgia from 2004 to 2014. The rate at which the State gained forest land acreage from converted agricultural land decreased until 2009 and after that time remained stable (fig. 7). The rate at which forest was lost to development decreased steadily since about 2007. The latter trend may reflect the economic downturn experienced across the country beginning that year. Loss of forest land to development in 2007, however, represents change on plots that were forest 5 years previously in 2002 and were developed at some time in the intervening 5 years. Therefore trends from 2007 onward reflect economic conditions but with some lag time and a degree of buffering, or muting, of the trends.

We can examine annualized land use change focusing only on forest that was or became planted loblolly-shortleaf stands (fig. 8). The decrease in the rate at which planted loblolly-shortleaf stands were established on former agricultural land from 2004 to 2007 is notable. The rate of decrease of planted pine establishment has slowed during the last 5 years through 2014. Gains in planted pine acres from development have remained at a stable, low rate. Losses to agriculture and development have remained relatively stable, with perhaps a slight indication of increased losses to agriculture in recent years.

Age Class Distribution

The rural landscape in the Southern United States has been dynamic, with forests and agricultural land expanding and contracting according to social and economic changes in the State, region, and nation. We can see the effects of this history on Georgia's forests when looking at forest stand ages. Figure 9 shows the distribution of stand age for all forest land in Georgia from 1999 to 2014. These data not only show what has gone on in the forest for the past 15 years; they also show the changes on the land for the past 100 years or more.

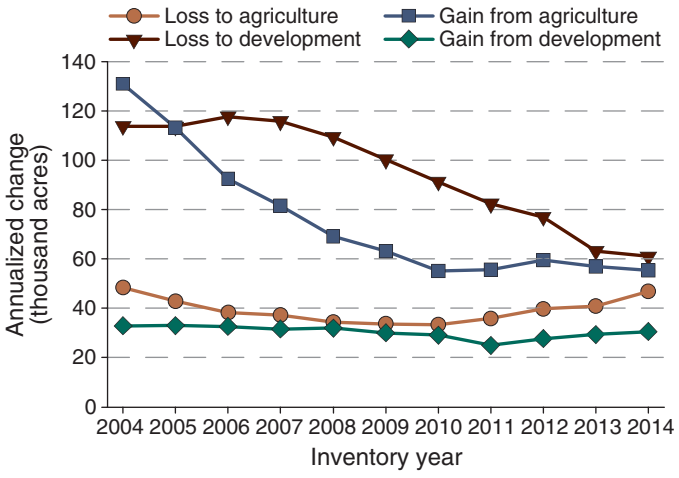

Figure 7—Annualized land use change, Georgia, 2004–14.

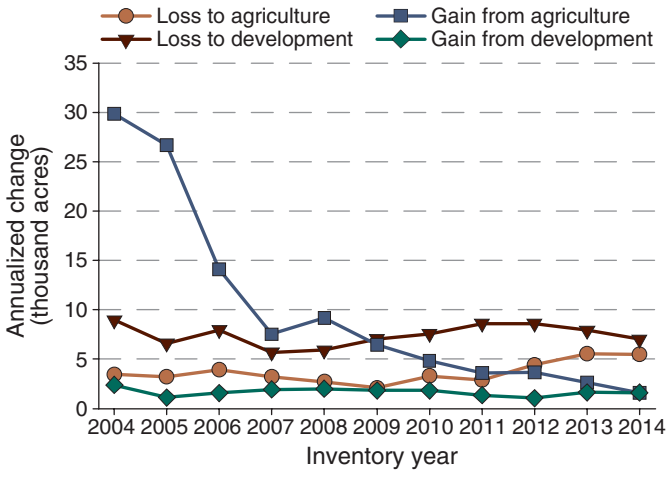

Figure 8—Annualized land use change of planted loblolly-shortleaf forest land, Georgia, 2004–14.

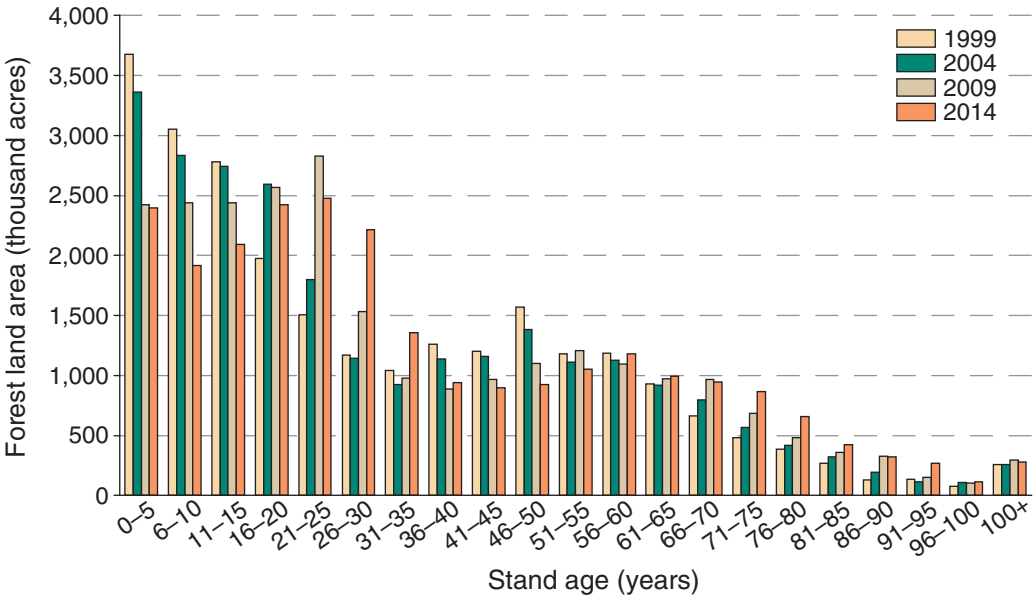

Figure 9—Distribution of forest land area by stand age, Georgia, 1999–2014.

In a State with an active forest products sector and intensive pine plantation management, we expect considerable forest acreage to be the age of the typical forest management rotation length or younger. We can see this more clearly by looking just at the stand age distribution of planted pine timberland acreage where two features are outstanding (fig. 10). First is the relatively abrupt drop in acreage more than 25 years old that indicates the typical age at which plantations are harvested and replanted. Second, we can see that in more recent years the numbers of acres older than 25 years has been increasing. Taking a more comprehensive look, we see that the entire population of planted pine acres has been getting older, that is, the distribution curve

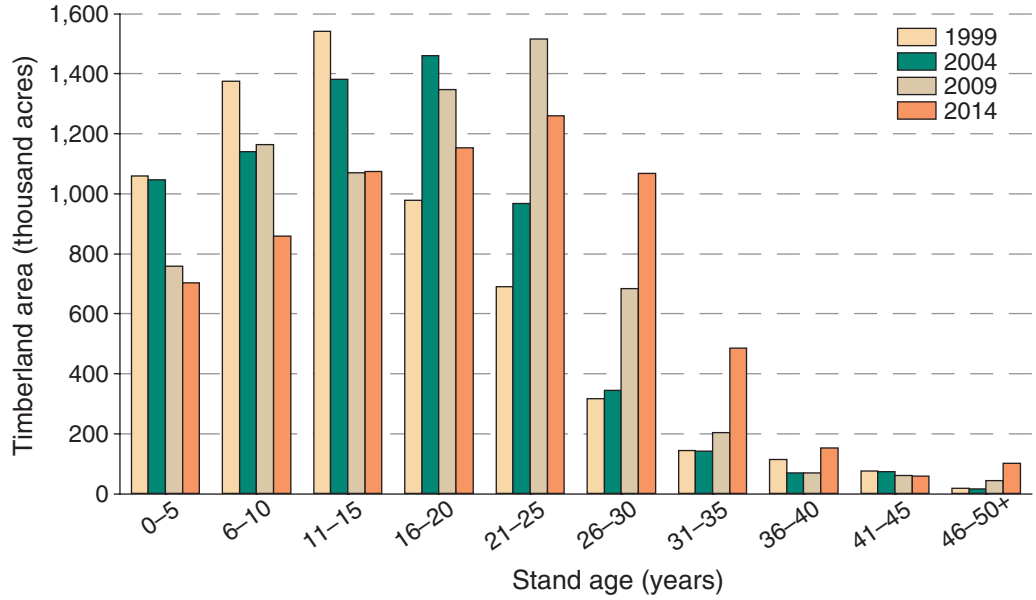

Figure 10—Distribution of pine timberland area by stand age, Georgia, 1999–2014.

has been shifting to the right over time such that the peak of the curve has moved from 11 to 15 years old in 1999 to 21 to 25 years in 2014. If the number of planted pine acres was stable for this time period and all acres were harvested at the same age and then replanted, we would have seen the distribution curve remaining in place for all four time periods. Instead, the shift toward older stands almost certainly reflects two socioeconomic events from the past. First, we can speculate that the current plantation acreage largely originated in the 1980s and 1990s when natural pine stands were converted to managed, more highly productive plantations, often with the assistance of financial incentives from Conservation Reserve Programs as postulated by Harper and others (2009). Second, while total planted acreage has remained stable, acres that were clearcut and presumably replanted have decreased in recent years, possibly in response to changes in ownership and weakened markets. We see the evidence for a shift from final harvest to stand tending treatments in Harper (2012) and Brandeis (2015). Forest industry divestiture of their lands and their acquisition by TIMOs and REITs has been long documented (Brandeis 2015, Harper and others 2009). One could assume that the non-mill owning TIMOs and REITs are not bound to harvest regularly by the needs to supply their wood-processing facilities as were the previous forest industry owners, therefore they can refrain from harvesting their forests until timber products markets are their most favorable. The weakened markets experienced during the economic downturn of 2007 to approximately 2011 would not have been an economically favorable time for the landowners to harvest stands, therefore many continue to age and accumulate volume. The result is that much of Georgia's pine plantations have been tended and continue to age and accumulate volume.

Looking back at the entire range of stand size distribution on forest land, there is an interesting peak in the 56–60 year old category that precedes a steady decrease in forest that is over 60 years old. There appears to be a cohort of forest acres that has been aging together, moving through time. This is probably not mostly planted pine because we do not see many acres of planted pine timberland over 40 years old in figure 10. These acres could be naturally regenerated forest, or planted forest that has aged into a natural-appearing mix of conifers and hardwoods, that was established around 60 years ago in the mid-1950s. Larson and Spada's (1963) report on the 1961 timberland inventory of Georgia helps to explain this population peak. They reported a 21 percent gain in timberland since the preceding 25 years, an increase of 4.5 million acres, and that these new forests were established on cropland that had been idled or abandoned from the late 1930's to the early 1950's. After 1953, the rate of cropland abandonment dropped by 41 percent (Larson and Spada 1963). Therefore what we see is another example of how the forests reflect the history of social and economic change in the State of Georgia.

NUMBER OF TREES, VOLUME, AND BIOMASS

Georgia's forest resources are considerable and increasing. In 2014, there were 15.2 billion trees with a diameter at breast height (d.b.h.) of ≥1.0 inch (table 3). The most numerous softwood species (d.b.h. ≥1.0 inch) were loblolly and slash pines, while the most numerous hardwoods were sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), water oak (*Quercus nigra*), swamp tupelo (*Nyssa biflora*), and laurel oak (*Quercus laurifolia*). In trees with d.b.h. of ≥5.0 inches, there were 22.0 billion cubic feet of wood volume in softwoods and 21.7 billion cubic feet in hardwoods, for a total of 43.7 billion cubic feet. Total volume

Table 3—Number of live trees[a], net volume[b], and aboveground green weight[a] on forest land by species group, Georgia, 2014

Species group	Number of live trees	Net volume	Aboveground green weight
	million trees	*million cubic feet*	*thousand tons*
Softwoods			
Longleaf and slash pines	1,125.1	5,389.3	273,301.3
Loblolly and shortleaf pines	2,829.3	14,267.4	668,799.2
Other yellow pines	155.4	836.4	39,078.4
Eastern white and red pines	65.7	463.3	17,188.4
Eastern hemlock	15.8	61.9	3,560.6
Cypress	227.8	883.6	45,052.8
Other eastern softwoods	63.8	76.4	4,412.2
Total softwoods	4,483.1	21,978.4	1,051,392.8
Hardwoods			
Select white oaks	239.0	1,943.7	113,333.3
Select red oaks	35.5	405.7	23,798.4
Other white oaks	379.5	1,790.3	108,371.0
Other red oaks	1,901.6	5,062.1	317,550.2
Hickory	359.9	1,006.9	59,682.9
Yellow birch	0.2	1.3	59.4
Hard maple	68.1	37.4	3,147.1
Soft maple	1,427.0	1,461.9	95,475.3
Beech	40.2	92.2	6,168.6
Sweetgum	2,042.0	2,719.7	151,405.6
Tupelo and blackgum	1,026.6	2,160.6	109,875.5
Ash	146.6	363.8	15,984.0
Cottonwood and aspen	0.2	7.3	399.9
Basswood	2.5	33.5	1,603.2
Yellow-poplar	410.5	2,624.2	117,727.3
Black walnut	4.6	26.9	1,773.5
Other eastern soft hardwoods	1,008.5	1,041.9	61,056.8
Other eastern hard hardwoods	584.0	159.0	17,806.3
Eastern noncommercial hardwoods	1,004.4	741.5	48,779.4
Total hardwoods	10,681.0	21,679.8	1,253,997.6
All species	15,164.1	43,658.1	2,305,390.4

D.b.h. = diameter at breast height.
Numbers in rows and columns may not sum to totals due to rounding.
[a] In trees with d.b.h. ≥1 inch.
[b] In trees with d.b.h. ≥5 inches.

on timberland was only slightly lower than that of forest land at 42.7 billion cubic feet. As in other recent years, the loblolly and shortleaf pines (which consists primarily of loblolly pine in Georgia) had the greatest volume of any species group (table 3). The distribution of net volume on live trees by ownership class (fig. 11) reflects the distribution of forest acreage previously seen.

While the numbers of most hardwood and softwood species are relatively stable or slightly down from the 2009 estimates in Brandeis (2015), net volume and forest biomass continues to increase (fig. 12). This can be attributed to the combination of steady or slightly increasing forest acreage and maturing stands. The evidence that older stands are becoming more prevalent seen previously in the example of stand age distribution of yellow pine forests is reinforced by the numbers of live trees, net volume and biomass (table 3) and the gradual but steady increase in the proportion of volume in larger diameter stems in both softwoods (fig. 13) and hardwoods (fig. 14). The total numbers of live trees continues to decrease while net volume and biomass increases, indicating stands with fewer, but larger trees. Evidence for this trend can also be seen in the increasing amounts of net volume found in the saw-log portions of both softwood and hardwood sawtimber trees (table 4).

