USDA
United States Department of Agriculture

Virginia's Forests, 2011

Anita K. Rose

Forest Service

Southern Research Station

Resource Bulletin SRS–197

About the Author

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Front cover: top left, tulip-poplars in late autumn, Jarmin Gap, Shenandoah National Park, Albemarle County, VA. (photo © Gary P. Fleming); top right, green tree frog (*Hyla cinerea*), False Cape State Park, Virginia Beach City, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming); bottom right, Potomac Gorge, view of Mather Gorge and Virginia-side cliffs from Maryland, Great Falls Park, Fairfax County, VA. (photo © Gary P. Fleming). Back cover: top left, wood fungus (*Xeromphalina* spp.), Chickahominy River, Charles City, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming); top right, tulip-poplars in late autumn, Jarmin Gap, Shenandoah National Park, Albemarle County, VA. (photo © Gary P. Fleming); bottom, maritime swamp with baldcypress, First Landing State Park, Virginia Beach City, VA. (photo © Gary P. Fleming).

Rich cove with Virginia bluebells (*Mertensia virginica*), Shenandoah River, Calmes Neck, Clarke County, VA. (photo © Gary P. Fleming)

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View to North Carolina from Buzzard Rock (Whitetop Mountain), Mount Rogers National Recreational Area (USFS), Washington County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Wood fungus (*Xeromphalina* spp.), Chickahominy River, Charles City, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Foreword

The U.S. Department of Agriculture Forest Service, 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. To provide more frequent and nationally consistent information on America's forest resources, all Research Stations and Work Units conduct annual surveys, which are mandated by the Agricultural Research Extension and Education Reform Act of 1998 (Farm Bill).

The primary objective in conducting these inventories is to gather the resource information needed to formulate sound forest policies and programs. These data are analyzed to provide a view of forest resources, such as forest area, forest ownership, forest type, stand structure, timber volume, growth, removals, and management activity. In addition, assessments that help address issues of ecosystem health include information about ozone-induced injury, down woody material, and tree crown condition. The information presented is applicable at the State and unit level; it furnishes the background for intensive studies of critical situations but is not designed to reflect resource conditions at very small scales.

More information about Forest Service resource inventories is available in Forest Service 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://srsfia2.fs.fed.us/states/virginia.shtml. For those who require more specialized information, FIA data for all States are retrievable at: http://fia.fs.fed.us/tools-data/default.asp.

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

Forest Inventory and Analysis
Research Work Unit
U.S. Department of Agriculture
Forest Service
Southern Research Station
4700 Old Kingston Pike
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Acknowledgments

The author gratefully acknowledges the staff of the Virginia Department of Forestry (VDOF) who provided reviews and comments on an earlier draft of this report. The author would also like to thank Anne Jenkins and her staff, Janet Griffin and Charlene Walker. Their efforts in checking for errors and in formatting text, tables, and figures are greatly appreciated. Thanks also to Gary Fleming of the Virginia Department of Conservation and Recreation, Natural Heritage Program, and John Pemberton of VDOF for providing photographs for this report. FIA thanks the VDOF for partnering with our program in conducting data collection for the survey that the author reports here. FIA also thanks other public agencies and the many private landowners who provided access to measurement plots.

The following people made field measurements for this survey. FIA appreciates their hard work and their consistent efforts to obtain high-quality data.

Virginia Department of Forestry

Trent Badgley
Thomas Callahan
Adam Dean
Steve Grayson
G.T. Hendrick
Andrew Hensley
Ryan Hewitt
Aaron Humphries
Mason Jeffries
Porter Knight
Joe Lawson
Brian Litchfield
Chad Lykins
Tracy McDonald
Larry Moody
Paul Owen
Ben Parsons
John Pemberton
Winston Percefull
Lynwood Rogers
Justin Shanks
Matthew Sink

SRS FIA

Jason Cooper
Lyndell Davidson
Jason Hewitt
Benjamin Koontz
Marcus Wood

Chicken mushrooms (*Laetiporus sulphureus*), Garden Mountain (USFS), Tazewell County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

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Christmas fern (*Polystichum acrostichoides*) fiddleheads, Scotts Run Nature Preserve, Fairfax County, VA. (photo © Gary P. Fleming)

• In 2011, about 15.9 million acres, or 62 percent, of Virginia's land area was forested. This was a slight increase from the 2007 survey.

• Most (13.0 million acres) of Virginia's forest land was in private forest ownership, which increased by 0.3 percent since 2007. Public ownership accounted for 2.9 million acres (18 percent).

• The predominant forest-type group in Virginia was oak-hickory. It occupied 61 percent or 9.7 million acres of forest land area and contained 65 percent (22.8 billion cubic feet) of the live volume across the State. Loblolly-shortleaf pine was the second most dominant forest-type group in both area (2.9 million acres) and volume (5.8 billion cubic feet). The oak-pine forest-type group ranked third, occupying 1.7 million acres.

• Most of Virginia's forest land was in large- and medium-diameter-sized stands, 10.0 million acres (63 percent) and 3.6 million acres (22 percent), respectively. Small-diameter-sized stands occupied 14 percent and nonstocked stands occupied <1 percent of forest land.

• Volume of live trees ≥5.0 inches diameter at breast height increased from 33.1 to 35.2 billion cubic feet. Softwoods made up 23 percent of the live volume and hardwoods 77 percent.

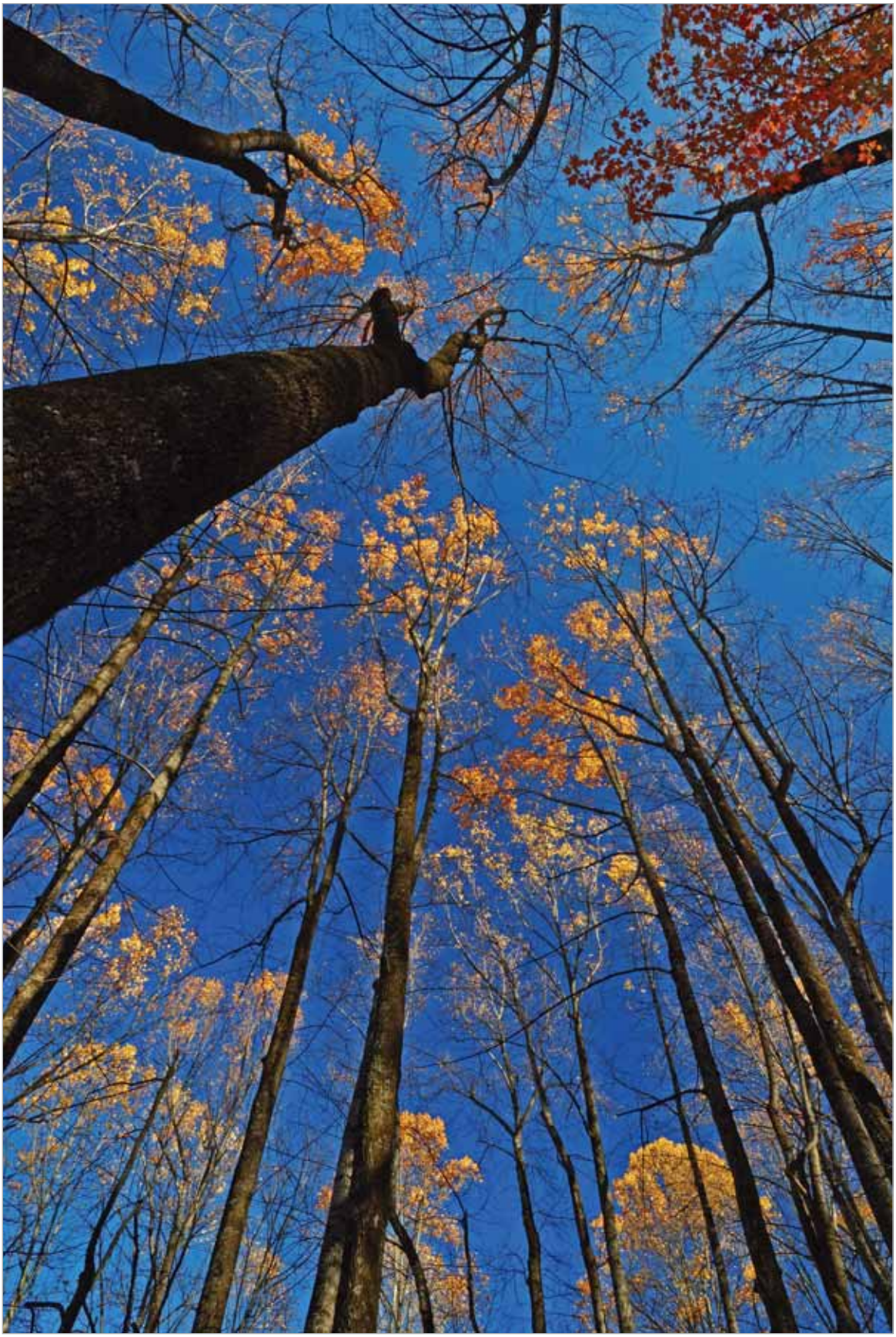
• Yellow-poplar continued to dominate the State's live-tree volume with 5.6 billion cubic feet, an increase of 10.4 percent since 2007. Red maple was dominant in terms of live stems, constituting 1.4 billion stems.