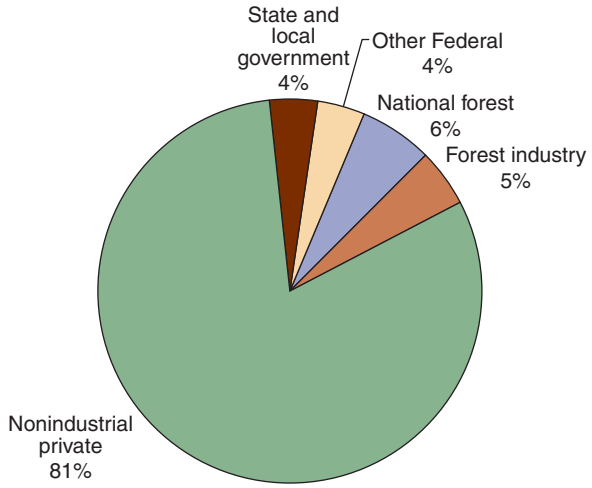

Figure 11—Percentage of net volume of live trees on forest land by ownership class, Georgia, 2014.

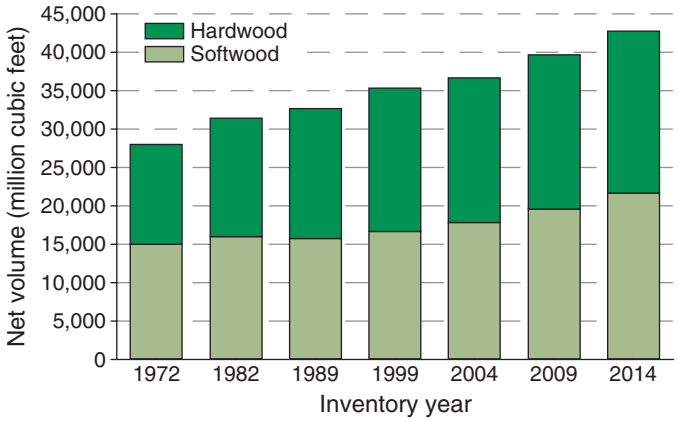

Figure 12—Net volume of live trees by major species group, Georgia, 1972–2014.

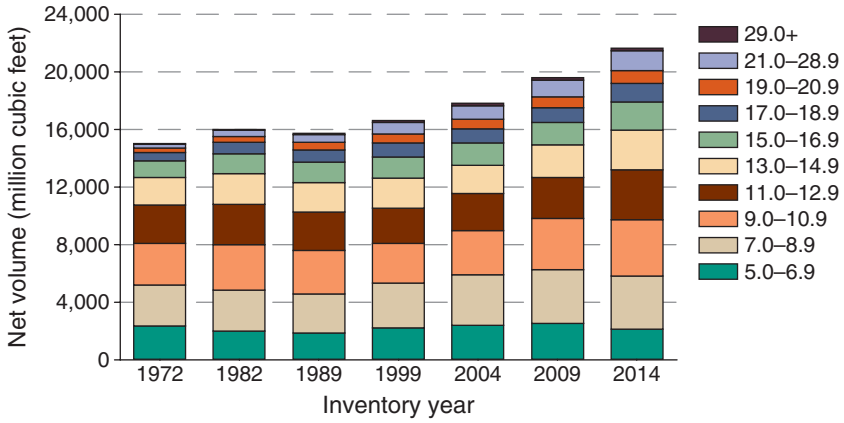

Figure 13—Net softwood volume of live trees by diameter class, Georgia, 1972–2014.

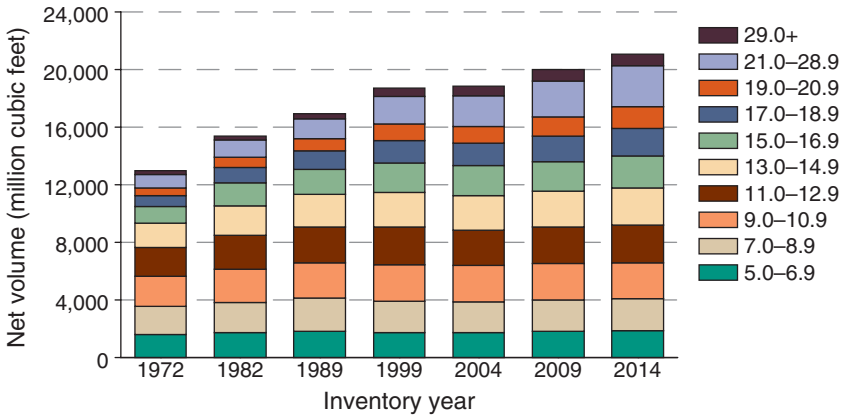

Figure 14—Net hardwood volume of live trees by diameter class, Georgia, 1972–2014.

Table 4—Net volume in the saw-log portion of sawtimber trees on timberland by inventory year and species group, Georgia, 1972–2014

Year	Total	Softwoods	Hardwoods
		million cubic feet	
1972	13,806	8,710	5,095
1982	17,003	9,960	7,043
1989	17,948	9,978	7,970
1999	19,408	10,121	9,287
2004	19,583	10,541	9,042
2009	21,296	11,664	9,632
2014	23,318	13,666	9,651

GROWTH, REMOVALS, AND MORTALITY

Forest land average annual volume net growth, removals, and mortality are calculated from plots measured during two consecutive inventories. For instance, estimates for the 2014 inventory are based on plots measured in the 2009 cycle that were remeasured during the 2014 cycle. Growth, removals, and mortality (GRM) estimates provide a measure of inventory change. As seen in figure 15, from 2004 to 2014, volumes of net growth, removals and mortality trended slightly upwards across the softwood resource, while hardwood species displayed declining net growth with decreasing removals and a slight increase in mortality.

Examining GRM estimates by stand size and species group, we observed softwood net growth increasing primarily within medium and large diameter size stands, with the 2014 net growth estimate for small diameter size stands displaying a decrease compared to 2009 estimates (fig. 16). For hardwoods, the decrease in net growth observed between 2004 and 2009 continued through 2014 with most of the change occurring within larger size stands. Looking at annual average removals by species group and stand size (fig. 17) across the 2004 to 2014 period, we observed a steady volume of softwood removals from small diameter size stands with the increase in removals from medium size stands offset by reduced removals from large diameter size stands. The change in average annual hardwood removals resulted largely from declining removals from large diameter stands as well, with small and medium diameter size stands remaining fairly stable throughout the 2004–14 period. Figure 18 revealed an upward trend in mortality across both species groups with a larger share of mortality in hardwood forest lands. Increasing softwood mortality occurred mostly across large diameter size stands. Although mortality in small diameter-size softwood stands represents a minor portion of this species group's total mortality, 2014 data revealed a 30-percent increase in mortality in this stand-size group compared to 2009 estimates. In hardwood stands mortality increased across large and medium diameter size stands, with small diameter size stands showing a slight decrease in the volume lost to mortality between 2009 and 2014.

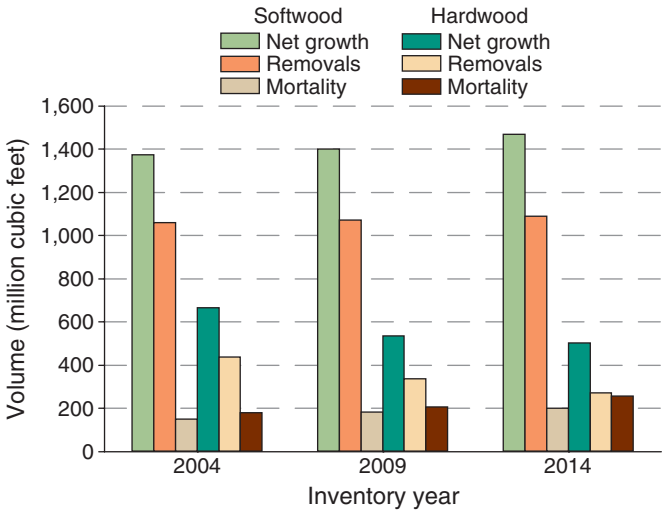

Figure 15—Average annual volume of net growth, removals, and mortality of live trees by major species group, Georgia, 2004–14.

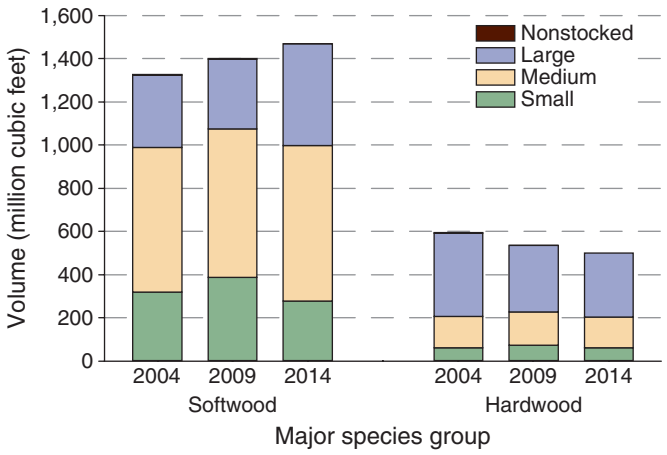

Figure 16—Average annual net growth of live trees by major species group and stand size, Georgia, 2004–14.

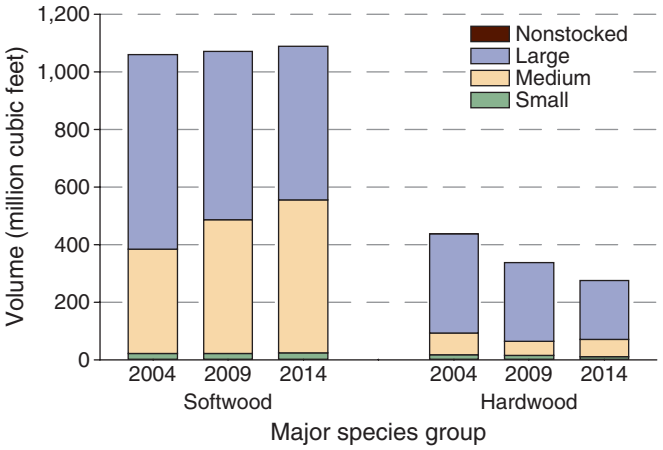

Figure 17—Average annual removals of live trees by major species group and stand size, Georgia, 2004–14.

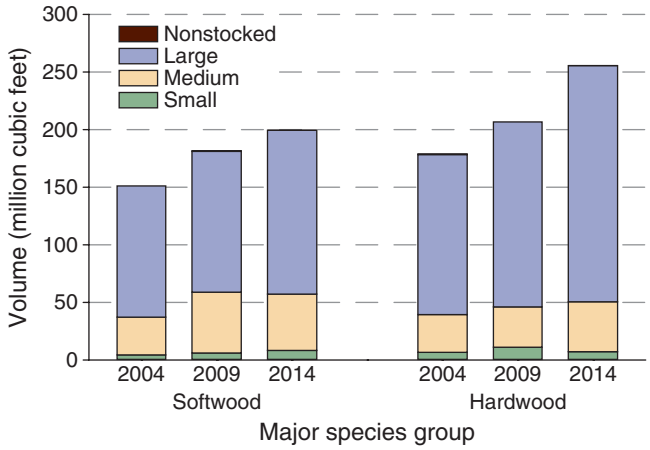

Figure 18—Average annual mortality of live trees by major species group and stand size, Georgia, 2004–14.

Treated Acres

A closer look at area of forest land undergoing a silvicultural treatment across the 2004 to 2014 period (fig. 19) revealed a slight increase in the area treated by a final harvest (clear cut), occurring mostly within the hardwood forest type. The acreage of forest land receiving partial harvests (partial, shelter, and salvage treatments) decreased significantly across both species groups. Acres of thinned forest land (including thinning and stand improvement treatments) trended upwards throughout the period.

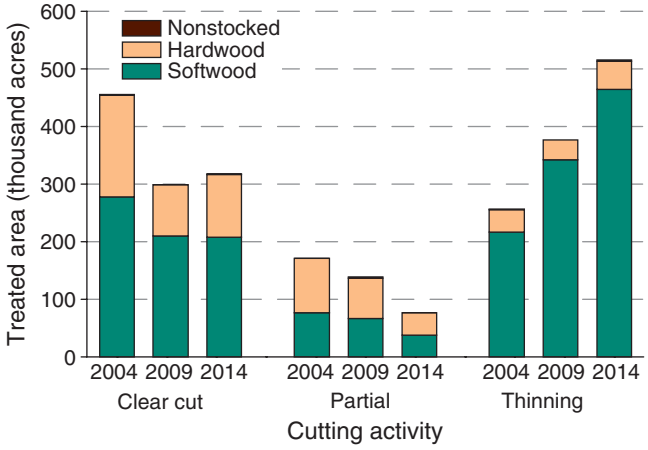

Figure 19—Average annual forest land acreage affected by cutting activity by major species group, Georgia, 2004–14.

Volume, Growth, and Removals of the Planted Pine Resource

Net volume of all-live trees on forest land for 2014 was estimated at 43.7 billion cubic feet, spread relatively equally across softwood and hardwood species groups (table 5). Forty-four percent of the net volume on softwood forest land originated from plantations, primarily of loblolly and shortleaf pine species. In contrast, plantation volume on hardwood forest lands accounted for close to 3 percent of all hardwood volume. When looking at table 5, readers are reminded that in FIA we define an area as planted or naturally regenerated, not whether the tree itself was planted. Consequently, volume in the hardwood species group could be classified as planted even if coming from naturally regenerated trees if these trees regenerated within pine plantations.

Table 5—Net volume of live trees on forest land by species group and stand origin, Georgia, 2010–14

Species group	Total	Stand Origin	
		Planted	Natural
	million cubic feet		
Softwood			
Longleaf and slash pines	5,389.3	3,021.9	2,367.4
Loblolly and shortleaf pines	14,267.4	6,578.4	7,689.0
Other yellow pines	836.4	29.8	806.6
Eastern white and red pines	463.3	14.8	448.5
Eastern hemlock	61.9	0.0	61.9
Cypress	883.6	6.6	877.0
Other eastern softwoods	76.4	4.1	72.3
Total softwoods	21,978.3	9,655.6	12,322.7
Hardwood			
Select white oaks	1,943.7	19.7	1,924.0
Select red oaks	405.7	1.1	404.6
Other white oaks	1,790.3	34.4	1,755.9
Other red oaks	5,062.1	191.1	4,871.0
Hickory	1,006.9	58.2	948.6
Yellow birch	1.3	0.0	1.3
Hard maple	37.4	0.8	36.6
Soft maple	1,461.9	26.5	1,435.4
Beech	92.2	3.9	88.3
Sweetgum	2,719.7	97.5	2,622.2
Tupelo and blackgum	2,160.6	18.0	2,142.6
Ash	363.8	4.0	359.8
Cottonwood and aspen	7.3	0.0	7.3
Basswood	33.5	0.2	33.2
Yellow-poplar	2,624.2	33.2	2,590.9
Black walnut	26.9	0.2	26.6
Other eastern soft hardwoods	1,041.9	48.4	993.5
Other eastern hard hardwoods	159.0	3.2	155.8
Eastern noncommercial hardwoods	741.5	14.6	727.0
Total hardwoods	21,679.9	555.0	21,124.6
All species	43,658.2	10,210.6	33,447.3

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

Examining the average annual volume of removals by species group and stand origin we observe softwoods representing close to 80 percent of all removals (table 6). Within softwoods, 70 percent of removals originated from planted forest land. Average annual growth follows a similar pattern with the majority of the average annual net volume of growth found in plantation forests (table 7). We use a growth-to-removals ratio as a rough measure of harvest sustainability, where a rate above one indicates likely sustainable harvest. We calculate a growth-to-removals rate of 1.4 for softwoods and 1.8 for hardwoods. This can be interpreted as the net growth volume being around 40 percent above the volume of removals for softwoods and hardwood growth to be approximately 80 percent above the volume of removals. For softwood plantation forest land, we estimated a growth-to-removals rate of 1.3, or growth exceeding removals by approximately 30 percent.