• Net annual growth for all-live trees on forest land for the 2011 survey period was 1,037.0 million cubic feet per year, an increase of 3.9 percent over the previous survey period. Since 2007, Virginia's live-tree removals averaged 545.0 million cubic feet per year. This was a decrease of 30 percent over the previous survey period. Growth exceeded removals in all units.

• Japanese honeysuckle, nonnative roses, and tree-of-heaven were the most often occurring invasive species in Virginia's forests.

• The biomass of coarse woody debris (CWD) on phase 3 plots averaged 3.3 tons per acre for the State. The amount of carbon in CWD and fine woody debris averaged 1.7 and 1.1 tons per acre, respectively.

Cecropia moth (*Hyalophora cecropia*), Naked Mountain State Natural Area Preserve, Nelson County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)



Tulip-poplars in late autumn, Jarmin Gap, Shenandoah National Park, Albemarle County, VA. (photo © Gary P. Fleming)

Introduction

Field measurements for this inventory of Virginia's forests began in August 2007 and were completed in March 2012. Even though measurements were spread over several years, the survey is dated 2011. Comparisons, unless otherwise noted, are based on estimates from the 2007 survey and the 2011 survey. The eight previous surveys and State analytical reports were completed in 1940 (Craig 1949), 1957 (Larson and Bryan 1959), 1966 (Knight and McClure 1967), 1977 (Knight and McClure 1978), 1986 (Bechtold and others 1987), 1992 (Thompson and Johnson 1994), 2001 (Rose 2007), and 2007 (Rose 2009). Numerous other publications were developed by using those surveys.

With a total of 25.3 million acres of land, Virginia includes a variety of physiographic provinces (fig. 1). The Appalachian Plateaus form the western border with Kentucky and West Virginia and are composed of the eastern escarpment of the Cumberland and Allegheny Mountains. To the east of these mountains are the Ridge and Valley Province and the Blue Ridge Mountains. Further east is the Piedmont, which ranges from rolling hills in the west to several nearly level basins in the east. The easternmost part of the State is on the Coastal Plain, which extends inland approximately 125 miles from the coast and about the same distance from the Potomac River to the southern boundary. The Coastal Plain is defined by the eastern Atlantic shore and the rolling and dissected area

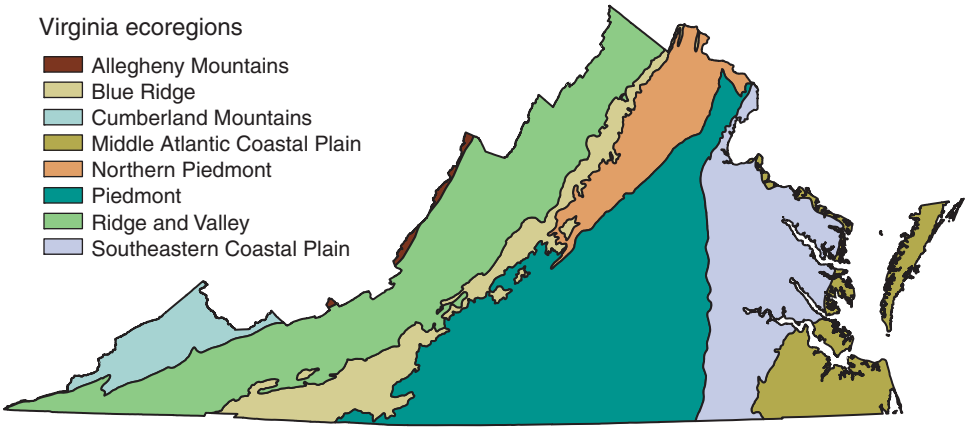


Figure 1—Physiographic provinces in Virginia.

where it meets the Piedmont at the fall line (Fenneman 1938). The State's elevation ranges from sea level to just over 5,700 feet on Mount Rogers in the George Washington and Jefferson National Forests. For the purposes of this report Virginia is divided into five survey units that approximate the physiographic provinces found in the State. These units are the Coastal Plain, Southern Piedmont, Northern Piedmont, Northern Mountains, and Southern Mountains (fig. 2).

Figure 2—Counties and forest survey units in Virginia.

Live oak maritime forest, False Cape State Park, Virginia Beach City, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Forest Area

Trends in Forest Area

In 2011, about 15.9 million acres, or 62 percent, of Virginia's land area were forested (table 1). Of this total, 15.5 million acres were classified as timberland. Just >400,000 acres were classified as reserved timberland, which includes such areas as wilderness, parks, and historic sites—where commercial timber harvesting is prohibited. The remaining 36,000 acres were classified as other forest land, land that, because of adverse site conditions, cannot produce 20 cubic feet of wood per acre per year.

Proportionally, the Southern Piedmont was the most heavily forested (at 67 percent), and the Northern Piedmont the least (at 57 percent). Since 2007, forest area increased by <1 percent across the State (table 1). Agricultural and urban/developed land uses dominated Virginia's nonforest land. The change in forest area since 2007 represented both reversions from nonforest and diversions to nonforest. Just over 250,000 acres of forest land were diverted to nonforest, and just over 350,000 acres of nonforest reverted to forest land. Fifty-nine percent of the gain in forest land came from the reversion of agricultural land. The reversion of agricultural land is a continuing trend that extends back to the first survey of Virginia.

Table 1—Area of forest land by survey year, unit, and ownership group, Virginia

Survey year and unit	All groups	Ownership group			
		Forest Service	Other Federal	State and local government	Private
			acres		
2001					
Coastal Plain	3,820,450	—	188,633	88,102	3,543,715
Southern Piedmont	3,757,400	18,127	85,332	105,721	3,548,220
Northern Piedmont	2,507,126	80,329	162,759	114,475	2,149,563
Northern Mountains	2,725,578	998,769	90,251	90,091	1,546,466
Southern Mountains	3,098,925	476,464	3,187	92,131	2,527,142
All units	15,909,478	1,573,690	530,162	490,521	13,315,105
2007					
Coastal Plain	3,784,086	—	203,188	122,300	3,458,597
Southern Piedmont	3,759,718	22,062	91,170	99,050	3,547,436
Northern Piedmont	2,518,892	71,263	150,345	105,719	2,191,566
Northern Mountains	2,729,182	1,174,685	88,686	93,816	1,371,996
Southern Mountains	3,076,625	551,309	—	100,941	2,424,375
All units	15,868,503	1,819,318	533,389	521,825	12,993,971
2011					
Coastal Plain	3,704,043	—	189,980	123,180	3,390,884
Southern Piedmont	3,791,292	21,901	78,972	119,206	3,571,213
Northern Piedmont	2,517,997	65,628	150,171	133,743	2,168,454
Northern Mountains	2,778,438	1,131,785	88,287	99,073	1,459,294
Southern Mountains	3,115,271	542,001	11,575	120,130	2,441,565
All units	15,907,041	1,761,314	518,985	595,332	13,031,410

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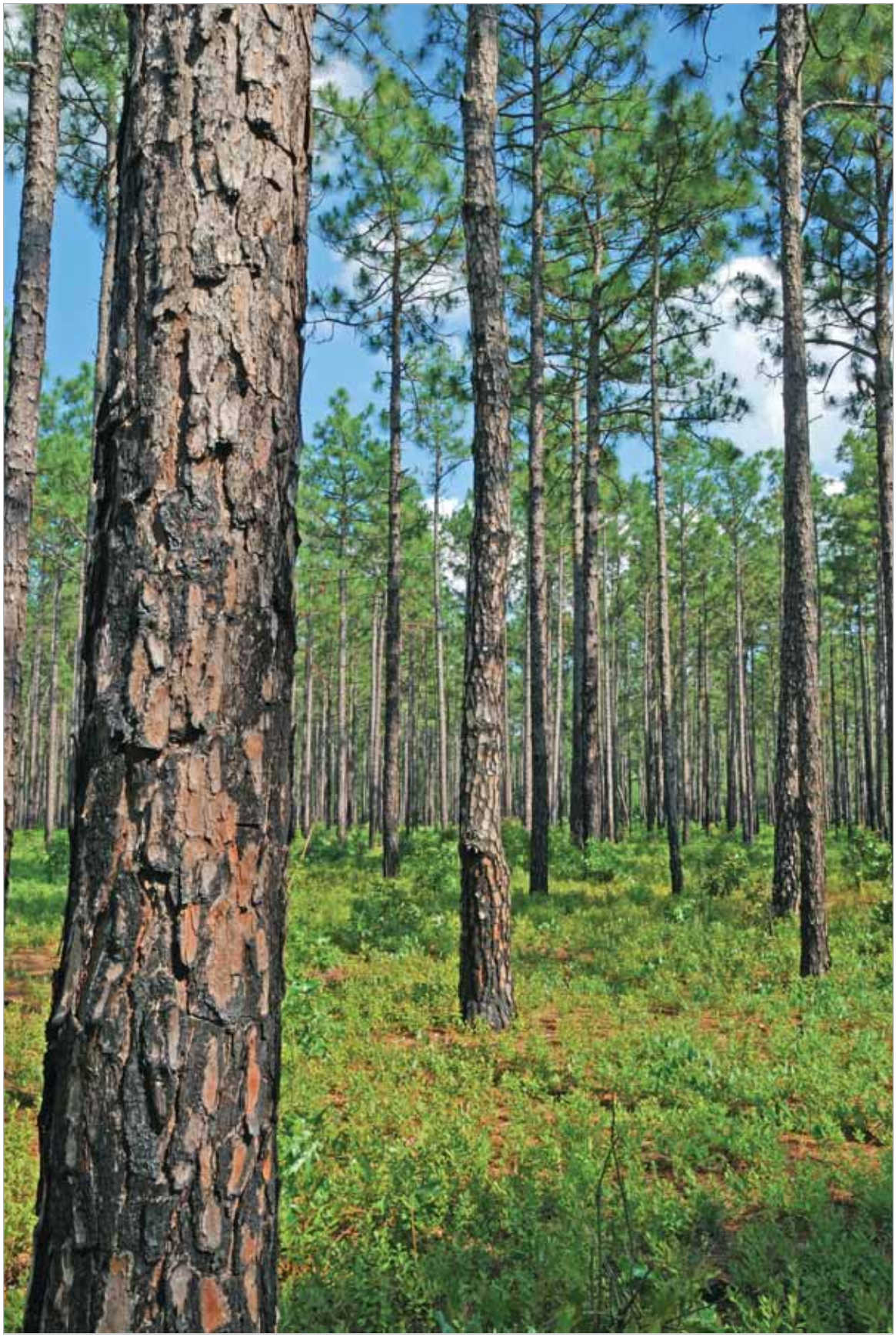


Longleaf pine savanna (managed by prescribed burning), Antioch Pines State Natural Area Preserve, Isle of Wight County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Thirty-seven percent of the diversions of forest land were to agriculture, and 63 percent were losses to urban development and other nonagricultural land uses.

Ownership

Nearly 82 percent of Virginia's forest land was held in private ownership, an increase of 0.3 percent from 2007 to 2011. Public ownership accounted for 2.9 million acres (18 percent). The National Forest System owned 1.8 million acres of public lands across the State, with the George Washington and Jefferson National Forest accounting for most of that total. Other public lands in Virginia include the Shenandoah National Park, the Great Dismal Swamp National Wildlife Refuge, Quantico Marine Corps base, and Fort A.P. Hill and Fort Pickett military reservations, as well as State forests and parks. Forest industry owned 1.2 percent of forest land across the State. This was a decrease of 65 percent since 2007, continuing a trend that began in the mid-1980s. This trend is not unique to Virginia, however, and has been noted throughout the South.

Forest-Type Group

As would be expected in a State with an area of 25.3 million acres and elevations ranging from sea level to just under 6,000 feet, Virginia's forests contained a wide variety of tree species. These species occur in associations known as forest types. Some forest types occurred across the entire State; others were restricted to limited areas especially suitable for particular species. Similar forest types are aggregated into forest-type groups.

The predominant forest-type group in Virginia was oak-hickory. It occupied 61 percent or 9.7 million acres of the forest land area and contained 65 percent (22.8 billion cubic feet) of the live volume across the State (figs. 3 and 4). This was both a decrease in area and an increase in volume from 2007, when this forest-type group occupied 9.9 million acres and contained 21.5 billion cubic feet. Loblolly-shortleaf pine was the second most dominant forest-type group in both area and volume.

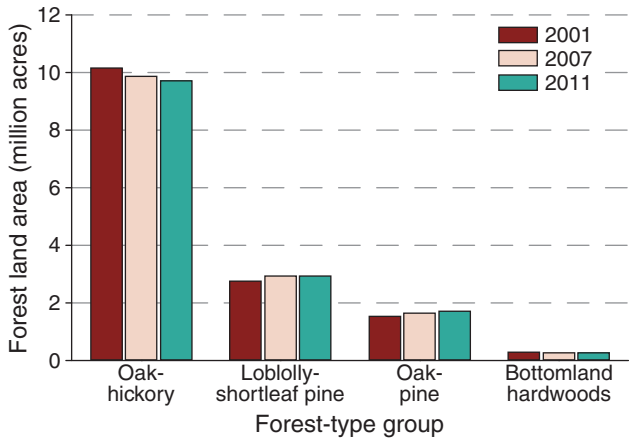


Figure 3—Area of forest land by forest-type group and survey year, Virginia.

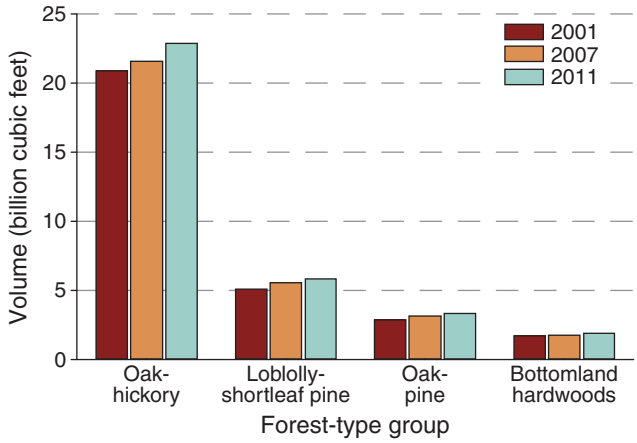


Figure 4—Volume of live trees on forest land by forest-type group and survey year, Virginia.

In 2011 it occupied 2.9 million acres (18 percent) of the State's forest land, and contained 5.8 billion cubic feet (17 percent) of the live volume. This was a 0.3-percent increase in area and a 5-percent increase in volume from 2007. The oak-pine forest-type group, which ranked third, increased from 1.6 to 1.7 million acres, and from 3.1 to 3.3 billion cubic feet of live volume.

Stand Origin

Eighty-four percent of stands were considered naturally regenerated and 16 percent artificially regenerated. Area of artificially regenerated stands increased by 169,000 acres (from 2.4 million to 2.6 million acres). The majority (96 percent) of artificially regenerated land was in the Piedmont and Coastal Plain. Between 2007 and 2011, area of artificially regenerated stands increased by 9 percent in the Coastal Plain and by 8 percent in both Piedmont units (fig. 5). Virtually all of the increase was in the loblolly-shortleaf pine forest-type group. In addition, the majority (68 percent) of the loblolly-shortleaf pine forest-type group was artificially regenerated, in comparison to other forest-type groups, where the majority was naturally regenerated.

Stand Size and Age

In 2011, 63 percent (10.0 million acres) of Virginia's forest land was in the large-diameter stand-size class, and 22 percent (3.6 million acres) was in the medium-diameter stand-size class. The small-diameter stands constituted an additional 14 percent of forest land area. Virginia was comparable to other Southern States in percentage of forest land area in each stand-size class (fig. 6). By unit, the Coastal Plain and Southern Piedmont had the smallest percentage of forest land in large-diameter stands (56 and 52 percent, respectively) and the largest percentage of forest land in small-diameter stands (21 percent each). Percentage of forest land area in small-diameter stands ranged from 7 to 9 percent for the other three units (fig. 7).