Table 6—Average annual removals of live trees on forest land by species group and stand origin, Georgia, 2010–14

Species group	Total	Stand origin	
		Planted	Natural
	million cubic feet		
Softwood			
Longleaf and slash pines	327.9	242.2	85.7
Loblolly and shortleaf pines	730.2	512	218.2
Other yellow pines	16.9	6.9	10
Eastern white and red pines	0.9	0	0.9
Eastern hemlock	0	0	0
Cypress	10.7	0.5	10.2
Other eastern softwoods	2	0.1	1.9
Total softwoods	1,088.6	761.7	326.9
Hardwood			
Select white oaks	16.9	0	16.8
Select red oaks	3.6	0	3.6
Other white oaks	13.6	1.4	12.2
Other red oaks	82.5	6.1	76.3
Hickory	11.4	0.1	11.3
Yellow birch	0	0	0
Hard maple	0.1	0	0.1
Soft maple	18	1.3	16.6
Beech	1	0	1
Sweetgum	40.9	3.6	37.3
Tupelo and blackgum	29.9	0.5	29.4
Ash	4.8	0	4.8
Cottonwood and aspen	0	0	0
Basswood	0	0	0
Yellow-poplar	26.3	0.6	25.6
Black walnut	0	0	0
Other eastern soft hardwoods	12.7	1	11.8
Other eastern hard hardwoods	1.7	0.1	1.6
Eastern noncommercial hardwoods	10.4	0.1	10.3
Total hardwoods	273.8	14.8	258.7
All species	1,362.4	776.5	585.6

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

Table 7—Average annual net growth of live trees on forest land by species group and stand origin, Georgia, 2010–14

Species group	Total	Stand origin	
		Planted	Natural
	million cubic feet		
Softwood			
Longleaf and slash pines	372.8	304.4	68.4
Loblolly and shortleaf pines	1,049.2	656.3	392.9
Other yellow pines	20.5	5.9	14.6
Eastern white and red pines	12.1	0.3	11.8
Eastern hemlock	1.0	0.0	1.0
Cypress	11.9	0.2	11.7
Other eastern softwoods	3.4	0.3	3.1
Total softwoods	1,471.0	967.4	503.6
Hardwood			
Select white oaks	50.3	-2.9	53.2
Select red oaks	10.9	0.1	10.7
Other white oaks	37.4	1.7	35.7
Other red oaks	137.1	10.6	126.5
Hickory	19.8	1.4	18.4
Yellow birch	-0.3	0.0	-0.3
Hard maple	1.2	0.0	1.2
Soft maple	32.1	2.5	29.6
Beech	1.8	0.1	1.7
Sweetgum	84.7	7.5	77.2
Tupelo and blackgum	24.5	0.8	23.7
Ash	7.3	0.4	7.0
Cottonwood and aspen	0.2	0.0	0.2
Basswood	2.1	0.0	2.0
Yellow-poplar	68.8	1.2	67.6
Black walnut	0.9	0.0	0.8
Other eastern soft hardwoods	19.9	3.3	16.6
Other eastern hard hardwoods	1.2	0.2	1.0
Eastern noncommercial hardwoods	6.5	1.2	5.3
Other	-7.5	-1.3	-6.2
Total hardwoods	499.0	26.9	472.0
All species	1,970.0	994.4	975.6

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

DISTURBANCE AND FOREST HEALTH INDICATORS

Disturbance

Many forest disturbances are naturally occurring and affect small areas of forest land. Disturbance is not necessarily a bad thing, and in some cases can result in a more resilient ecosystem and/or increased species richness. Fire (from all causes) was the most frequently recorded disturbance on forest land in Georgia during the 2014 survey. It affected an estimated 572,600 acres of forest land per year between 2009 and 2014 (table 8). This was a 39-percent increase over the previous survey when fire affected an estimated 412,900 acres of forest land per year. The next most frequently recorded disturbance was disease, affecting an estimated 148,300 acres of forest land per year, the majority of which was recorded in softwood forest-type groups.

Carbon

The forests of Georgia sequester approximately 1.8 billion tons of carbon (table 9). Over 50 percent of this was in the forest soil (fig. 20). These forest carbon estimates were derived using the component ratio method described in Woodall and others (2011). Standing dead trees are an important part of the forest, both for carbon and for wildlife. Many forest species rely on standing trees during some or all of their life cycle. The number of standing dead trees ≥5.0 inches d.b.h. in forests of Georgia increased from 151.8 million in the 2009 survey to 162.9 million in the 2014 survey, a 7-percent increase (table 10).

Table 8—Area of forest land disturbed annually by forest-type group and disturbance class, Georgia, 2010–14

	Disturbance class[a]							
Forest-type group[b]	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
	thousand acres							
Softwood types								
White-red-jack pine	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longleaf-slash pine	1.9	71.8	2.7	157.2	4.9	2.5	13.8	0.0
Loblolly-shortleaf pine	16.6	59.0	13.3	209.7	10.6	0.6	7.8	4.2
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Total softwoods	22.0	130.8	16.0	366.8	15.5	3.1	21.6	4.9
Hardwood types								
Oak-pine	18.2	4.8	4.4	63.1	10.7	0.2	6.2	3.3
Oak-hickory	30.3	7.8	10.9	69.3	16.3	3.8	10.3	1.8
Oak-gum-cypress	4.6	2.6	6.3	65.7	6.3	14.2	2.4	1.1
Elm-ash-cottonwood	0.0	2.2	3.0	2.6	0.3	4.4	1.9	0.0
Other hardwoods	1.5	0.0	0.0	0.6	0.0	0.0	0.0	0.0
Tropical hardwoods	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
Exotic hardwoods	0.0	0.0	0.6	0.4	0.0	0.0	0.0	0.0
Total hardwoods	54.6	17.4	25.2	201.6	33.7	23.7	20.8	6.2
Nonstocked	0.0	0.0	1.6	4.1	0.3	0.3	0.0	0.7
All groups	76.6	148.3	42.8	572.6	49.6	27.1	42.5	11.9

Numbers in rows and columns may not sum to totals due to rounding.
0.0 = no sample for the cell or a value of >0.0 but <0.05.
[a] Based on current conditions.
[b] Based on past conditions.

Table 9—Carbon pool on forest land by forest-type group and carbon pool groups, Georgia, 2014

Forest-type group[a]	Carbon pool								
	Above ground trees	Below ground trees	Standing dead trees	Above ground understory	Below ground understory	Down dead material	Forest floor litter	Soil organic matter	Total
	thousand short tons								
Softwood types									
White-red-jack pine	3,031.0	654.0	174.0	69.0	8.0	341.0	397.0	1,520.0	6,194.0
Longleaf-slash pine	64,625.0	14,733.0	1,273.0	5,368.0	596.0	9,509.0	15,440.0	178,124.0	289,670.0
Loblolly-shortleaf pine	160,543.0	36,163.0	6,181.0	10,485.0	1,165.0	22,137.0	32,585.0	242,324.0	511,583.0
Other eastern softwoods	96.0	22.0	37.0	21.0	2.0	27.0	71.0	224.0	499.0
Total softwoods	228,295.0	51,572.0	7,665.0	15,943.0	1,771.0	32,014.0	48,493.0	422,192.0	807,946.0
Hardwood types									
Oak-pine	59,467.0	12,458.0	2,623.0	3,625.0	403.0	5,923.0	11,515.0	74,831.0	170,845.0
Oak-hickory	157,099.0	30,930.0	8,826.0	8,285.0	920.0	15,040.0	17,626.0	130,290.0	369,016.0
Oak-gum-cypress	88,800.0	17,753.0	5,165.0	2,240.0	249.0	9,133.0	9,301.0	243,373.0	376,014.0
Elm-ash-cottonwood	8,367.0	1,641.0	797.0	300.0	33.0	977.0	1,082.0	19,378.0	32,575.0
Other hardwoods	172.0	35.0	16.0	43.0	5.0	35.0	46.0	2,044.0	2,395.0
Tropical hardwoods	218.0	42.0	10.0	3.0	0.0	35.0	11.0	373.0	691.0
Exotic hardwoods	464.0	94.0	39.0	50.0	6.0	119.0	118.0	5,370.0	6,259.0
Total hardwoods	314,587.0	62,953.0	17,476.0	14,546.0	1,616.0	31,262.0	39,699.0	475,659.0	957,795.0
Nonstocked	275.0	58.0	59.0	612.0	68.0	59.0	455.0	16,026.0	17,612.0
All groups	543,157.0	114,583.0	25,200.0	31,101.0	3,455.0	63,335.0	88,647.0	913,877.0	1,783,353.0

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

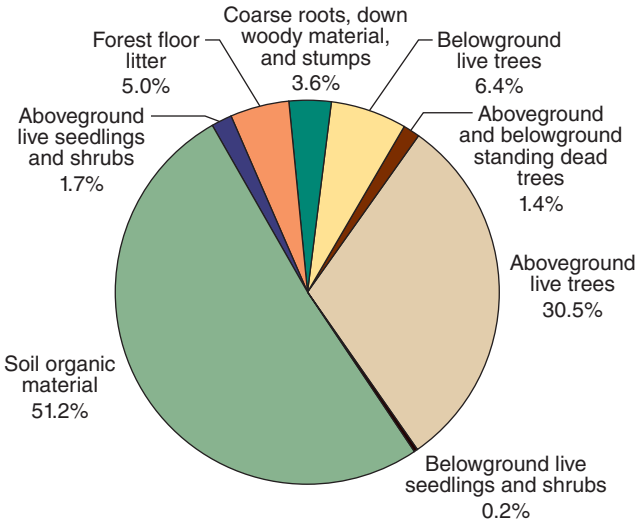

Figure 20—Percentage of forest carbon in the aboveground and belowground portions of live and dead trees [diameter at breast height (d.b.h.) ≥1 inch], seedlings and shrubs (d.b.h. <1 inch), coarse woody material, forest floor litter, and soil organic material, Georgia, 2014.

Table 10—Number of standing dead trees on forest land by forest-type group and diameter class, Georgia, 2014

Forest type	All classes	Diameter class (*inches at breast height*) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0+
					number of trees						
Softwood types											
White-red-jack pine	1,407,269	599,962	320,971	236,041	112,455	93,324	14,839	—	14,839	14,839	—
Longleaf-slash pine	13,855,815	6,018,935	4,059,900	1,634,882	1,274,360	357,773	215,380	145,273	111,817	—	37,495
Loblolly-shortleaf pine	39,330,117	18,490,077	9,470,829	4,991,434	3,111,943	1,709,293	600,347	516,519	211,996	85,980	141,698
Total softwoods	54,593,201	25,108,974	13,851,700	6,862,357	4,498,758	2,160,390	830,566	661,792	338,652	100,819	179,193
Hardwood types											
Oak-pine	19,766,267	8,352,632	4,095,565	3,071,100	1,754,752	985,451	835,992	281,072	84,439	217,681	87,583
Oak-hickory	46,029,670	18,302,957	9,527,821	6,457,049	4,457,060	3,097,356	1,740,802	921,103	529,060	875,926	120,535
Oak-gum-cypress	36,387,533	15,281,443	7,399,688	5,294,576	3,137,348	1,885,076	1,313,125	577,824	428,121	889,902	180,430
Elm-ash-cottonwood	2,385,674	853,118	501,734	466,793	143,775	110,401	35,034	106,175	49,287	84,322	35,034
Other hardwoods	14,253	14,253	—	—	—	—	—	—	—	—	—
Tropical hardwoods	232,793	—	—	38,799	116,396	77,598	—	—	—	—	—
Exotic hardwoods	281,193	140,597	71,262	—	—	—	—	34,667	—	34,667	—
Total hardwoods	105,097,383	42,945,000	21,596,070	15,328,317	9,609,331	6,155,882	3,924,953	1,920,841	1,090,907	2,102,498	423,582
Nonstocked	3,258,640	2,190,449	401,682	139,594	348,522	—	178,393	—	—	—	—
All groups	162,949,222	70,244,421	35,849,453	22,330,268	14,456,612	8,316,271	4,933,913	2,582,634	1,429,558	2,203,317	602,775

— = no sample for the cell.

Species of Concern

Several tree species in Georgia have serious issues at this time. These include, but are not limited to, redbay (*Persea borbonia*), sassafras (*Sassafras albidum*), flowering dogwood (*Cornus florida*), and various species of ash (*Fraxinus* spp.). All of these are under threat from either a disease or an insect. Redbay, a small tree native to the Southeastern United States is under attack from laurel wilt disease. This disease is a fungus (*Raffaelea lauricola*) that is spread by the redbay ambrosia beetle (*Xyleborus glabratus*). Both this disease and its vector were introduced from Asia. In 2004, there were an estimated 248.5 million live redbay trees ≥1.0 inch d.b.h. As of the 2014 survey, that number dropped to 108.9 million, a 56-percent decrease. In addition, the population of trees ≥5.0 inches d.b.h. has been decimated. Between 2004 and 2014, the number of live redbay trees of this size dropped by 84 percent. For trees measured at both time periods, redbay had the highest percentage of trees die between the 2009 survey and the 2014 survey (69.5 percent). Sassafras is also attacked by laurel wilt disease and is starting to show an increase in mortality as well. Almost 41 percent of sassafras trees measured at both time periods died between the 2009 survey and the 2014 survey.

Flowering dogwood is another species with a rather high rate of mortality. This is most likely due to a number of factors, including drought stress, dogwood anthracnose (*Discula destructiva*), and powdery mildew (*Erysiphe pulchra* and possibly other fungi). Between 2009 and 2014 the number of live dogwood trees ≥1.0 inch d.b.h. declined from 420.6 million to 307.4 million, a 27-percent decrease. Declines in dogwood have been noted in other States, particularly Virginia (Rose 2013).

The emerald ash borer (*Agrilus planipennis* Fairmaire) (fig. 21) is an exotic pest insect in the family Buprestidae (metallic wood boring beetles). First found in the United States near Detroit, MI in 2002, the beetle has rapidly spread to infest native ash trees in 23 States. The insect's larval stage feeds within the phloem, rapidly girdling even healthy trees and killing them in as little as 3 years (fig. 22).

Figure 21—Emerald ash borer adult. (photo by Leah Bauer, USDA Forest Service, Northern Research Station, Bugwood.org)

Figure 22—Typical serpentine larval galleries of emerald ash borer. (photo courtesy of James W. Smith, USDA APHIS PPQ, Bugwood.org)

While the overall economic importance of ash is greater in other parts of the United States, primarily the Midwest and northern States, ash is still a valuable resource in Georgia. As of 2014, Georgia's forests contained nearly 24 million ash trees ≥5 inches in diameter. Green ash is often a major component of forests in low-lying areas. Ash wood is relatively strong and resistant to shock, and is used for manufacturing handles, oars, baseball bats, and furniture. Seeds provide mast for wildlife, and trees provide harborage and nesting sites for a variety of birds. More than 40 arthropod species in North America feed exclusively on ash. Green ash is also widely used as a landscape tree. The Georgia Forestry Commission estimates that Georgia's urban and community forests contain nearly 3 million ash trees with a value of $725 million.

As of October 2015, 19 Georgia counties were under Federal quarantine for emerald ash borer. It was first detected in DeKalb and Fulton Counties in July of 2013. One notable tree threatened by the borer is the "Battle of Decatur" white ash, on the campus of Agnes Scott College, a tree that survived that battle in 1864 but will likely not survive the onslaught of this pest without chemical treatment. There are four champion trees in the genus *Fraxinus* in Georgia, representing *F. pennsylvanica* (Green), *F. americana* (white), and *F. caroliniana* (Carolina) ash.

One champion tree is in the current quarantine area (Fulton county), and all are susceptible to the borer. The future of Georgia's ash resource is uncertain—in areas where the emerald ash borer has been present for a number of years, mortality can exceed 99 percent. Some studies have demonstrated that regeneration essentially ceases as ash mortality approaches 100 percent, suggesting that viable seeds do not remain in the soil for an extended period of time. Current management efforts include slowing the spread of the borer, biological control, and prophylactic insecticidal treatment for high-value trees, as well as investigations into mechanisms of resistance. The speed with which emerald ash borer kills healthy trees suggests that even with a successful combination of control and/or restoration efforts, its effects will be significant and widespread.

Nonnative Invasive Plants

Many nonnative invasive plants have been recognized as problematic because they may compete with or even displace native species, in addition to changing the characteristics of forest soils and potentially altering a site's biodiversity. It is important, therefore, to continually monitor and track their occurrence and spread to gauge their potential impact on forest resources.

Table 11 lists by frequency those invasive species of trees, shrubs, vines, grasses and herbs encountered on FIA survey plots in Georgia during the 2014 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 (U.S. Department of Agriculture Forest Service 2007a) to field manual version 6.0 guidelines (U.S. Department of Agriculture Forest Service 2012) between the previous and current survey cycles. The predominant change between the two manuals is the identification of additional species as nonnative invasives.

The most frequently encountered invasive tree was chinaberry tree (*Melia azedarach*), which was encountered on a total of 251 plots (5 percent of all forested plots sampled). An import from Asia, chinaberry tree is an escaped ornamental with brightly colored fall foliage and berries that are poisonous to both humans and livestock. The second most commonly recorded tree was mimosa (*Albizia julibrissin*), encountered on 114 plots. Mimosa, like chinaberry tree, was also imported for ornamental use from Asia, but the tree's ability to form dense colonies from root sprouts harms wildlife who are dependent on native vegetation (Miller and others 2010). Chinese tallowtree (*Triadica sebifera*) was the third most commonly encountered invasive tree, recorded on 60 plots. Chinese tallowtree has earned a reputation as a rapidly spreading pest along the Southern Coast and has been the focus of recent research. The tree has the ability to displace native species, change soil chemistry, and transform community structure (Battaglia and others 2009). Fan (2015) estimates that over 1.5 million ha of U.S. forest lands could be infested by Chinese tallowtree by the year 2023, and identified the oak-gum-cypress forest type as one susceptible ecological community.

The most frequently encountered invasive shrubs were Chinese/European privets (*Ligustrum* spp.), which were encountered on 1,660 plots, a full 34 percent of all forested plots sampled, and the second most invasive plant collected by FIA on forests in Georgia. These aggressively spreading shrubs, introduced for use as hedgerows, are ubiquitous in the forests of the Southeastern United States. Although deer browse the shrubs, the plants form dense thickets along the forest edge and in the understory of forests, displacing native vegetation important to other wildlife. The second most commonly recorded shrubs were nonnative roses (*Rosa* spp.), on 101 plots.

Table 11—Regionally recognized nonnative invasive plants identified on forest survey plots by common name, scientific name, and number and percent of plots, Georgia, 2014

Common name	Scientific name	Survey plots 4.0[a]	Survey plots 6.0[b]	Survey plots Total	Proportion of total sample
		- - - - - number - - - - -			- - percent - -
Trees					
Chinaberrytree	*Melia azedarach*	151	100	251	5.2
Silktree, mimosa	*Albizia julibrissin*	71	43	114	2.4
Chinese tallow tree	*Triadica sebifera*	36	24	60	1.2
Hardy orange	*Poncirus trifoliata*	17	11	28	0.6
Princesstree	*Paulownia tomentosa*	9	8	17	0.4
Callery pear	*Pyrus calleryana*	8	7	15	0.3
Tree of heaven	*Ailanthus altissima*	4	5	9	0.2
Camphortree	*Cinnamomum camphora*	3	4	7	0.1
Tungoil tree	*Vernicia fordii*	2	3	5	0.1
Shrubs					
Chinese/European privet	*Ligustrum* spp.	994	666	1,660	34.4
Nonnative rose	*Rosa* spp.	60	41	101	2.1
Autumn olive, oleaster	*Elaeagnus* spp.	47	38	85	1.8
Sacred bamboo	*Nandina domestica*	42	34	76	1.6
Thorny olive	*Elaeagnus pungens*	38	28	66	1.4
Japanese privet	*Ligustrum japonicum*	18	14	32	0.7
Beale's barberry	*Mahonia bealei*	5	7	12	0.2
Honeysuckle	*Lonicera*	2	4	6	0.1
Vines					
Japanese honeysuckle	*Lonicera japonica*	1,364	861	2,225	46.2
Japanese climbing fern	*Lygodium japonicum*	149	93	242	5.0
Wisteria	*Wisteria*	29	22	51	1.1
Kudzu	*Pueraria montana* var. *lobata*	25	20	45	0.9
Ivy	*Hedera*	14	10	24	0.5
Periwinkle	*Vinca*	4	5	9	0.2
Winter creeper	*Euonymus fortunei*	—	1	1	0.0
Grass					
Nepalese browntop	*Microstegium vimineum*	126	87	213	4.4
Tall fescue	*Schedonorus phoenix*	3	4	7	0.1
Golden bamboo	*Phyllostachys aurea*	1	2	3	0.1
Bamboo	*Bambusa*	1	—	1	0.0
Herbs					
Chinese or sericea lespedeza	*Lespedeza cuneata*	212	123	335	7.0
Lespedeza	*Lespedeza* spp.	23	20	43	0.9

— = no observations.

[a] Count of survey plots with at least one invasive plant present collected under Forest Inventory and Analysis Program field manual version 4.0 guidelines during inventory cycle.

[b] Count of survey plots with at least one invasive plant present collected under Forest Inventory and Analysis Program field manual version 6.0 guidelines during inventory cycle.

The most frequently encountered invasive vine, and also the overall most frequently recorded invasive plant across all monitored species, was Japanese honeysuckle (*Lonicera japonica*). This aggressive invader was detected on 2,225 forested plots in Georgia—46 percent of all forested plots sampled in the State. Japanese honeysuckle is widely recognized for its fragrant flowers in the summer, and has been intentionally planted in many areas for both deer browse and for ornamental use. However, the plant is extremely persistent and difficult to eradicate once established, and it grows rapidly in response to disturbance in the forest canopy. The rapid growth response can result in the shading of developing seedlings and small saplings in the understory, hampering successful regeneration of tree species, and even preventing afforestation of new sites (Nickelson and others 2015). The next most common vine detected on Georgia forests was Japanese climbing fern (*Lygodium japonicum*) on 242, or 5 percent, of plots sampled. This increasingly problematic vine, if left unchecked, can shade out entire trees and produce a thick groundcover that prevents native plants from germinating.

The most frequently detected invasive grass was Nepalese browntop (*Microstegium vimineum*), with occurrences on 213 or 4 percent of forested plots. While this grass is fairly small and unnoticeable in a shady understory, it rapidly expands with exposure to sunlight and has the ability to grow over and hamper tree regeneration in the understory (Oswalt and others 2007). Tall fescue (*Schedonorus phoenix*) was the second most commonly recorded grass, but was only encountered on seven forested plots in Georgia.

Chinese lespedeza (*Lespedeza cuneata*) was the most commonly encountered invasive herb on forested plots, with detections on 335 plots (7 percent). Other lespedezas made up the remainder of invasive herb observations (43) on forested plots.

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GLOSSARY

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 includes 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.

Blind check—A reinstallation done by a qualified inspection crew without production crew data on hand; at least two full subplots are completely remeasured along with all the plot level information. The two datasets are maintained separately. Discrepancies between the two sets of data are not reconciled. See: Quality assurance and quality control.

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

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.

Cold check—An inspection done either as part of the training process, or as part of the ongoing quality control program. Normally the installation crew is not present at the time of inspection. The inspector has the completed data in-hand at the time of inspection. The inspection can include the whole plot or a subset of the plot. Data errors are corrected. See: Quality assurance and quality control.

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.

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.

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 to 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.

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.

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 fuelbed; fuel loading on the microplot; and residue piles are also measured as part of the DWM indicator for FIA.

Dry weight—The oven-dry weight of biomass.

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

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 forms 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.)

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 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 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.

Hardwoods—Tree species belonging to the botanical divisions Magnoliophyta, Ginkgophyta, Cycadophyta, or Pteridophyta, 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.

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

Hot check—An inspection normally done as part of the training process. The inspector is present on the plot with the trainee and provides immediate feedback regarding data quality. Data errors are corrected. Hot checks can be done on training plots or production plots. See: Quality assurance and quality control.

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 U.S. 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.).

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.

Measurement quality objective (MQO)—A data user's estimate of the precision, bias, and completeness of data necessary to satisfy a prescribed application (e.g., Resource Planning Act, assessments by State foresters, forest planning, forest health analyses). Describes the acceptable tolerance for each data element. MQOs consist of two parts: a statement of the tolerance and a percentage of time when the collected data are required to be within tolerance. MQOs can only be assigned where standard methods of sampling or field measurements exist, or where experience has established upper or lower bounds on precision or bias. MQOs can be set for measured data elements, observed data elements, and derived data elements.

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.

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.

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.

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 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.

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 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 3 (P3)—A subset of Phase 2 plots where additional attributes related to forest health are measured.

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

Poletimber-sized 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.

Private land—See: Ownership.

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.

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.

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.

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

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

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 to 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, 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.

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

Planted—Planted or artificially seeded.

Natural—No evidence of artificial regeneration.

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 at 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.

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.

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.

INVENTORY METHODS

The Georgia 2014 inventory was a three-phase, fixed-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 field personnel. 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. 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 P3 hexagon. P2 and P3 hexagons represent about 6,000 and 96,000 acres, respectively.

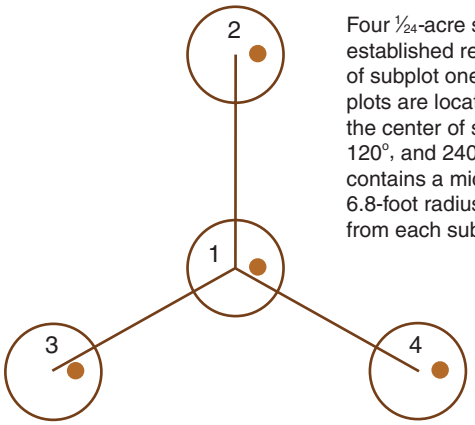
Under the annual inventory system, 20 percent (1 panel) of the total number of plots in a State are measured every year over a 5-year period (1 cycle). Each panel of plots is selected on a subgrid that is slightly offset from the previous panel so that each panel covers essentially the same sample area (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 of data is available for the 5-year report.

Phase 1

For the 2014 inventory of Georgia, the P1 forest area estimate was based on classifying National Land Cover Database points. 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, will not agree exactly with the statistical estimate of national forest land derived by Forest Inventory and Analysis. These numbers could differ substantially for very small areas.

Phase 2

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



Four 1/24-acre subplots are established relative to the center of subplot one. The 24-foot radius plots are located 120 feet from the center of subplot one at 360°, 120°, and 240°. Each subplot contains a microplot with a 6.8-foot radius, 12 feet (at 90°) from each subplot center.

Figure A.1—Layout of annual fixed-radius plot design.

in turn contains a circular microplot with a fixed 6.8-foot radius. Trees 1.0 to 4.9 inches d.b.h. and seedlings (<1.0 inch d.b.h.) are measured in these microplots (U.S. Department of Agriculture Forest Service 2004a).

Sometimes, a plot cluster straddles two or more land use or forest condition classes (Bechtold and Patterson 2005). There are seven condition-class variables that require mapping of a unique condition on a plot: land use, forest type, stand size, ownership, stand density, regeneration status, and reserved status. A new condition is defined and mapped each time one of these variables changes during plot measurement.

Phase 3

Data on forest health variables (P3) are collected on about $1/16^{th}$ of the P2 sample plots. P3 data are coarse descriptions and are meant to be used as general indicators of overall forest health over large geographic areas. P3 data collection includes variables pertaining to tree crown health, down woody material, and foliar ozone injury (U.S. Department of Agriculture Forest Service 2004b).

Summary

Users wishing to make rigorous comparisons of data between surveys should be aware of any changes in methodologies between measurements. The most valuable and powerful trend information is obtained when the same plots are revisited from one survey to the next and measured in the same way. Determining the strength of a trend, or determining the level of confidence associated with a trend, is difficult or impossible when sampling methods change over time.

DATA RELIABILITY

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

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 post-survey 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 Field Manual (U.S. Department of Agriculture Forest Service 2004a, U.S. Department of Agriculture Forest Service 2004b). 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. Tables B.1–B.5 show the results of various blind checks for Georgia.

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 (table B.6).

Table B.1—Results of plot, subplot, and boundary-level blind checks for Georgia, 2014

Variable	Number of observations	Number within tolerance	Percent within tolerance
	- - - - - - - - *number* - - - - - - - -		*- - percent - -*
Plot variables			
Plot status	60	59	98.0
Plot nonsampled reason	0	—	—
Distance to road	108	78	72.0
Water on plot	108	92	85.0
Latitude longitude	66	66	100.0
Plot in correct county	123	123	100.0
Corrected county	0	—	—
Plot accessibility	123	115	93.0
Subplot variables			
Subplot nonsampled reason	0	—	—
Subplot center condition	492	479	97.0
Microplot center condition	473	473	100.0
Subplot slope	228	227	100.0
Subplot aspect	228	177	78.0
Snow/water depth			
Boundary variables			
Existence of change	24	13	54.0
Boundary change	18	7	39.0
Contrasting condition	24	22	92.0
Left azimuth	10	5	50.0
Right azimuth	10	2	20.0
Existence of corner	10	9	90.0
Corner azimuth	1	0	0.0
Corner distance	1	0	0.0
Boundary status	15	15	100.0

— = no sample for the cell.