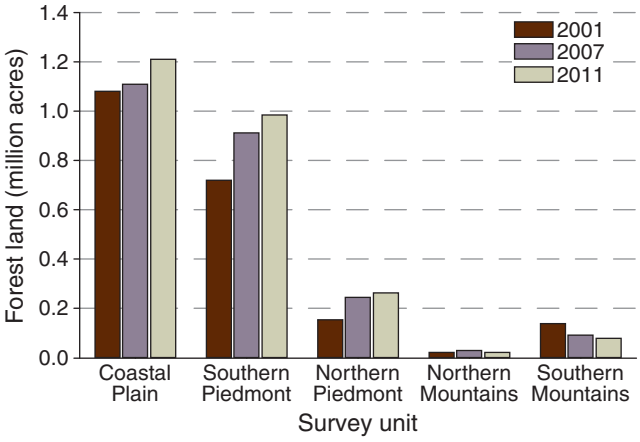


Figure 5—Area of artificially regenerated forest land by survey unit and year, Virginia.

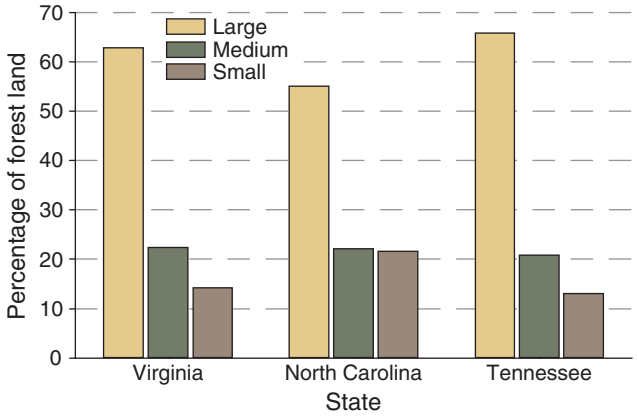


Figure 6—Percentage of forest land area by State and stand-size class, 2011.

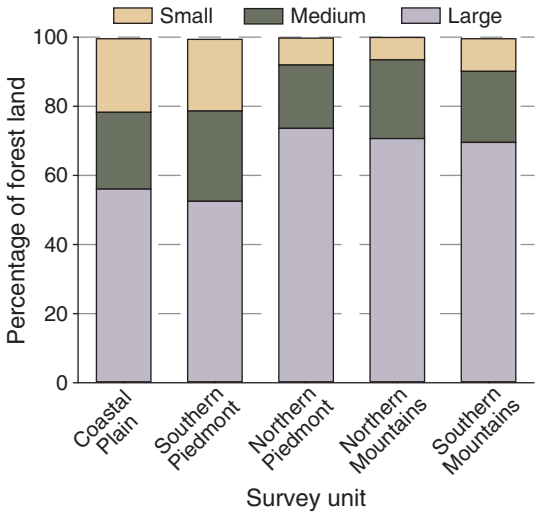


Figure 7—Percentage of forest land area in each stand-size class by survey unit, Virginia, 2011.

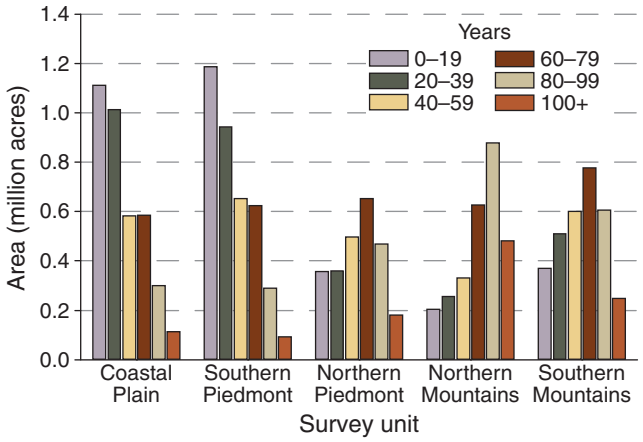


Figure 8—Area of forest land by survey unit and stand-age class, Virginia, 2011.

Stands 0 to 19 years old and those 60 to 79 years old each accounted for about 20 percent of forest land. Sixty percent, or 9.6 million acres, of Virginia's forest land was >39 years old, while 23 percent was >79 years old. Forest land in the Coastal Plain and Southern Piedmont tended to be younger than forest land in other units (fig. 8). Just over 55 percent of the forest land in these two units was <40 years old. This is likely due, in part, to the higher prevalence of planted stands in these units. In contrast, about 52 percent of the forest land in the Northern Piedmont and Southern Mountains was >59 years old. The Northern Mountains had the highest percentage of forest land that was >79 years old (49 percent). Since 2007, about one-half of the stand age classes <80 years old decreased in acreage (fig. 9).

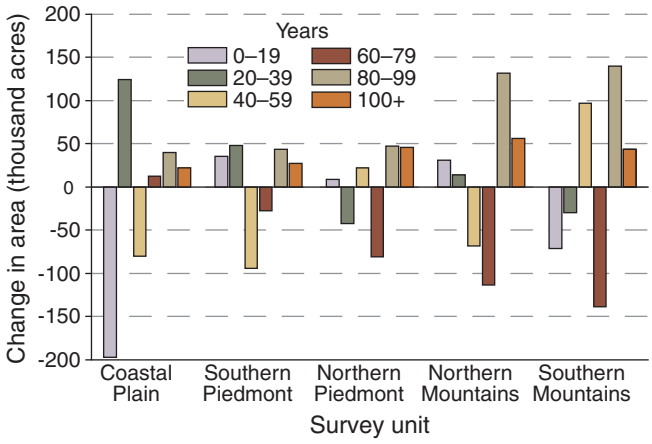


Figure 9—Change in forest land area from previous survey by survey unit and stand-age class, Virginia, 2011.

Potomac Gorge, view of Mather Gorge and Virginia-side cliffs from Maryland, Great Falls Park, Fairfax County, VA. (photo © Gary P. Fleming)

Stand-Level Volume and Number of Trees

Volume of live trees ≥5.0 inches diameter at breast height (d.b.h.) on all forest land increased from 33.1 billion cubic feet in 2007 to 35.2 billion cubic feet in 2011, an increase of 6.2 percent. Volume increased in all five survey units. The largest increase in volume occurred in the Southern Mountains, where it increased by 632.2 million cubic feet, or 9.6 percent. The volume per acre there increased by 8.3 percent. The smallest increase in volume occurred in the Southern Piedmont (156.8 million cubic feet, or 2.2 percent). The Northern Piedmont continued to have the highest volume per acre, at 2,475.4 cubic feet per acre, and the Southern Piedmont had the least, at 1,929.5 cubic feet per acre (table 2). Volume of standing dead trees ≥5.0 inches d.b.h. on all forest land decreased from 1,390.7 million cubic feet in 2007 to 1,033.8 million cubic feet in 2011.

Volume on public land went from 2,301.0 to 2,470.5 cubic feet per acre, and volume on private land went from 2,038.6 to 2,153.5 cubic feet per acre (table 2). The number of live trees ≥1.0 inch d.b.h. increased from 11.3 to 11.5 billion stems, 77 percent of which were 1.0 to 4.9 inches d.b.h. Increases were noted in all size classes, except those in the 5.0 to 8.9 inch range. The number of standing dead trees ≥5.0 inches d.b.h. on all forest land increased slightly from 174.6 to 175.5 million trees.

Table 2—Volume of live trees per acre on forest land by survey year, unit, and ownership group, Virginia

Survey year and unit	All groups	Ownership group	
		Public	Private
	cubic feet per acre		
2001			
Coastal Plain	2,030.59	3,400.55	1,923.61
Southern Piedmont	1,765.63	2,360.96	1,730.53
Northern Piedmont	2,184.81	2,240.49	2,175.55
Northern Mountains	1,895.15	1,902.71	1,889.39
Southern Mountains	2,119.25	2,353.17	2,066.32
All units	1,986.38	2,245.26	1,935.94
2007			
Coastal Plain	2,116.00	3,276.37	2,006.79
Southern Piedmont	1,904.03	2,291.03	1,880.88
Northern Piedmont	2,328.53	2,293.82	2,333.71
Northern Mountains	2,016.09	2,015.83	2,016.34
Southern Mountains	2,135.82	2,414.48	2,060.85
All units	2,086.17	2,301.00	2,038.65
2011			
Coastal Plain	2,277.62	3,171.55	2,195.06
Southern Piedmont	1,929.54	2,335.22	1,904.54
Northern Piedmont	2,475.41	2,660.23	2,445.61
Northern Mountains	2,152.03	2,188.77	2,118.81
Southern Mountains	2,312.26	2,642.20	2,221.22
All units	2,210.81	2,470.54	2,153.50

Softwoods

Live softwood volume on forest land increased from 7.6 billion cubic feet in 2007 to 8.1 billion cubic feet in 2011. Increases in live-tree softwood volume ranged from 1.0 percent in the Southern Piedmont to 9.7 percent in the Northern Piedmont. Increases in volume were noted in most diameter classes, with the exception of trees 5.0 to 8.9 inches d.b.h. (fig. 10). Sixty-four percent of softwood volume was in trees <13.0 inches d.b.h. The number of live softwood trees ≥1.0 inch d.b.h. increased by 7 percent, from 2.1 to 2.3 billion stems.