Table B.2—Results of condition-level blind checks for Georgia, 2014

Variable	Number of observations	Number within tolerance	Percent within tolerance
	- - - - - - - - number - - - - - - - -		*- - percent - -*
Condition variables			
Condition status	176	175	99.0
Condition nonsampled reason	0	—	—
Reserved status	134	134	100.0
Owner group	134	134	100.0
Field forest type	134	102	76.0
Field forest-type group	134	111	83.0
Stand-size class	134	119	89.0
Regeneration status	134	130	97.0
Tree density	134	134	100.0
Artificial regeneration species	44	41	93.0
Owner class	134	132	99.0
Private owner industrial status	62	62	100.0
Stand age	134	74	55.0
Disturbance 1	134	122	91.0
Disturbance year 1	19	12	63.0
Disturbance 2	19	17	89.0
Disturbance year 2	1	1	100.0
Disturbance 3	1	1	100.0
Disturbance year 3	0	—	—
Treatment 1	134	131	98.0
Treatment year 1	22	18	82.0
Treatment 2	22	22	100.0
Treatment year 2	8	8	100.0
Treatment 3	8	8	100.0
Treatment year 3	4	4	100.0
Physiographic class	134	120	90.0
Present land use	134	134	100.0
Total acres	117	109	93.0
Percent forest	125	97	78.0
Stand structure	134	122	91.0
Operability	134	117	87.0
Site class	64	47	73.0
Afforestation	0	—	—
Chaining	90	90	100.0
Harvest type 1	70	65	93.0
Harvest type 2	10	10	100.0
Harvest type 3	0	—	—
Live canopy	80	71	89.0
Live and missing canopy	80	73	91.0
Number of stems	0	—	—
Secondary land use	0	—	—
Fire	64	61	95.0
Grazing	64	64	100.0

— = no sample for the cell.

Table B.3—Results of tree and seedling blind checks for Georgia, 2014

Variable	Number of observations	Number within tolerance	Percent within tolerance
	number		*percent*
Tree variables			
Condition number	1,864	1,804	97.0
Azimuth	1,687	1,567	93.0
Horizontal distance	1,610	1,602	100.0
Present tree status	1,862	1,836	99.0
Reconcile	275	272	99.0
Standing dead	203	202	100.0
Species	1,864	1,801	97.0
Genus	1,863	1,850	99.0
Live d.b.h.	1,444	1,142	79.0
Live d.b.h.: both diameter checks = 0	653	543	83.0
Live d.b.h.: both diameter checks >0	32	22	69.0
Live d.b.h.: mixed diameter checks	51	25	49.0
Sound dead d.b.h.	12	9	75.0
Decayed dead d.b.h.	19	19	100.0
Live rotten/missing cull	32	27	84.0
Dead rotten/missing cull	17	8	47.0
Number of d.r.c. stems	1	1	100.0
Diameter root collar	1	0	0.0
Total length	1,445	1,207	84.0
Live tree actual length	11	8	73.0
Dead tree actual length	28	19	68.0
Crown class	1,445	1,270	88.0
Compacted crown ratio	1,442	1,224	85.0
Cause of death	0	—	—
Mortality year	0	—	—
Decay class	203	200	99.0
Tree class	1,141	1,034	91.0
Tree grade	294	248	84.0
Board foot cull	294	240	82.0
Dieback incidence	517	517	100.0
Dieback severity	456	453	99.0
Utilization class	156	153	98.0
Abnormal termination	753	726	96.0
Damage agent 1	753	647	86.0
Damage agent 2	93	70	75.0
Damage agent 3	22	10	45.0
Seedling variables			
Species	389	351	90.0
Genus	389	379	97.0
Count	389	255	66.0

D.b.h. = diameter at breast height; d.r.c. = diameter at root collar.
— = no sample for the cell.

Table B.4—Results of missing species, extra trees and seedlings, and invasive species blind checks for Georgia, 2014

Variable	Observations found by both	Observations found by cruiser	Observations found by QA
		number	
Missing/extra tree/seedling			
Trees	1,869	15	22
Seedlings	389	28	81
Invasive species			
Invasive species	170	111	36

QA = quality assurance.

Table B.5—Results of invasive species and down woody materials blind checks for Georgia, 2014

Variable	Number of observations	Number within tolerance	Percent within tolerance
	- - - - - - - - *number* - - - - - - - -		- - *percent* - -
Invasive species variables			
Invasive cover	170	131	77.0
Down woody materials variables			
Transect segments	0	—	—
Existence of transect subsegments	22	22	100.0
Transect break point	1	1	100.0
Down woody materials duff/litter	0	—	—
Duff/litter method	25	25	100.0
Litter depth	25	18	72.0
Duff depth	25	22	88.0
Fine woody debris	0	—	—
Small count	12	1	8.0
Medium count	12	3	25.0
Large count	12	9	75.0
Coarse woody debris	0	—	—

— = no sample for the cell.

Table B.6—Statistical reliability for Georgia, 2014

Item	Sample estimate and 68.27 percent confidence interval	Sampling error
		percent
Forest land (*1,000 acres*)		
State	24,728.4 ± 126.1	0.51
Southeast	7,928.9 ± 66.6	0.84
Southwest	2,959.2 ± 49.1	1.66
Central	7,660.8 ± 67.4	0.88
North Central	3,244.1 ± 54.8	1.69
North	2,935.3 ± 42.0	1.43
All-live volume (*million cubic feet*)		
State	43,658.1 ± 475.9	1.09
Softwoods	21,978.4 ± 369.2	1.68
Hardwoods	21,679.8 ± 401.1	1.85
Growth, removals, and mortality (*million cubic feet*)		
Net annual growth	1,970.0 ± 33.3	1.69
Softwoods	1,471.0 ± 29.7	2.02
Hardwoods	506.5 ± 18.8	3.72
Annual removals	1,362.3 ± 54.4	3.99
Softwoods	1,088.6 ± 47.1	4.33
Hardwoods	273.7 ± 21.7	7.93
Annual mortality	50.8 ± 1.7	3.41
Softwoods	22.7 ± 1.1	4.96
Hardwoods	28.1 ± 1.3	4.47

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 softwood live-tree volume on forest land in the Central survey unit is computed as:

$$SE_s = 2.01\% \left[\frac{\sqrt{12{,}795{,}915{,}772}}{\sqrt{6{,}855{,}051{,}565}} \right] = 2.75\%$$

Thus, the estimated sampling error is 2.75 percent, and the resulting 68.27-percent confidence interval for softwood live-tree volume in the Central survey unit is 6,855.05 ± 188.25 million cubic feet.

Georgia's pine plantations are a valuable resource that make important contributions to the State's economy. (photo courtesy of the Georgia Forestry Commission)

Table C.1—Area by survey unit and land status, Georgia, 2014

Survey unit	Total area	All forest land	Land status						Nonforest land	Census water
			Unreserved			Reserved				
			Total	Timberland	Un-productive	Total	Productive	Un-productive		
	thousand acres									
Southeast	11,183.3	7,928.9	7,573.7	7,573.7	0.0	355.2	355.2	0.0	2,769.1	485.4
Southwest	5,652.3	2,959.2	2,959.2	2,959.2	0.0	0.0	0.0	0.0	2,592.9	100.2
Central	10,612.3	7,660.8	7,615.4	7,615.4	0.0	45.5	45.5	0.0	2,788.6	162.8
North Central	6,315.6	3,244.1	3,244.1	3,244.1	0.0	0.0	0.0	0.0	2,941.8	129.7
North	4,268.4	2,935.3	2,765.6	2,765.6	0.0	169.8	169.8	0.0	1,257.4	75.7
All survey units	38,031.9	24,728.4	24,158.0	24,158.0	0.0	570.4	570.4	0.0	12,349.9	953.6

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

Table C.2—Area of forest land by ownership class and land status, Georgia, 2014

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
	thousand acres						
U.S. Forest Service							
National forest	871.7	710.6	710.6	0.0	161.2	161.2	0.0
Total	871.7	710.6	710.6	0.0	161.2	161.2	0.0
Other Federal							
National Park Service	27.6	0.0	0.0	0.0	27.6	27.6	0.0
U.S. Fish and Wildlife Service	381.7	0.0	0.0	0.0	381.7	381.7	0.0
Dept. of Defense/Dept. of Energy	532.9	532.9	532.9	0.0	0.0	0.0	0.0
Other Federal	22.5	22.5	22.5	0.0	0.0	0.0	0.0
Total	964.6	555.3	555.3	0.0	409.3	409.3	0.0
State and local government							
State	471.3	471.3	471.3	0.0	0.0	0.0	0.0
Local	353.7	353.7	353.7	0.0	0.0	0.0	0.0
Total	825.0	825.0	825.0	0.0	0.0	0.0	0.0
Forest industry							
Corporate	1,542.9	1,542.9	1,542.9	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	23.4	23.4	23.4	0.0	0.0	0.0	0.0
Individual	5.8	5.8	5.8	0.0	0.0	0.0	0.0
Total	1,572.2	1,572.2	1,572.2	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	6,920.9	6,920.9	6,920.9	0.0	0.0	0.0	0.0
Conservation/natural resources organization	26.9	26.9	26.9	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	318.5	318.5	318.5	0.0	0.0	0.0	0.0
Individual	13,228.7	13,228.7	13,228.7	0.0	0.0	0.0	0.0
Total	20,495.0	20,495.0	20,495.0	0.0	0.0	0.0	0.0
All classes	24,728.4	24,158.0	24,158.0	0.0	570.4	570.4	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.

Table C.3—Area of forest land by forest-type group and ownership group, Georgia, 2014

Forest-type group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	thousand acres					
Softwood types						
White-red-jack pine	65.0	41.0	0.0	0.0	0.0	24.1
Longleaf-slash pine	3,628.5	0.0	215.2	94.0	522.6	2,796.7
Loblolly-shortleaf pine	7,448.1	128.3	177.2	224.1	476.9	6,441.6
Other eastern softwoods	15.5	0.0	1.5	0.0	0.0	14.0
Total softwoods	11,157.1	169.2	393.9	318.1	999.5	9,276.4
Hardwood types						
Oak-pine	2,731.6	149.3	115.0	101.2	102.0	2,264.1
Oak-hickory	6,454.2	542.0	104.8	264.4	115.8	5,427.2
Oak-gum-cypress	3,452.7	4.1	279.7	84.5	285.3	2,799.0
Elm-ash-cottonwood	454.1	4.8	0.0	29.2	20.3	399.7
Other hardwoods	26.5	2.4	0.0	0.0	0.0	24.1
Tropical hardwoods	4.8	0.0	0.0	4.8	0.0	0.0
Exotic hardwoods	69.7	0.0	0.0	5.8	0.0	63.9
Total hardwoods	13,193.6	702.5	499.6	489.9	523.5	10,978.1
Nonstocked	377.7	0.0	71.1	17.0	49.2	240.5
All groups	24,728.4	871.7	964.6	825.0	1,572.2	20,495.0

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.

Table C.4—Area of forest land by forest-type group and stand-size class, Georgia, 2014

Forest-type group	All size classes	Stand-size class			Non-stocked
		Large diameter	Medium diameter	Small diameter	
	thousand acres				
Softwood types					
White-red-jack pine	65.0	59.5	4.9	0.6	0.0
Longleaf-slash pine	3,628.5	1,521.1	1,296.0	811.4	0.0
Loblolly-shortleaf pine	7,448.1	3,903.7	2,456.6	1,087.8	0.0
Other eastern softwoods	15.5	0.0	9.7	5.8	0.0
Total softwoods	11,157.1	5,484.4	3,767.2	1,905.6	0.0
Hardwood types					
Oak-pine	2,731.6	1,367.3	705.9	658.4	0.0
Oak-hickory	6,454.2	3,524.4	1,075.8	1,854.0	0.0
Oak-gum-cypress	3,452.7	1,769.1	690.7	992.9	0.0
Elm-ash-cottonwood	454.1	222.4	104.6	127.0	0.0
Other hardwoods	26.5	2.4	0.0	24.1	0.0
Tropical hardwoods	4.8	4.8	0.0	0.0	0.0
Exotic hardwoods	69.7	1.6	18.3	49.8	0.0
Total hardwoods	13,193.6	6,892.1	2,595.4	3,706.1	0.0
Nonstocked	377.7	0.0	0.0	0.0	377.7
All groups	24,728.4	12,376.5	6,362.6	5,611.7	377.7

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

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

Table C.5—Area of forest land by forest-type group and stand origin, Georgia, 2014

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	thousand acres		
Softwood types			
White-red-jack pine	65.0	59.2	5.9
Longleaf-slash pine	3,628.5	995.7	2,632.8
Loblolly-shortleaf pine	7,448.1	3,149.5	4,298.6
Other eastern softwoods	15.5	15.5	0.0
Total softwoods	11,157.1	4,219.8	6,937.3
Hardwood types			
Oak-pine	2,731.6	2,329.3	402.3
Oak-hickory	6,454.2	6,234.3	219.9
Oak-gum-cypress	3,452.7	3,396.4	56.3
Elm-ash-cottonwood	454.1	430.5	23.6
Other hardwoods	26.5	26.5	0.0
Tropical hardwoods	4.8	4.8	0.0
Exotic hardwoods	69.7	58.7	11.0
Total hardwoods	13,193.6	12,480.6	713.0
Nonstocked	377.7	300.2	77.5
All groups	24,728.4	17,000.6	7,727.9

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

Table C.6—Area of forest land disturbed annually by forest-type group and disturbance class, Georgia, 2010–14

Forest-type group[a]	Disturbance class							
	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
	thousand acres							
Softwood types								
White-red-jack pine	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longleaf-slash pine	1.9	71.8	2.7	157.2	4.9	2.5	13.8	0.0
Loblolly-shortleaf pine	16.6	59.0	13.3	209.7	10.6	0.6	7.8	4.2
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Total softwoods	22.0	130.8	16.0	366.8	15.5	3.1	21.6	4.9
Hardwood types								
Oak-pine	18.2	4.8	4.4	63.1	10.7	0.2	6.2	3.3
Oak-hickory	30.3	7.8	10.9	69.3	16.3	3.8	10.3	1.8
Oak-gum-cypress	4.6	2.6	6.3	65.7	6.3	14.2	2.4	1.1
Elm-ash-cottonwood	0.0	2.2	3.0	2.6	0.3	4.4	1.9	0.0
Other hardwoods	1.5	0.0	0.0	0.6	0.0	0.0	0.0	0.0
Tropical hardwoods	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
Exotic hardwoods	0.0	0.0	0.6	0.4	0.0	0.0	0.0	0.0
Total hardwoods	54.6	17.4	25.2	201.6	33.7	23.7	20.8	6.2
Nonstocked	0.0	0.0	1.6	4.1	0.3	0.3	0.0	0.7
All groups	76.6	148.3	42.8	572.6	49.6	27.1	42.5	11.9

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

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

[a] Based on past conditions.

Table C.7—Area of forest land treated annually by forest-type group and treatment class, Georgia, 2010–14

Forest-type group[a]	Treatment class						
		Cutting					
	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	220.9	79.6	4.0	0.5	132.2	1.1	3.4
Loblolly-shortleaf pine	488.8	128.4	19.4	5.4	325.9	5.1	4.5
Other eastern softwoods	1.2	0.0	1.2	0.0	0.0	0.0	0.0
Total softwoods	710.9	208.0	24.6	6.0	458.2	6.3	7.9
Hardwood types							
Oak-pine	60.1	29.3	7.5	1.3	19.3	0.0	2.7
Oak-hickory	79.1	37.4	17.9	0.9	20.1	1.4	1.4
Oak-gum-cypress	53.5	38.9	6.2	0.0	7.5	1.0	0.1
Elm-ash-cottonwood	2.8	2.3	0.0	0.0	0.5	0.0	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	0.6	0.6	0.0	0.0	0.0	0.0	0.0
Total hardwoods	196.1	108.4	31.5	2.2	47.4	2.4	4.2
Nonstocked	3.4	1.3	0.3	0.0	1.5	0.3	0.0
All groups	910.4	317.7	56.5	8.2	507.1	8.9	12.0

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

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

[a] Based on past conditions.

Table C.8—Number of live trees on forest land by species group and diameter class, Georgia, 2014

Species group	All classes	Diameter class 1.0–2.9	3.0–4.9	5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
	million trees															
Softwood																
Longleaf and slash pines	1,125.1	248.9	291.7	259.0	161.4	80.5	42.3	21.7	10.9	4.1	2.4	1.6	0.3	0.1	0.0	0.0
Loblolly and shortleaf pines	2,829.3	919.6	608.8	486.8	372.8	210.2	112.5	58.5	29.0	14.9	7.6	7.0	1.3	0.3	0.1	0.0
Other yellow pines	155.4	69.7	30.2	16.3	13.6	9.6	7.2	4.2	2.8	0.9	0.3	0.4	0.1	0.0	0.0	0.0
Eastern white and red pines	65.7	33.7	12.0	6.9	3.9	2.4	1.9	1.0	0.9	0.6	0.7	1.1	0.4	0.1	0.0	0.0
Eastern hemlock	15.8	7.0	3.3	2.5	1.5	0.6	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Cypress	227.8	110.1	55.6	21.8	12.7	9.5	6.9	5.0	3.0	1.5	0.6	0.6	0.3	0.1	0.1	0.1
Other eastern softwoods	63.8	39.6	12.6	6.0	2.6	1.3	0.7	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total softwoods	4,483.1	1,428.6	1,014.2	799.4	568.6	314.2	171.9	91.0	46.9	22.3	11.9	10.7	2.4	0.6	0.3	0.1
Hardwood																
Select white oaks	239.0	102.3	46.4	24.4	17.1	12.2	11.0	8.3	6.3	5.0	2.6	2.6	0.6	0.2	0.0	0.0
Select red oaks	35.5	17.0	5.0	2.8	2.1	2.0	1.7	1.0	1.0	1.1	0.7	0.7	0.2	0.1	0.0	0.1
Other white oaks	379.5	206.7	67.0	30.2	21.1	15.3	12.7	9.7	6.1	3.7	2.4	2.3	1.3	0.5	0.3	0.2
Other red oaks	1,901.6	1,269.0	305.7	121.7	65.9	41.7	30.8	22.5	15.2	10.1	7.5	6.7	3.0	1.1	0.3	0.2
Hickory	359.9	237.8	46.4	27.9	17.0	11.4	7.7	4.8	3.2	1.7	1.0	0.6	0.1	0.1	0.0	0.1
Yellow birch	0.2	0.0	0.0	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
Hard maple	68.1	54.9	7.8	2.8	1.2	0.7	0.3	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Soft maple	1,427.0	1,040.4	222.9	78.2	38.0	19.8	11.8	7.2	3.6	2.2	1.3	1.3	0.2	0.2	0.0	0.0
Beech	40.2	26.4	7.9	2.5	1.1	0.5	0.4	0.4	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0
Sweetgum	2,042.0	1,427.3	357.7	122.6	58.5	31.1	19.1	11.1	7.0	3.0	2.1	1.9	0.4	0.1	0.1	0.0
Tupelo and blackgum	1,026.6	632.5	177.2	89.5	51.2	31.9	18.8	12.0	6.6	3.4	1.8	1.3	0.1	0.1	0.0	0.0
Ash	146.6	92.4	30.4	10.1	4.7	2.6	1.6	1.5	1.3	0.9	0.4	0.6	0.1	0.0	0.0	0.0
Cottonwood and aspen	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basswood	2.5	0.5	0.5	0.2	0.2	0.2	0.3	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	410.5	224.4	69.6	35.5	22.1	16.5	12.2	9.0	6.1	5.7	3.5	3.9	1.4	0.5	0.1	0.0
Black walnut	4.6	2.2	0.4	0.5	0.5	0.4	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	1,008.5	694.3	180.9	66.5	32.8	16.2	8.4	4.5	2.1	1.2	0.8	0.7	0.2	0.1	0.1	0.0
Other eastern hard hardwoods	584.0	462.6	86.2	24.1	6.6	2.4	1.0	0.7	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	1,004.4	701.7	173.1	69.7	31.1	14.9	7.1	3.6	1.7	0.7	0.3	0.3	0.1	0.0	0.0	0.0
Total hardwoods	10,681.0	7,192.3	1,785.1	709.4	371.5	219.9	145.3	96.8	60.7	39.5	24.7	23.4	7.7	3.1	0.9	0.7
All species	15,164.1	8,620.9	2,799.4	1,508.8	940.1	534.0	317.3	187.8	107.6	61.8	36.6	34.1	10.1	3.7	1.1	0.8

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

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

Table C.9—Net[a] volume of live trees on forest land by ownership class and land status, Georgia, 2014

Ownership class	All forest land	Land status					
		Unreserved			Reserved		
		Total	Timberland	Unproductive	Total	Productive	Unproductive
	million cubic feet						
U.S. Forest Service							
National forest	2,697.8	2,125.3	2,125.3	0.0	572.6	572.6	0.0
Total	2,697.8	2,125.3	2,125.3	0.0	572.6	572.6	0.0
Other Federal							
National Park Service	59.8	0.0	0.0	0.0	59.8	59.8	0.0
U.S. Fish and Wildlife Service	335.5	0.0	0.0	0.0	335.5	335.5	0.0
Dept. of Defense/Dept. of Energy	1,308.2	1,308.2	1,308.2	0.0	0.0	0.0	0.0
Other Federal	38.7	38.7	38.7	0.0	0.0	0.0	0.0
Total	1,742.1	1,346.9	1,346.9	0.0	395.2	395.2	0.0
State and local government							
State	1,070.3	1,070.3	1,070.3	0.0	0.0	0.0	0.0
Local	690.5	690.5	690.5	0.0	0.0	0.0	0.0
Total	1,760.8	1,760.8	1,760.8	0.0	0.0	0.0	0.0
Forest industry							
Corporate	2,047.6	2,047.6	2,047.6	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	60.9	60.9	60.9	0.0	0.0	0.0	0.0
Individual	14.0	14.0	14.0	0.0	0.0	0.0	0.0
Total	2,122.6	2,122.6	2,122.6	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	10,993.6	10,993.6	10,993.6	0.0	0.0	0.0	0.0
Conservation/natural resources organization	37.3	37.3	37.3	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	613.1	613.1	613.1	0.0	0.0	0.0	0.0
Individual	23,690.7	23,690.7	23,690.7	0.0	0.0	0.0	0.0
Total	35,334.8	35,334.8	35,334.8	0.0	0.0	0.0	0.0
All classes	43,658.1	42,690.4	42,690.4	0.0	967.8	967.8	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.

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

Table C.10—Net[a] volume of live trees on forest land by forest-type group and stand-size class, Georgia, 2014

Forest-type group	All size classes	Stand-size class: Large diameter	Medium diameter	Small diameter	Non-stocked
	million cubic feet				
Softwood types					
White-red-jack pine	321.8	310.6	11.2	0.0	0.0
Longleaf-slash pine	5,081.5	3,384.0	1,617.3	80.2	0.0
Loblolly-shortleaf pine	14,128.9	10,205.5	3,690.6	232.8	0.0
Other eastern softwoods	6.8	0.0	3.8	3.0	0.0
Total softwoods	19,539.1	13,900.1	5,323.0	316.0	0.0
Hardwood types					
Oak-pine	4,663.8	3,606.1	861.4	196.3	0.0
Oak-hickory	11,607.6	9,831.9	1,376.7	398.9	0.0
Oak-gum-cypress	7,088.6	5,755.6	1,124.7	208.3	0.0
Elm-ash-cottonwood	677.6	548.6	105.2	23.9	0.0
Other hardwoods	12.9	9.7	0.0	3.2	0.0
Tropical hardwoods	15.7	15.7	0.0	0.0	0.0
Exotic hardwoods	27.4	2.0	17.3	8.1	0.0
Total hardwoods	24,093.7	19,769.5	3,485.4	838.8	0.0
Nonstocked	25.3	0.0	0.0	0.0	25.3
All groups	43,658.1	33,669.6	8,808.4	1,154.8	25.3

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

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

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

Table C.11—Net[a] volume of live trees on forest land by species group and ownership group, Georgia, 2014

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Longleaf and slash pines	5,389.3	0.0	451.9	166.5	602.4	4,168.6
Loblolly and shortleaf pines	14,267.4	357.7	487.1	598.8	745.0	12,078.9
Other yellow pines	836.4	149.6	14.5	22.0	2.1	648.2
Eastern white and red pines	463.3	339.2	0.0	1.5	0.0	122.6
Eastern hemlock	61.9	47.3	0.0	0.8	0.0	13.8
Cypress	883.6	0.0	69.5	59.8	87.3	667.1
Other eastern softwoods	76.4	1.0	4.0	4.1	1.6	65.6
Total softwoods	21,978.4	894.6	1,027.0	853.6	1,438.4	17,764.8
Hardwood						
Select white oaks	1,943.7	187.2	36.6	66.6	24.5	1,628.6
Select red oaks	405.7	91.4	5.6	35.2	18.2	255.3
Other white oaks	1,790.3	445.6	52.5	141.6	21.7	1,128.9
Other red oaks	5,062.1	293.1	186.7	205.6	188.6	4,188.0
Hickory	1,006.9	92.8	17.0	50.9	13.6	832.6
Yellow birch	1.3	0.2	0.0	0.0	0.0	1.1
Hard maple	37.4	2.1	3.6	0.9	1.7	29.1
Soft maple	1,461.9	162.2	35.6	28.6	52.9	1,182.6
Beech	92.2	2.9	1.0	4.5	0.0	83.7
Sweetgum	2,719.7	34.9	104.9	96.9	96.1	2,386.9
Tupelo and blackgum	2,160.6	51.8	111.3	68.2	106.0	1,823.3
Ash	363.8	14.4	13.8	25.5	20.7	289.4
Cottonwood and aspen	7.3	0.0	1.2	0.0	4.5	1.7
Basswood	33.5	13.7	0.0	0.0	0.1	19.6
Yellow-poplar	2,624.2	252.0	33.2	59.6	46.7	2,232.7
Black walnut	26.9	0.4	0.2	0.8	1.4	24.1
Other eastern soft hardwoods	1,041.9	39.3	71.0	69.7	45.9	816.1
Other eastern hard hardwoods	159.0	39.6	5.3	7.2	4.1	102.8
Eastern noncommercial hardwoods	741.5	79.5	35.6	45.4	37.4	543.6
Total hardwoods	21,679.8	1,803.2	715.1	907.2	684.2	17,570.0
All species	43,658.1	2,697.8	1,742.1	1,760.8	2,122.6	35,334.8

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

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

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

Table C.12—Net[a] volume of live trees on forest land by species group and diameter class, Georgia, 2014

Species group	All classes	Diameter class 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														
Longleaf and slash pines	5,389.3	655.8	1,050.7	1,029.8	877.8	676.4	469.6	239.2	177.8	158.1	40.0	14.0	0.0	0.0
Loblolly and shortleaf pines	14,267.4	1,298.8	2,465.8	2,633.2	2,299.5	1,802.1	1,269.8	890.8	594.7	727.5	192.3	62.8	30.1	0.0
Other yellow pines	836.4	55.0	103.1	137.3	157.2	131.1	119.9	49.2	25.4	47.6	10.6	0.0	0.0	0.0
Eastern white and red pines	463.3	20.3	24.9	28.4	33.3	27.5	35.7	33.5	50.8	107.6	59.3	27.8	8.6	5.5
Eastern hemlock	61.9	5.9	8.2	6.0	7.5	3.5	2.4	4.3	7.0	3.6	3.3	6.5	3.5	0.0
Cypress	883.6	66.4	88.4	112.8	125.6	130.4	111.5	78.8	42.5	46.6	36.3	11.3	14.6	18.3
Other eastern softwoods	76.4	14.1	14.1	12.7	10.3	10.5	6.1	5.8	2.9	0.0	0.0	0.0	0.0	0.0
Total softwoods	21,978.4	2,116.3	3,755.2	3,960.3	3,511.3	2,781.4	2,015.1	1,301.5	901.2	1,091.1	341.8	122.5	56.8	23.7
Hardwood														
Select white oaks	1,943.7	71.3	117.7	156.1	228.3	250.6	269.1	279.7	182.1	261.4	79.0	43.6	0.0	4.8
Select red oaks	405.7	9.5	14.7	26.3	33.7	28.6	40.8	57.7	47.8	65.9	26.8	22.1	2.8	28.9
Other white oaks	1,790.3	81.5	129.2	170.2	219.3	245.7	210.4	162.8	129.7	164.4	127.1	63.4	42.5	44.2
Other red oaks	5,062.1	346.8	415.8	482.2	554.6	592.0	542.2	483.8	446.6	551.7	345.6	188.4	57.4	55.0
Hickory	1,006.9	70.7	105.0	132.7	153.0	137.6	124.5	96.8	72.5	57.0	20.2	13.2	7.1	16.5
Yellow birch	1.3	0.3	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	37.4	7.3	6.5	8.1	6.1	4.6	1.3	3.5	0.0	0.0	0.0	0.0	0.0	0.0
Soft maple	1,461.9	226.1	230.2	209.2	193.4	175.7	116.4	92.0	76.1	96.6	24.2	22.0	0.0	0.0
Beech	92.2	7.9	6.9	6.3	8.6	10.7	6.0	12.5	10.6	15.5	0.0	7.1	0.0	0.0
Sweetgum	2,719.7	302.7	376.1	392.9	400.6	346.9	298.9	173.2	157.3	192.9	48.7	17.4	10.3	1.7
Tupelo and blackgum	2,160.6	231.4	313.8	363.2	340.7	310.3	232.7	155.0	99.9	95.2	8.1	10.3	0.0	0.0
Ash	363.8	29.6	31.3	32.8	30.3	45.6	50.5	47.0	22.1	54.9	14.2	5.7	0.0	0.0
Cottonwood and aspen	7.3	0.1	0.3	0.0	1.5	0.9	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0
Basswood	33.5	0.9	1.6	2.9	6.1	2.0	4.3	4.2	5.8	4.2	1.4	0.0	0.0	0.0
Yellow-poplar	2,624.2	112.2	160.7	219.2	260.4	279.6	267.2	337.7	260.1	388.4	197.6	109.4	16.3	15.4
Black walnut	26.9	1.4	3.3	4.2	4.4	3.6	4.8	2.8	0.0	2.3	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	1,041.9	175.1	191.1	165.2	141.7	111.7	66.7	52.4	43.0	44.2	19.6	17.7	13.5	0.0
Other eastern hard hardwoods	159.0	54.4	33.8	24.8	16.7	16.6	3.2	4.0	0.0	5.6	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	741.5	173.2	168.5	142.1	99.7	64.0	42.4	19.8	12.3	16.5	3.1	0.0	0.0	0.0
Total hardwoods	21,679.8	1,902.4	2,307.2	2,538.6	2,699.1	2,626.8	2,281.3	1,985.1	1,565.8	2,016.7	919.9	520.4	149.8	166.5
All species	43,658.1	4,018.7	6,062.3	6,498.9	6,210.4	5,408.3	4,296.5	3,286.7	2,467.0	3,107.8	1,261.8	643.0	206.6	190.3