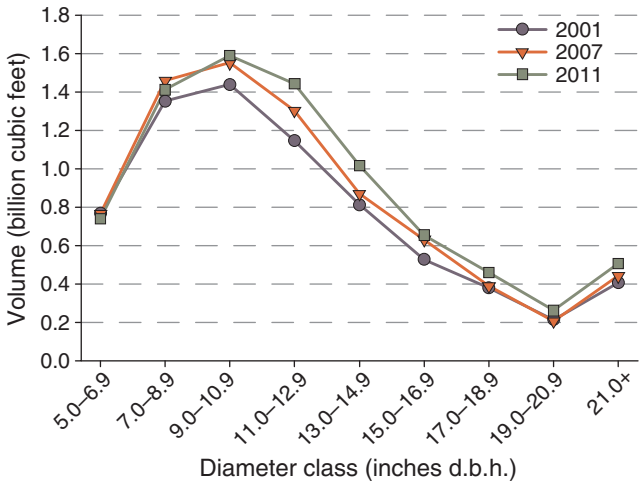


Figure 10—Volume of live softwoods on forest land by diameter class and survey year, Virginia.

Bottomland swamp along Turkey Run, Weston Wildlife Management Area, Fauquier County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Hardwoods

Hardwood live-tree volume on forest land continued to increase, from 25.5 billion cubic feet in 2007 to 27.1 billion cubic feet in 2011, a 6.3-percent change. The largest increase occurred in the Southern Mountains, where live-tree volume rose by 574.0 million cubic feet, a 9.7-percent change. In contrast, the smallest increase in hardwood volume was in the Southern Piedmont of 133.5 million cubic feet, a 2.7-percent change.

Hardwood volume decreased in the two smallest diameter classes (fig. 11). The largest percentage change was the 16.5-percent increase in volume of trees >20.9 inches d.b.h. Although 64 percent of softwood volume was in trees <13.0 inches d.b.h., only 38 percent of hardwood volume was in trees of that size. The number of live hardwoods ≥1.0 inch d.b.h. increased by 0.6 percent, from 9.16 to 9.21 billion stems.

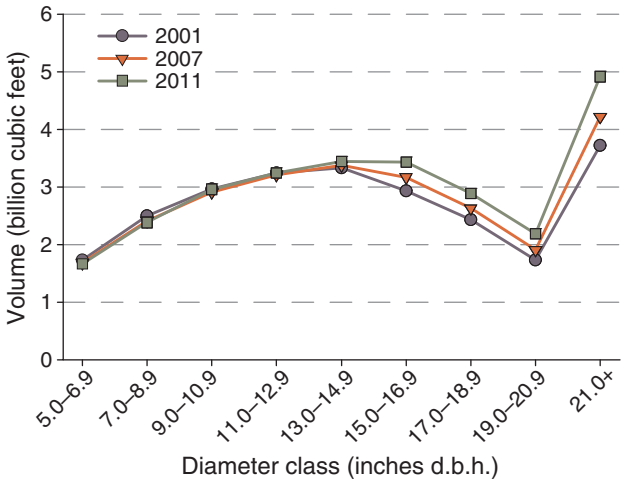


Figure 11—Volume of live hardwoods on forest land by diameter class and survey year, Virginia.

Species Importance

Volume

Yellow-poplar continued to rank first for live-tree volume with 5.6 billion cubic feet in 2011, an increase of 10.5 percent from 2007 (table 3). This species contained 15.8 percent of the live-tree volume for all trees ≥5.0 inches d.b.h. Since 2001, this species increased by 22 percent (fig. 12). Loblolly pine was the second most dominant species, and increased by 13 percent to 4.8 billion cubic feet. It was the predominant softwood species, accounting for almost 60 percent of the softwood live-tree volume. Loblolly pine showed the largest gain in volume of any single species in Virginia, increasing by 546.6 million cubic feet. Since 2001, this species increased by 32 percent (fig. 12). Chestnut oak, white oak, and red maple continued to rank next in live-tree volume. Altogether, the top five species made up 19.2 billion cubic feet, or 54 percent of the State's live-tree volume on forest land. Virginia pine and eastern white pine were still the second and third ranked softwoods for volume. Eighteen species of oak were tallied in the 2011 survey, and as a genus they accounted for 11.4 billion cubic feet, or

Table 3—Top 50 tree species dominant for volume (≥5.0 inches d.b.h.) on forest land, Virginia, 2011

Species	Volume	Species	Volume
	million cubic feet		*million cubic feet*
Yellow-poplar	5,571.6	Green ash	208.3
Loblolly pine	4,807.9	American basswood	206.5
Chestnut oak	3,277.2	Sourwood	190.8
White oak	3,135.5	Swamp tupelo	177.4
Red maple	2,357.8	Eastern hemlock	168.0
Northern red oak	1,765.7	Black walnut	164.4
Virginia pine	1,323.4	Willow oak	164.0
Sweetgum	1,190.2	Bitternut hickory	139.6
Scarlet oak	1,096.1	Cucumbertree	131.8
Black oak	1,023.0	Shagbark hickory	118.2
Eastern white pine	887.5	Table Mountain pine	95.8
Pignut hickory	700.8	River birch	93.7
Mockernut hickory	635.5	American holly	82.3
American beech	619.0	Tree-of-heaven	78.9
Southern red oak	592.9	Post oak	78.8
Sugar maple	414.1	Swamp chestnut oak	78.7
White ash	412.8	Sassafras	69.6
Blackgum	405.1	Yellow buckeye	67.8
Sweet birch	305.5	American elm	64.4
American sycamore	294.2	Baldcypress	63.7
Black cherry	293.8	Water tupelo	53.7
Shortleaf pine	260.8	Cherrybark oak	49.6
Pitch pine	218.6	Slippery elm	48.7
Black locust	213.3	Red spruce	42.8
Eastern redcedar	212.8	Pin oak	42.4

d.b.h. = diameter at breast height.

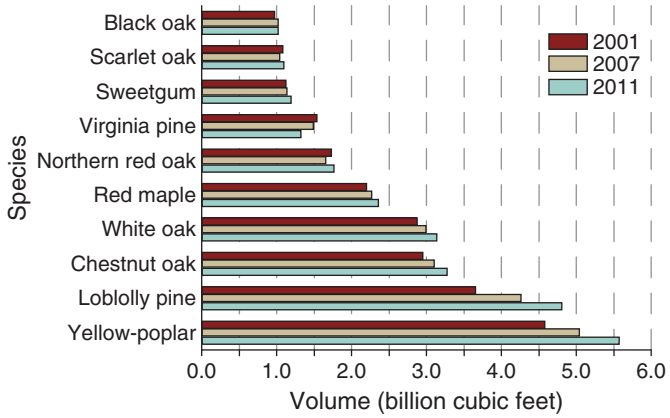


Figure 12—Live volume on forest land for the top 10 species dominant for volume by survey year, Virginia.

32 percent of the total live volume. Virginia pine, black locust, and chestnut oak were the top three species for standing dead volume.

Species dominance varied by unit. Yellow-poplar ranked first for volume in both Piedmont units and the Southern Mountains, and ranked second on the Coastal Plain. It accounted for between 7 and 22 percent of the volume in each of the five units. Loblolly pine was first for volume on the Coastal Plain and was second on the Southern Piedmont, accounting for 36 percent and 19 percent of the volume in those units, respectively. Volume in the Northern Mountains was dominated by chestnut oak, which accounted for 1.5 billion cubic feet, or 25 percent of the live-tree volume.

Longleaf pine plantation (part of multi-agency re-establishment program), Chub Sandhill State Natural Area Preserve, Sussex County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Number of Trees

Despite a 2.3-percent decrease, red maple continued to rank first for number of live trees ≥1.0 inch d.b.h with 1.4 billion stems, which represented 12 percent of the total number (table 4). Loblolly pine was second, with 1.2 billion live stems, an increase of 16 percent since 2007. Yellow-poplar, sweetgum, and blackgum were third, fourth, and fifth for number of stems. Yellow-poplar accounted for 8 percent, sweetgum accounted for 7 percent, and blackgum accounted for 6 percent of all-live stems. These top five species represented 43 percent of all-live stems. Virginia pine, black locust, and loblolly pine were the top three species for number of standing dead trees ≥5.0 inches d.b.h.

Red maple was dominant for number of live stems in both Piedmont units and the Southern Mountains. Blackgum was dominant in the Northern Mountains, and loblolly pine was dominant in the Coastal Plain.

Table 4—Top 50 tree species dominant for number of stems (≥1.0 inch d.b.h.) on forest land, Virginia, 2011

Species	Number	Species	Number
	million trees		*million trees*
Red maple	1,409.3	White ash	109.7
Loblolly pine	1,221.6	Sweet birch	107.8
Yellow-poplar	899.3	Black locust	100.4
Sweetgum	761.1	Striped maple	90.4
Blackgum	636.2	Serviceberry spp.	84.2
American holly	501.3	Tree-of-heaven	82.6
Virginia pine	488.6	Green ash	77.2
White oak	416.8	Willow oak	66.1
Chestnut oak	348.7	Winged elm	65.0
Sourwood	313.3	Water oak	53.2
American hornbeam	302.2	American elm	51.8
Eastern redcedar	266.5	Eastern hemlock	39.9
Flowering dogwood	249.8	Eastern hophornbeam	38.8
American beech	240.9	Pawpaw	34.2
Black cherry	205.7	Post oak	33.1
Mockernut hickory	198.1	Swamp tupelo	31.8
Pignut hickory	187.3	River birch	30.5
Eastern white pine	179.4	Hawthorn spp.	30.0
Eastern redbud	161.4	Shortleaf pine	28.6
Scarlet oak	160.5	Cucumbertree	25.4
Sugar maple	155.6	Fraser magnolia	25.3
Northern red oak	154.2	Sweetbay	24.1
Sassafras	140.9	Pitch pine	23.3
Southern red oak	136.1	American sycamore	22.4
Black oak	124.5	American basswood	21.9

d.b.h. = diameter at breast height.

Growth, Removals, and Mortality

Three major components of change were monitored in the Virginia survey: growth, removals, and mortality. Complex interactions among these components can result in increases or decreases in the inventory. Estimates are given as an annual average and reflect the status of trees measured in the 2007 survey and then remeasured in the 2011 survey. Gross growth minus mortality equals net growth, and net growth minus removals equals either a positive or negative net change in volume for the total forest resource.

Net growth for all-live trees on forest land averaged 1,037.0 million cubic feet per year (table 5). This was an increase of 3.9 percent from the 2007 survey, when it averaged 998.3 million cubic feet per year. Net growth of hardwoods increased from 620.7 to 653.2 million cubic feet per year, and net growth of softwoods increased from 377.6 to 383.8 million cubic feet per year. Loblolly pine accounted for 32 percent of the net growth for all-live trees, and 85 percent of the growth for softwoods. Softwood net growth increased in the Coastal Plain and the Southern Mountains and decreased in the other three units. Hardwood net growth decreased in the Coastal Plain and both Piedmont units, but increased in the Mountains. The change was most dramatic in the Northern Mountains, where hardwood net growth increased by 83 percent, from 66.0 to 120.7 million cubic feet per year.

On a per-acre basis, net growth of all-live trees on forest land averaged 64.9 cubic feet per acre per year across the State. This was an increase of 4.2 percent. At 70.1 cubic feet per acre per year, net growth was higher on private land than public land

Table 5—Average net annual growth, removals, and mortality of all-live trees on forest land by species group and survey unit, Virginia, 2011

Component and species group	All units	Survey unit				
		Coastal Plain	Southern Piedmont	Northern Piedmont	Northern Mountains	Southern Mountains
	million cubic feet					
Growth						
Softwoods	383.8	182.6	124.1	38.5	14.6	24.0
Hardwoods	653.2	123.2	124.3	116.8	120.7	168.2
All	1,037.0	305.9	248.4	155.3	135.3	192.2
Removals						
Softwoods	274.1	113.1	121.6	21.4	5.9	12.2
Hardwoods	270.9	61.0	93.3	46.1	26.9	43.5
All	545.0	174.1	214.9	67.5	32.9	55.7
Mortality						
Softwoods	101.4	38.2	22.8	19.2	13.7	7.5
Hardwoods	200.7	55.7	34.8	41.2	27.5	41.5
All	302.2	94.0	57.7	60.4	41.1	49.0

A beech-dominated mesic mixed hardwood forest in an acidic ravine, Great Falls Park, Fairfax County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

(fig. 13). This was an increase of 1.0 cubic foot per acre per year. Net growth on public land increased from 32.0 to 41.7 cubic feet per acre per year. The relatively low amount of growth on public land is a reflection of the large proportion of land in the large diameter stand-size class.

Live-tree removals on forest land averaged 545.0 million cubic feet per year (table 5). This was a decrease of 30 percent from the 2007 survey, when removals averaged 777.4 million cubic feet per year. Removals declined more for hardwoods (-40.7 percent) than for softwoods (-14.4 percent). Although 23 percent of inventory volume was in softwoods and 77 percent in hardwoods, 50.3 percent of the volume of live-tree removals consisted of softwoods and 49.7 percent of hardwoods. Removals decreased in all units except the Southern Piedmont. In the Coastal Plain removals were down substantially, from 316.3 to 174.1 million cubic feet, a 45-percent decrease. Removals also decreased substantially in the Northern Piedmont and in the Mountains, reversing a trend from the previous survey when increases in removals were partially attributed to Hurricane Isabel (Rose 2009).

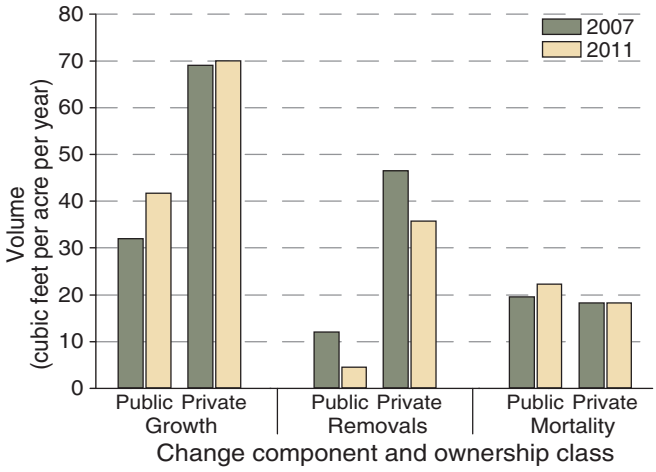


Figure 13—Average net annual growth, removals, and mortality per acre on forest land by ownership class, and survey period, Virginia.

Overall, the ratio of live net growth to live removals was 1.9:1.0. This indicates that net growth exceeded harvesting in Virginia. The softwood growth-to-removals ratio was 1.4:1.0, and the hardwood growth-to-removals ratio was 2.4:1.0. When ratios approach 1:1 there is a high likelihood that removals exceeded growth in several areas in the State. Ideally, if harvesting is to be sustainable, removals should not exceed growth for long periods. Growth of softwoods and hardwoods exceeded removals in all units. However, the growth-to-removals ratio for softwoods in the Southern Piedmont declined between surveys to barely above 1:1 (1.02:1.00), a trend that deserves watching closely. Loblolly pine accounted for 38 percent of all removals.

On a per-acre basis, removals of live trees decreased from 40.3 to 30.1 cubic feet per acre per year. Rates of removals, like rates of growth, were highest on privately owned land. Here, rates of removals decreased by 10.8 cubic feet per acre per year to 35.8 cubic feet per acre per year (23 percent) (fig. 13). Removals decreased by 7.5 cubic feet per acre per year (62.5 percent) on public lands.

Across the State, mortality averaged 302.2 million cubic feet per year (table 5). This was a 2.8-percent increase since the 2007 survey, when mortality averaged 293.8 million cubic feet per year. Mortality decreased in the Coastal Plain and the Northern Mountains and increased in the other three units. The largest percentage increase in mortality occurred in the Northern Piedmont (18 percent). Per-acre mortality increased on public land, from 19.5 to 22.3 cubic feet per acre per year (14 percent) (fig. 13). On private land, per-acre mortality decreased by 0.2 percent. By species group, there was an increase in mortality of hardwoods (4.4 percent) and a slight decrease in mortality of softwoods (0.04 percent).

Forest Health

Disturbance

Management activities, especially the establishment of plantations, can impact stand structure by altering forest type, species composition, stand age, stand density, and other stand attributes. As noted previously, 2.6 million acres of forest land in Virginia were classified as planted, and 13.3 million acres were classified as natural. Eighty-six percent (2.2 million acres) of all planted stands were in the Coastal Plain and Southern Piedmont. Between the 2007 survey and the 2011 survey, forest land area classified as planted increased by 7 percent (168,900 acres), and since the 2001 survey it has increased by 21 percent from 2.1 to 2.6 million acres. Seventy-eight percent of the planted acreage was in the loblolly-shortleaf forest-type group. The oak-pine and oak-hickory forest-type groups occupied most of the remaining area classified as planted.