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

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

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

Table C.13—Net[a] volume of live trees on forest land by forest-type group and stand origin, Georgia, 2014

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	million cubic feet		
Softwood types			
White-red-jack pine	321.8	305.7	16.1
Longleaf-slash pine	5,081.5	1,954.5	3,127.0
Loblolly-shortleaf pine	14,128.9	7,422.9	6,706.1
Other eastern softwoods	6.8	6.8	0.0
Total softwoods	19,539.1	9,689.9	9,849.1
Hardwood types			
Oak-pine	4,663.8	4,409.4	254.4
Oak-hickory	11,607.6	11,545.3	62.4
Oak-gum-cypress	7,088.6	7,086.3	2.4
Elm-ash-cottonwood	677.6	637.7	40.0
Other hardwoods	12.9	12.9	0.0
Tropical hardwoods	15.7	15.7	0.0
Exotic hardwoods	27.4	27.2	0.2
Total hardwoods	24,093.7	23,734.3	359.4
Nonstocked	25.3	23.2	2.1
All groups	43,658.1	33,447.5	10,210.6

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

Table C.14—Aboveground dry weight[a] of live trees on forest land by ownership class and land status, Georgia, 2014

Ownership class	All forest land	Land status					
		Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
		thousand tons					
U.S. Forest Service							
National forest	69,224.8	54,634.1	54,634.1	0.0	14,590.7	14,590.7	0.0
Total	69,224.8	54,634.1	54,634.1	0.0	14,590.7	14,590.7	0.0
Other Federal							
National Park Service	1,724.1	0.0	0.0	0.0	1,724.1	1,724.1	0.0
U.S. Fish and Wildlife Service	9,336.1	0.0	0.0	0.0	9,336.1	9,336.1	0.0
Dept. of Defense/Dept. of Energy	31,573.9	31,573.9	31,573.9	0.0	0.0	0.0	0.0
Other Federal	1,007.5	1,007.5	1,007.5	0.0	0.0	0.0	0.0
Total	43,641.6	32,581.4	32,581.4	0.0	11,060.2	11,060.2	0.0
State and local government							
State	27,993.6	27,993.6	27,993.6	0.0	0.0	0.0	0.0
Local	18,319.2	18,319.2	18,319.2	0.0	0.0	0.0	0.0
Total	46,312.8	46,312.8	46,312.8	0.0	0.0	0.0	0.0
Forest industry							
Corporate	56,275.1	56,275.1	56,275.1	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	1,557.3	1,557.3	1,557.3	0.0	0.0	0.0	0.0
Individual	340.8	340.8	340.8	0.0	0.0	0.0	0.0
Total	58,173.2	58,173.2	58,173.2	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	290,770.1	290,770.1	290,770.1	0.0	0.0	0.0	0.0
Conservation/natural resources organization	918.5	918.5	918.5	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	15,880.2	15,880.2	15,880.2	0.0	0.0	0.0	0.0
Individual	627,774.0	627,774.0	627,774.0	0.0	0.0	0.0	0.0
Total	935,342.8	935,342.8	935,342.8	0.0	0.0	0.0	0.0
All classes	1,152,695.2	1,127,044.4	1,127,044.4	0.0	25,650.9	25,650.9	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.

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

Table C.15—Total carbon[a] of live trees on forest land by ownership class and land status, Georgia, 2014

Ownership class	All forest land	Land status					
		Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
		thousand tons					
U.S. Forest Service							
National forest	34,612.4	27,317.1	27,317.1	0.0	7,295.3	7,295.3	0.0
Total	34,612.4	27,317.1	27,317.1	0.0	7,295.3	7,295.3	0.0
Other Federal							
National Park Service	862.0	0.0	0.0	0.0	862.0	862.0	0.0
U.S. Fish and Wildlife Service	4,668.1	0.0	0.0	0.0	4,668.1	4,668.1	0.0
Dept. of Defense/Dept. of Energy	15,787.0	15,787.0	15,787.0	0.0	0.0	0.0	0.0
Other Federal	503.7	503.7	503.7	0.0	0.0	0.0	0.0
Total	21,820.8	16,290.7	16,290.7	0.0	5,530.1	5,530.1	0.0
State and local government							
State	13,996.8	13,996.8	13,996.8	0.0	0.0	0.0	0.0
Local	9,159.6	9,159.6	9,159.6	0.0	0.0	0.0	0.0
Total	23,156.4	23,156.4	23,156.4	0.0	0.0	0.0	0.0
Forest industry							
Corporate	28,137.5	28,137.5	28,137.5	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	778.7	778.7	778.7	0.0	0.0	0.0	0.0
Individual	170.4	170.4	170.4	0.0	0.0	0.0	0.0
Total	29,086.6	29,086.6	29,086.6	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	145,385.1	145,385.1	145,385.1	0.0	0.0	0.0	0.0
Conservation/natural resources organization	459.2	459.2	459.2	0.0	0.0	0.0	0.0
Unincorporated local partnership/ association/club	7,940.1	7,940.1	7,940.1	0.0	0.0	0.0	0.0
Individual	313,887.0	313,887.0	313,887.0	0.0	0.0	0.0	0.0
Total	467,671.4	467,671.4	467,671.4	0.0	0.0	0.0	0.0
All classes	576,347.6	563,522.2	563,522.2	0.0	12,825.4	12,825.4	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.

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

Table C.16—Average annual net growth of live trees by ownership class and land status, Georgia, 2010–14

Ownership class[a]	Land status	
	Timberland	Forest land
	million cubic feet	
U.S. Forest Service		
National forest	47.5	57.2
Total	47.5	57.2
Other Federal		
National Park Service	0.0	0.7
U.S. Fish and Wildlife Service	0.3	-37.0
Dept. of Defense/Dept. of Energy	27.9	27.9
Other Federal	1.3	1.3
Total	29.4	-7.2
State and local government		
State	29.9	29.9
Local	32.2	32.2
Total	62.1	62.1
Forest industry		
Corporate	152.0	152.0
Unincorporated partnership/ association/club	1.5	1.5
Individual	0.3	0.3
Total	153.8	153.8
Nonindustrial private		
Corporate	596.9	596.7
Conservation/natural resources organization	3.2	3.2
Unincorporated partnership/ association/club	28.8	28.8
Individual	1,075.0	1,075.0
Total	1,703.9	1,703.8
All classes	1,996.7	1,969.6

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

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

[a] Based on current conditions.

Table C.17—Average annual net growth of live trees on forest land by forest-type group and stand-size class, Georgia, 2010–14

Forest-type group[a]	All size classes	Stand-size class: Large diameter	Medium diameter	Small diameter	Non-stocked
	million cubic feet				
Softwood types					
White-red-jack pine	7.1	5.4	1.7	0.0	0.0
Longleaf-slash pine	360.2	104.2	172.9	83.1	0.0
Loblolly-shortleaf pine	985.8	336.5	519.9	129.4	0.0
Other eastern softwoods	0.3	0.0	0.3	0.0	0.0
Total softwoods	1,353.4	446.1	694.9	212.5	0.0
Hardwood types					
Oak-pine	162.6	67.0	53.2	42.4	0.0
Oak-hickory	296.1	174.1	69.8	52.2	0.0
Oak-gum-cypress	131.4	71.2	39.2	21.0	0.0
Elm-ash-cottonwood	22.3	7.9	6.1	8.3	0.0
Other hardwoods	0.6	0.5	0.0	0.1	0.0
Tropical hardwoods	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	1.1	0.0	0.4	0.7	0.0
Total hardwoods	614.1	320.6	168.7	124.8	0.0
Nonstocked	2.1	0.0	0.0	0.0	2.1
All groups	1,969.6	766.7	863.6	337.3	2.1

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.

[a] Based on past conditions.

Table C.18—Average annual net growth of live trees on forest land by species group and ownership group, Georgia, 2010–14

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Longleaf and slash pines	371.4	0.0	-7.3	10.7	56.0	312.1
Loblolly and shortleaf pines	1,048.4	12.0	9.5	28.0	76.8	922.2
Other yellow pines	20.3	2.3	0.4	0.8	0.8	15.9
Eastern white and red pines	12.2	10.4	0.0	0.1	0.0	1.7
Eastern hemlock	1.0	0.4	0.0	0.0	0.0	0.7
Cypress	11.9	0.0	-2.3	1.5	1.4	11.3
Other eastern softwoods	3.5	0.0	0.2	0.2	0.2	2.9
Total softwoods	1,468.7	25.1	0.5	41.2	135.1	1,266.8
Hardwood						
Select white oaks	50.1	3.2	1.0	2.2	0.8	42.9
Select red oaks	10.3	2.0	0.9	0.3	0.8	6.2
Other white oaks	37.5	7.0	1.3	2.8	1.3	25.2
Other red oaks	135.8	5.8	4.8	6.0	8.0	111.2
Hickory	19.4	0.3	0.3	1.3	0.5	16.9
Yellow birch	0.1	0.0	0.0	0.0	0.0	0.1
Hard maple	1.2	0.0	0.1	0.0	0.0	0.9
Soft maple	32.1	4.1	-3.7	1.4	1.9	28.3
Beech	1.8	0.0	0.1	0.0	0.0	1.7
Sweetgum	84.2	0.8	1.7	2.5	3.8	75.4
Tupelo and blackgum	24.2	0.7	-2.0	-0.2	0.9	24.8
Ash	7.7	0.2	0.3	0.2	0.6	6.3
Cottonwood and aspen	0.2	0.0	0.1	0.0	-0.1	0.1
Basswood	0.1	0.0	0.0	0.0	0.0	0.1
Yellow-poplar	68.8	4.9	1.3	1.4	1.8	59.4
Black walnut	0.9	0.0	0.0	0.0	0.1	0.8
Other eastern soft hardwoods	17.2	1.2	-6.6	1.8	-2.0	22.8
Other eastern hard hardwoods	2.3	0.5	0.1	0.2	0.2	1.4
Eastern noncommercial hardwoods	7.2	1.3	-7.5	1.0	0.0	12.4
Total hardwoods	501.0	32.1	-7.7	20.9	18.6	437.0
All species	1,969.6	57.2	-7.2	62.1	153.8	1,703.8

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

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

[a] Based on current conditions.

Table C.19—Average annual mortality of live trees by ownership class and land status, Georgia, 2010–14

Ownership class[a]	Land status	
	Timberland	Forest land
	million cubic feet	
U.S. Forest Service		
National forest	13.4	17.6
Total	13.4	17.6
Other Federal		
National Park Service	0.0	1.4
U.S. Fish and Wildlife Service	0.0	51.4
Dept. of Defense/ Dept. of Energy	10.8	10.8
Other Federal	0.1	0.1
Total	10.9	63.7
State and local government		
State	10.9	10.9
Local	6.0	6.0
Total	16.9	16.9
Forest industry		
Corporate	22.1	22.1
Unincorporated partnership/ association/club	0.8	0.8
Individual	0.7	0.7
Total	23.6	23.6
Nonindustrial private		
Corporate	98.3	98.3
Conservation/natural resources organization	0.4	0.4
Unincorporated partnership/ association/club	3.7	3.7
Individual	231.3	231.3
Total	333.7	333.7
All classes	398.5	455.5

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

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

[a] Based on current conditions.

Table C.20—Average annual mortality of live trees on forest land by forest-type group and stand-size class, Georgia, 2010–14

Forest-type group[a]	All size classes	Stand-size class: Large diameter	Stand-size class: Medium diameter	Stand-size class: Small diameter	Non-stocked
	million cubic feet				
Softwood types					
White-red-jack pine	0.6	0.5	0.1	0.0	0.0
Longleaf-slash pine	53.0	34.1	17.6	1.4	0.0
Loblolly-shortleaf pine	108.7	79.3	27.4	2.0	0.0
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0
Total softwoods	162.3	113.8	45.1	3.4	0.0
Hardwood types					
Oak-pine	62.7	53.8	6.9	2.0	0.0
Oak-hickory	108.5	90.5	13.3	4.7	0.0
Oak-gum-cypress	107.9	79.1	24.1	4.8	0.0
Elm-ash-cottonwood	13.1	9.3	3.1	0.7	0.0
Other hardwoods	0.1	0.0	0.0	0.0	0.0
Tropical hardwoods	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	0.4	0.0	0.3	0.0	0.0
Total hardwoods	292.6	232.7	47.7	12.2	0.0
Nonstocked	0.5	0.0	0.0	0.0	0.5
All groups	455.5	346.5	92.9	15.6	0.5

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

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

[a] Based on past conditions.