The rate of plantings on forest land increased slightly, from 82,900 acres per year in the 2007 survey to 93,000 acres per year in the 2011 survey, a 12-percent increase. Plantings increased, but the rate of clearcutting on forest land decreased by 27 percent, from 149,300 acres per year in the 2007 survey to 109,400 acres per year in the 2011 survey. Partial harvesting fell by almost one-half, from 119,300 to 67,800 acres per year.

Turkey-tail fungi (*Trametes versicolor*), Pinnacles, Shenandoah National Park, Rappahannok County, VA.
(photo © Virginia Natural Heritage Program, Gary P. Fleming)

Weather-caused disturbance, including events such as wind, ice, flooding, hurricanes, or tornadoes, affected an estimated 51,100 acres per year of Virginia's forest land since 2007. This was a decrease of 58 percent from the previous survey, when 121,800 acres per year were disturbed by weather, presumably due in part to Hurricane Isabel. Human-related and insect-related damage exceeded weather-related damage in the 2011 survey (88,200 and 71,100 acres per year, respectively). Much of the State's insect damage probably was caused by gypsy moth, southern pine beetle, and hemlock woolly adelgid.

Species of Concern

Many invasive insects and diseases are affecting or have the potential to affect Virginia's forests. The gypsy moth, which first moved through Northern Virginia in 1984, has impacted millions of acres of the State's forests. Defoliation caused by gypsy moth has occurred primarily in the Northern Mountains due to the prevalence of oaks and large, contiguous tracts of forest in that unit. It is estimated that this insect defoliated 141,388 acres between 2008 and 2011 (U.S. Department of Agriculture Forest Service 2013). This is almost one-half of the area defoliated between 2002 and 2007 (225,605 acres) and far less than the 834,380 acres defoliated between 1997 and 2001 (Asaro 2007, U.S. Department of Agriculture Forest Service 2013). This downward trend is generally attributed to wet weather in the spring, which encourages the growth of a fungus that kills the gypsy moth larvae (Asaro 2011).

In 2003, the emerald ash borer, an insect native to Asia that kills ash trees, was detected in Fairfax County, Virginia. Since then, it has been confirmed in at least 17 additional counties (U.S. Department of Agriculture Forest Service 2012, Asaro 2012). Ash trees are killed when larvae feed underneath the bark. In 2011 there were about 187.7 million ash trees ≥1.0 inch d.b.h. (a 3.5-percent increase since 2007), and 622.9 million cubic feet of volume in ash trees ≥5.0 inches d.b.h. (a 10-percent increase since 2007). White ash and green ash are the predominant species of ash in Virginia. The highest concentration of white ash was in the Northern Piedmont and the Mountains; the highest concentration of green ash was in the Coastal Plain and Southern Piedmont. Efforts are underway to quarantine areas where the borer has been discovered in order to help prevent further spread of the insect. To find out more information please visit the emerald ash borer website at: http://www.emeraldashborer.info/.

Eastern and Carolina hemlock are susceptible to several pests and pathogens. Of particular concern is the hemlock woolly adelgid. Since introduction of this insect into Virginia in the 1950s, the hemlock woolly adelgid has spread to most counties where hemlock occurs. It feeds on the phloem of hemlock twigs, it typically leads to tree death within 4 to 5 years (Lovett and others 2006), but can sometimes take much longer. Symptoms of adelgid infestation include poor crown condition, conspicuous wool-like ovisacs on the underside of branch tips, and areas of extensive hemlock

mortality and decline (U.S. Department of Agriculture Forest Service 2005). Hemlock is most prevalent in the Northern and Southern Mountains, where this insect is expected to cause a marked reduction in hemlock populations. Between 2007 and 2011, there was a 10-percent decrease in live volume, from 187.2 to 168.0 million cubic feet and an 11-percent decrease in the number of live trees, from 17.8 to 15.9 million (fig. 14). In addition, there was a substantial increase in the number of dead trees ≥5.0 inches d.b.h., from 2.6 to 4.9 million trees, an 86-percent increase.

Seven of the top 15 species decreased in number of trees between 2007 and 2011. Most notable for decrease in number of trees was dogwood, which declined by 25 percent (from 333.3 to 249.8 million trees ≥1.0 inch d.b.h.). This trend deserves watching, as the number of dogwood trees decreased by 33 percent between 2001 and 2007. Mortality of dogwood is most likely due to several factors, including drought stress, dogwood anthracnose, and powdery mildew.

Another species under serious threat of decline due to insect and disease is black walnut. Thousand cankers disease was discovered in Virginia in 2011 and quarantines have been enacted in those areas affected. As of yet, Forest Inventory and Analysis (FIA) data do not show a decline in this species. The number of live trees went from 18.9 to 21.1 million trees between 2007 and 2011.

Nonnative Invasive Plants

Nonnative invasive plants (NNIPs) pose a threat to the health of forests across the United States. Through competitive exclusion, suppression via allelopathy, and various other methods, invasive plants can suppress tree regeneration and reduce herbaceous species diversity (Merriam and Feil 2002, Orr and others 2005). Some evidence suggests that past land use and current levels of land development are factors that strongly influence invasion (Lundgren and others 2004). Heavy deer browse of native plants can also facilitate invasion by NNIPs. Crews noted NNIPs on 60 percent of forested plots and 42 percent of forested

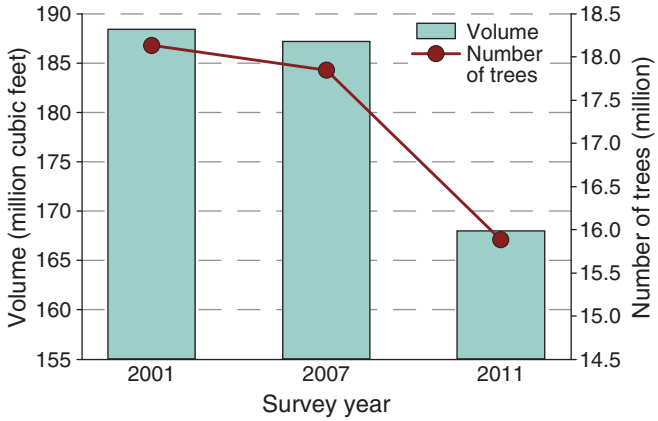


Figure 14—Volume and number of live eastern hemlock trees (≥5.0 inches d.b.h.) on forest land by survey year, Virginia.

Northern red oak forest and interrupted fern (*Osmunda claytoniana*), Stony Man Mountain, Shenandoah National Park, Madison County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

subplots (table 6). The Piedmont units had the highest percentage of forested plots with NNIPs (72 percent of forested plots in both units); the Northern Mountains had the lowest (34 percent). Japanese honeysuckle, nonnative roses, and tree-of-heaven were the most often occurring invasive species in Virginia's forests (table 7). These three NNIPs occurred on 45, 19, and 11 percent of forested plots, respectively. At the unit level, Japanese honeysuckle was the most frequently occurring NNIP in the Coastal Plain and the Piedmont. Nonnative roses were most frequently occurring in

Table 6—Occurrence of nonnative invasive plants by survey unit, plot, and subplot, Virginia, 2011

	Forested plots			Forested subplots		
Survey unit	Total	With invasives		Total	With invasives	
		number	*percent*		*number*	*percent*
Coastal Plain	733	470	64.1	2,641	1,219	46.2
Southern Piedmont	728	523	71.8	2,647	1,365	51.6
Northern Piedmont	488	350	71.7	1,759	957	54.4
Northern Mountains	493	168	34.1	1,860	389	20.9
Southern Mountains	590	304	51.5	2,125	694	32.7
Total	3,032	1,815	59.9	11,032	4,624	41.9

Table 7—Occurrence of nonnative invasive plants by species, survey unit, plot, and subplot, Virginia, 2011