Table C.21—Average annual mortality of live trees on forest land by species group and ownership group, Georgia, 2010–14

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Longleaf and slash pines	56.0	0.0	20.1	2.4	7.0	26.5
Loblolly and shortleaf pines	116.0	3.6	5.1	6.1	6.2	94.9
Other yellow pines	11.3	0.9	0.0	0.3	0.0	10.1
Eastern white and red pines	5.3	1.2	0.0	0.0	0.0	4.1
Eastern hemlock	0.7	0.7	0.0	0.0	0.0	0.0
Cypress	9.6	0.0	5.7	0.3	0.6	3.0
Other eastern softwoods	0.5	0.0	0.0	0.0	0.0	0.5
Total softwoods	199.5	6.4	31.0	9.2	13.8	139.2
Hardwood						
Select white oaks	8.1	1.2	0.2	0.0	0.3	6.5
Select red oaks	2.8	0.2	0.0	0.6	0.0	2.0
Other white oaks	9.9	2.9	0.0	0.7	0.1	6.2
Other red oaks	74.2	2.7	1.6	2.1	1.2	66.6
Hickory	7.8	0.8	0.1	0.5	0.1	6.3
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	25.7	0.3	5.6	0.3	1.0	18.7
Beech	1.6	0.0	0.0	0.1	0.0	1.5
Sweetgum	20.4	0.2	0.6	0.4	0.1	19.1
Tupelo and blackgum	26.7	0.4	6.1	0.8	1.4	18.0
Ash	3.0	0.1	0.1	0.5	0.1	2.3
Cottonwood and aspen	0.0	0.0	0.0	0.0	0.0	0.0
Basswood	0.3	0.0	0.0	0.0	0.0	0.2
Yellow-poplar	18.1	1.2	0.0	0.0	0.1	16.7
Black walnut	0.3	0.0	0.1	0.0	0.0	0.2
Other eastern soft hardwoods	36.7	0.2	10.1	1.2	4.7	20.5
Other eastern hard hardwoods	3.5	0.7	0.1	0.1	0.1	2.5
Eastern noncommercial hardwoods	16.8	0.3	8.2	0.4	0.7	7.3
Total hardwoods	256.0	11.2	32.7	7.7	9.8	194.6
All species	455.5	17.6	63.7	16.9	23.6	333.7

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

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

Table C.22—Average annual net removals of live trees by ownership class and land status, Georgia, 2010–14

Ownership class	Land status	
	Timberland	Forest land
	million cubic feet	
U.S. Forest Service		
National forest	3.5	3.1
Total	3.5	3.1
Other Federal		
U.S. Fish and Wildlife Service	1.9	3.1
Dept. of Defense/Dept. of Energy	6.7	6.7
Total	8.6	9.8
State and local government		
State	5.5	5.5
Local	16.4	16.4
Total	21.9	21.9
Forest industry		
Corporate	146.4	146.4
Total	146.4	146.4
Nonindustrial private		
Corporate	461.7	461.7
Conservation/natural resources organization	3.2	3.2
Unincorporated partnership/ association/club	15.6	15.6
Individual	700.6	700.6
Total	1,181.1	1,181.1
All classes	1,361.6	1,362.4

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 C.23—Average annual removals of live trees on forest land by forest-type group and stand-size class, Georgia, 2010–14

Forest-type group[a]	All size classes	Stand-size class: Large diameter	Medium diameter	Small diameter	Non-stocked
	million cubic feet				
Softwood types					
White-red-jack pine	0.0	0.0	0.0	0.0	0.0
Longleaf-slash pine	330.2	163.7	164.7	1.9	0.0
Loblolly-shortleaf pine	720.7	350.7	358.6	11.4	0.0
Other eastern softwoods	1.0	0.0	1.0	0.0	0.0
Total softwoods	1,051.9	514.4	524.2	13.2	0.0
Hardwood types					
Oak-pine	85.3	59.2	20.1	6.1	0.0
Oak-hickory	113.7	79.4	24.2	10.2	0.0
Oak-gum-cypress	106.9	81.5	22.7	2.6	0.0
Elm-ash-cottonwood	3.6	3.4	0.2	0.0	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	0.5	0.1	0.0	0.4	0.0
Total hardwoods	310.0	223.5	67.1	19.4	0.0
Nonstocked	0.5	0.0	0.0	0.0	0.5
All groups	1,362.4	737.9	591.3	32.6	0.5

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

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

[a] Based on past conditions.

Table C.24—Average annual removals of live trees on forest land by species group and ownership group, Georgia, 2010–14

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Longleaf and slash pines	327.9	0.0	4.6	2.2	57.6	263.5
Loblolly and shortleaf pines	730.3	2.9	4.1	11.0	65.9	646.4
Other yellow pines	16.9	0.1	0.0	0.5	2.9	13.3
Eastern white and red pines	0.9	0.0	0.0	0.0	0.0	0.9
Eastern hemlock	0.0	0.0	0.0	0.0	0.0	0.0
Cypress	10.7	0.0	0.0	0.0	3.6	7.1
Other eastern softwoods	2.0	0.0	0.0	0.0	0.1	1.9
Total softwoods	1,088.7	3.0	8.7	13.8	130.1	933.1
Hardwood						
Select white oaks	16.9	0.0	0.0	1.3	0.4	15.1
Select red oaks	3.6	0.0	0.0	0.0	0.1	3.6
Other white oaks	13.6	0.0	0.1	1.3	0.6	11.6
Other red oaks	82.5	0.0	0.0	1.0	5.3	76.1
Hickory	11.4	0.0	0.0	0.2	1.3	9.9
Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	0.1	0.0	0.0	0.0	0.0	0.1
Soft maple	18.0	0.0	0.1	0.1	1.6	16.2
Beech	1.0	0.0	0.0	0.0	0.0	1.0
Sweetgum	40.9	0.0	0.0	1.8	1.1	38.0
Tupelo and blackgum	29.9	0.0	0.2	0.2	0.9	28.6
Ash	4.8	0.0	0.0	0.0	2.1	2.7
Cottonwood and aspen	0.0	0.0	0.0	0.0	0.0	0.0
Basswood	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	26.3	0.0	0.0	1.7	0.2	24.4
Black walnut	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	12.7	0.0	0.6	0.2	1.9	10.1
Other eastern hard hardwoods	1.7	0.0	0.0	0.0	0.1	1.5
Eastern noncommercial hardwoods	10.4	0.0	0.1	0.4	0.8	9.1
Total hardwoods	273.7	0.1	1.1	8.2	16.3	247.9
All species	1,362.4	3.1	9.8	21.9	146.4	1,181.1

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

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

Table C.25—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Georgia, 2014

Common name	Scientific name[a]	Trees measured
		number
Softwoods		
Atlantic white-cedar	*Chamaecyparis thyoides*	5
Eastern redcedar	*Juniperus virginiana*	2,148
Southern redcedar	*Juniperus virginiana* var. *silicicola*	6
Sand pine	*Pinus clausa*	327
Shortleaf pine	*P. echinata*	8,019
Slash pine	*P. elliottii*	80,716
Spruce pine	*P. glabra*	367
Longleaf pine	*P. palustris*	8,062
Table Mountain pine	*P. pungens*	22
Pitch pine	*P. rigida*	250
Pond pine	*P. serotina*	931
Eastern white pine	*P. strobus*	3,695
Loblolly pine	*P. taeda*	201,351
Virginia pine	*P. virginiana*	7,398
Pondcypress	*Taxodium ascendens*	8,120
Baldcypress	*T. distichum*	1,534
Eastern hemlock	*Tsuga canadensis*	1,167
Carolina hemlock	*T. caroliniana*	10
Hardwoods		
Florida maple	*Acer barbatum*	1,353
Chalk maple	*A. leucoderme*	55
Boxelder	*A. negundo*	747
Black maple	*A. nigrum*	13
Striped maple	*A. pensylvanicum*	1
Red maple	*A. rubrum*	37,682
Silver maple	*A. saccharinum*	76
Sugar maple	*A. saccharum*	43
Mountain maple	*A. spicatum*	2
Yellow buckeye	*Aesculus flava*	48
Ailanthus	*Ailanthus altissima*	39
Mimosa, silktree	*Albizia julibrissin*	139
Serviceberry spp.	*Amelanchier* spp.	262
Pawpaw	*Asimina triloba*	14
Yellow birch	*Betula alleghaniensis*	70
Sweet birch	*B. lenta*	708
River birch	*B. nigra*	895

continued

Table C.25—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Georgia, 2014 (continued)

Common name	Scientific name[a]	Trees measured
		number
Hardwoods (continued)		
American hornbeam, Musclewood	*Carpinus caroliniana*	2,339
Mockernut hickory	*Carya alba*	4,921
Water hickory	*C. aquatica*	355
Bitternut hickory	*C. cordiformis*	195
Pignut hickory	*C. glabra*	7,442
Pecan	*C. illinoinensis*	404
Shellbark hickory	*C. laciniosa*	52
Nutmeg hickory	*C. myristiciformis*	5
Red hickory	*C. ovalis*	433
Shagbark hickory	*C. ovata*	365
Sand hickory	*C. pallida*	255
American chestnut	*Castanea dentata*	22
Southern catalpa	*Catalpa bignonioides*	33
Sugarberry	*Celtis laevigata*	1,010
Hackberry	*C. occidentalis*	251
Eastern redbud	*Cercis canadensis*	712
Camphortree	*Cinnamomum camphora*	11
Flowering dogwood	*Cornus florida*	6,033
Hawthorn spp.	*Crataegus* spp.	442
Cockspur hawthorn	*C. crus-galli*	5
Downy hawthorn	*C. mollis*	101
Common persimmon	*Diospyros virginiana*	1,949
American beech	*Fagus grandifolia*	1,194
Other palms	Family *Arecaceae*	5
White ash	*Fraxinus americana*	192
Carolina ash	*F. caroliniana*	37
Green ash	*F. pennsylvanica*	4,677
Waterlocust	*Gleditsia aquatica*	23
Honeylocust	*G. triacanthos*	44
Loblolly-bay	*Gordonia lasianthus*	3,352
Carolina silverbell	*Halesia carolina*	277
Two-wing silverbell	*H. diptera*	1
Silverbell spp.	*Halesia* spp.	57
American holly	*Ilex opaca*	2,212
Butternut	*Juglans cinerea*	19
Black walnut	*J. nigra*	317
Sweetgum	*Liquidambar styraciflua*	55,730

continued

Table C.25—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Georgia, 2014 (continued)

Common name	Scientific name[a]	Trees measured
		number
Hardwoods (continued)		
Yellow-poplar	*Liriodendron tulipifera*	20,382
Osage-orange	*Maclura pomifera*	5
Cucumbertree	*Magnolia acuminata*	88
Mountain or Fraser magnolia	*Magnolia fraseri*	106
Southern magnolia	*M. grandiflora*	843
Bigleaf magnolia	*M. macrophylla*	26
Sweetbay	*M. virginiana*	6,737
Apple spp.	*Malus* spp.	30
Southern crab apple	*M. angustifolia*	263
Sweet crab apple	*M. coronaria*	3
Chinaberry	*Melia azedarach*	1,569
White mulberry	*Morus alba*	52
Red mulberry	*M. rubra*	553
Water tupelo	*Nyssa aquatica*	2,319
Swamp tupelo	*N. biflora*	31,309
Ogeechee tupelo	*N. ogeche*	1,329
Blackgum	*N. sylvatica*	7,099
Eastern hophornbeam	*Ostrya virginiana*	1,464
Sourwood	*Oxydendrum arboreum*	10,169
Paulownia, Empress-tree	*Paulownia tomentosa*	68
Redbay	*Persea borbonia*	1,967
Water-elm, Planertree	*Planera aquatica*	27
American sycamore	*Platanus occidentalis*	767
Eastern cottonwood	*Populus deltoides*	30
American plum	*Prunus americana*	184
Pin cherry	*P. pensylvanica*	8
Peach	*P. persica*	75
Black cherry	*P. serotina*	7,890
Chokecherry	*P. virginiana*	12
White oak	*Quercus alba*	14,237
Swamp white oak	*Q. bicolor*	12
Scarlet oak	*Q. coccinea*	4,749
Southern red oak	*Q. falcata*	8,364
Bluejack oak	*Q. incana*	283
Turkey oak	*Q. laevis*	1,186
Laurel oak	*Q. laurifolia*	13,941

continued

Table C.25—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Georgia, 2014 (continued)

Common name	Scientific name[a]	Trees measured
		number
Hardwoods (continued)		
Overcup oak	*Quercus lyrata*	639
Dwarf post oak	*Q. margarettiae*	1,317
Blackjack oak	*Q. marilandica*	617
Swamp chestnut oak	*Q. michauxii*	526
Dwarf live oak	*Q. minima*	11
Chinkapin oak	*Q. muehlenbergii*	10
Water oak	*Q. nigra*	32,136
Oglethorpe oak	*Q. oglethorpensis*	2
Cherrybark oak	*Q. pagoda*	399
Willow oak	*Q. phellos*	1,599
Chestnut oak	*Q. prinus*	9,537
Northern red oak	*Q. rubra*	1,918
Shumard oak	*Q. shumardii*	49
Durand oak	*Q. sinuata* var. *sinuata*	26
Post oak	*Q. stellata*	4,692
Texas red oak	*Q. texana*	5
Black oak	*Q. velutina*	2,620
Live oak	*Q. virginiana*	3,070
Black locust	*Robinia pseudoacacia*	436
Cabbage palmetto	*Sabal palmetto*	230
Black willow	*Salix nigra*	2,132
Sassafras	*Sassafras albidum*	816
American basswood	*Tilia americana*	158
Carolina basswood	*T. americana* var. *caroliniana*	18
White basswood	*T. americana* var. *heterophylla*	80
Unknown hardwood	Tree, broadleaf	52
Chinese tallowtree	*Triadica sebifera*	467
Winged elm	*Ulmus alata*	5,833
American elm	*U. americana*	1,274
Slippery elm	*U. rubra*	742

D.b.h. = diameter at breast height; FIA = Forest Inventory and Analysis.
[a] Nomenclature based on USDA NRCS 2016. The PLANTS Database (http://plants.usda.gov). National Plant Data Team, Greensboro, NC 27401-4901.

Brandeis, Thomas J.; McCollum, Joseph M.; Hartsell, Andrew J. [and others]. 2016. Georgia's forests, 2014. Resour. Bull. SRS–209. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 78 p.

Georgia's 24.7 million acres of forest are a diverse mix of hardwood and softwood tree species typical of the South. Hardwood forests account for 53 percent of the forested area versus 45 percent for softwood types, with balance in mixed forests. Georgia's forest resources are considerable and increasing. The rate at which the State gained forest land acreage from converted agricultural land decreased until 2009 and after that time remained stable. The rate at which forest was lost to development decreased steadily since about 2007. There were 22.0 billion cubic feet of wood volume in softwoods and 21.7 billion cubic feet in hardwoods, for a total of 43.7 billion cubic feet, with growth to removals rates of 1.4 for softwoods and 1.8 for hardwoods. Several tree species in Georgia have serious issues at this time. Redbay and sassafras are under attack from laurel wilt disease. Flowering dogwood shows a high rate of mortality, most likely due to a number of factors, and the emerald ash borer threatens native ash trees. Japanese honeysuckle is the most invasive nonnative plant in Georgia forests, followed by Chinese/European privets.

Keywords: Components of change, forest inventory, FIA, forest survey, forest trends, Georgia.

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Native irises (*Iris* spp.) are found in the forests of Georgia. (photo by James Gray, U.S. Forest Service)

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