Species	Coastal Plain		Southern Piedmont		Northern Piedmont		Northern Mountains		Southern Mountains		All units	
	Plots	Sub-plots	Plots	Sub-plots	Plots	Sub-plots	Plots	Sub-plots	Plots	Sub-plots	Plots	Sub-plots
	number											
Autumn olive	7	9	7	10	31	59	31	60	67	105	143	243
Bush honeysuckle	—	—	29	62	1	1	6	10	6	10	42	83
Chinese lespedeza	32	56	35	53	9	11	2	3	9	20	87	143
Chinese privet	77	116	57	94	30	54	6	17	16	25	186	306
Chinese silvergrass	—	—	1	1	—	—	—	—	2	7	3	8
Chinese yams	—	—	—	—	—	—	1	4	—	—	1	4
Chinese/Japanese wisteria	2	3	4	4	1	2	2	5	2	3	11	17
English ivy	5	8	2	2	6	7	—	—	—	—	13	17
Garlic mustard	—	—	—	—	21	49	13	24	3	8	37	81
Japanese honeysuckle	426	1,097	462	1,187	292	771	79	183	111	219	1,370	3,457
Japanese privet	6	16	1	1	—	—	1	1	—	—	8	18
Kudzu	1	1	3	4	1	3	1	1	2	5	8	14
Mimosa	8	13	1	1	4	4	—	—	2	2	15	20
Nepalese browntop	15	29	47	82	77	137	29	49	58	107	226	404
Nonnative bamboo	1	1	1	1	1	3	—	—	—	—	3	5
Nonnative roses	29	47	108	161	126	213	89	174	217	437	569	1,032
Oriental bittersweet	—	—	2	3	20	45	4	5	14	27	40	80
Paulownia	12	14	15	21	26	38	9	9	10	10	72	92
Periwinkle	—	—	7	10	—	—	1	1	2	2	10	13
Russian olive	1	1	—	—	—	—	—	—	—	—	1	1
Sacred bamboo	1	1	1	3	—	—	—	—	—	—	2	4
Shrubby lespedeza	24	35	15	26	12	17	14	29	22	47	87	154
Tall fescue	5	5	6	8	22	34	20	45	36	68	89	160
Thorny olive	—	—	—	—	—	—	—	—	3	4	3	4
Tree-of-heaven	37	42	101	164	100	159	57	101	49	66	344	532
Winged burning bush	—	—	1	1	1	1	2	3	4	6	8	11
Wintercreeper	18	49	5	5	—	—	—	—	—	—	23	54

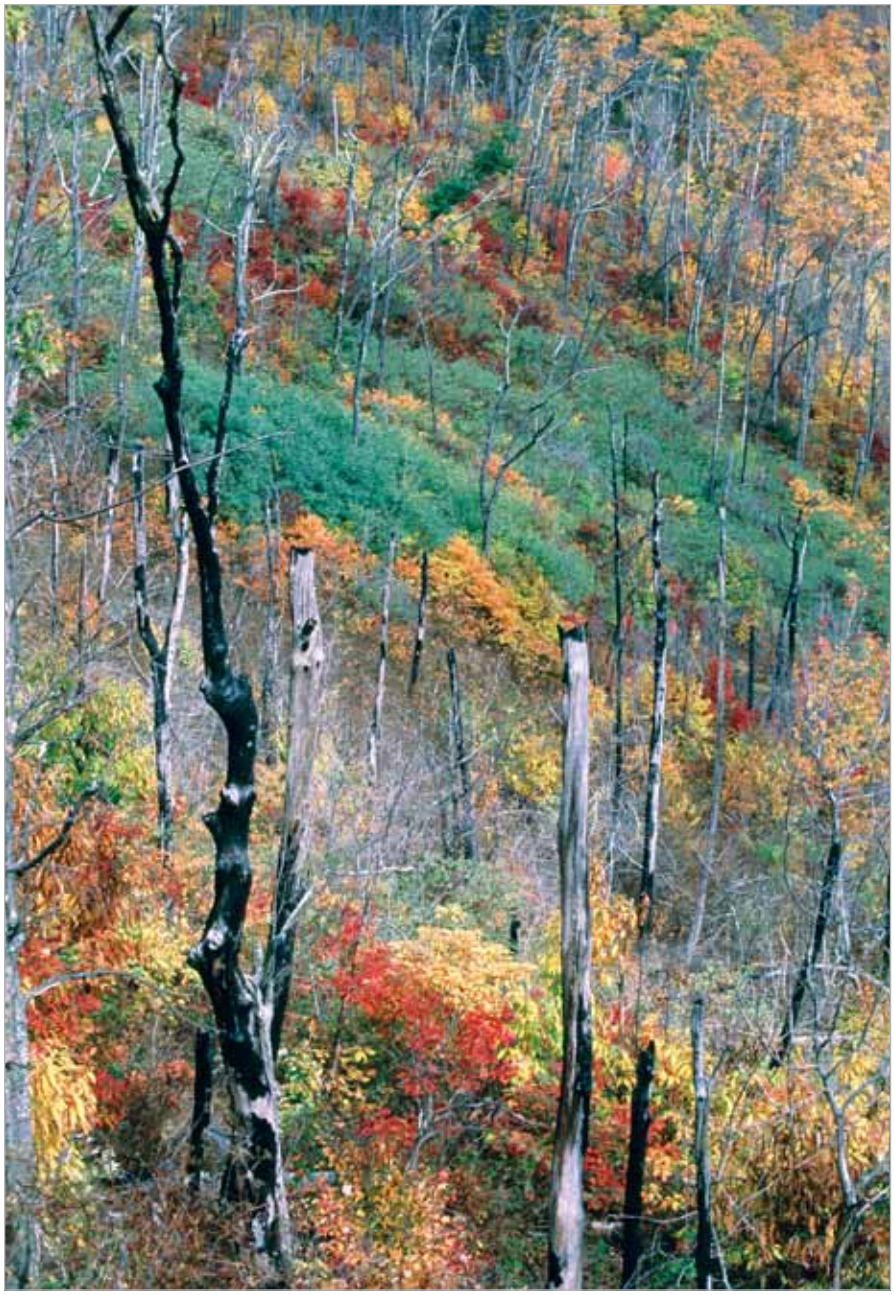
— = no sample for the cell.

the Mountains, with Japanese honeysuckle a close second. Between the 2007 survey and 2011 survey, the number of tree-of-heaven stems increased by 15.6 percent, from 71.5 to 82.6 million trees. In addition, the volume of this species increased by 16.7 percent, from 67.6 to 78.9 million cubic feet. Paulownia, another invasive tree species, also increased in number of trees (from 8.6 to 9.8 million stems) and volume (9.8 to 14.5 million cubic feet). Cover for about one-half of the invasive species, was <1 percent on more than 30 percent of the subplots they occupied. Plots with NNIPs had between one (30 percent) and eight (0.03 percent) unique species.

Phase 3 Indicators

FIA assesses several additional indicators to aid in the detection of potential forest health issues that may warrant further evaluation. These Phase 3 (P3) indicators include ozone-induced injury, crown condition, and down woody material. Readers should be aware that these indicators are based on a smaller plot population than the regular, Phase 2 (P2), sample, where approximately 1 out of every 16 P2 plots is a P3 plot, or 1 plot per 96,000 acres. In addition, no P3 data were collected during the 2011 field season due to budgetary constraints.

Ozone—Ozone is the product of chemical reactions that take place in the air when volatile organic compounds (VOCs) mix and react with nitrogen oxides (NO_x) in the presence of sunlight. Anthropogenic emissions, primarily through the combustion of organic compounds (for example, gasoline and coal) account for the most input of NO_x into the environment. In contrast, VOCs



"Ghost forest" of oak killed by gypsy moth and drought, Shenandoah National Park, Albemarle County, VA. (photo © Gary P. Fleming)

come primarily from natural sources, such as trees and other vegetation, although a sizable portion of the total input of VOCs does come from industrial and vehicular emissions. Weather plays a key role in the formation of ozone, with hot, dry, calm, cloudless days providing ideal conditions for VOCs and NO_x to combine and react to form ozone (U.S. Environmental Protection Agency 2004).

During the summer months, ozone concentrations can reach levels known to be toxic to plants. Many plants are sensitive to ozone exposures above normal background levels. These bioindicator species, such as yellow-poplar and sweetgum, exhibit an upper surface foliar injury symptom that can be distinguished from other foliar injuries. FIA tracks foliar injury to determine where negative impacts to forest trees may be occurring.

Ozone phytotoxicity is evaluated by field personnel Statewide between late July and mid-August (U.S. Department of Agriculture Forest Service 2004a). The amount and severity of ozone injury vary according to a complex set of factors including exposure, rates of stomatal uptake, and sensitivity to ozone. Studies have shown that periods of drought can offset the effects of ozone by reducing stomatal conductance (Patterson and others 2000). Variation in injury within a plant is largely determined by the position of the foliage, exposure to air and sunlight, and the age of the leaves.

Between 2008 and 2010, FIA evaluated 9,848 plants from various locations in Virginia (biosites), of which only 0.2 percent had ozone injury. In the survey documented here, most of the injury occurred in 2008, whereas no injury was detected in 2010 (table 8). These field studies indicate that very little foliar injury from ozone occurred across the State during the 2011 survey period. It is hoped that this trend of very little ozone-induced injury will continue.

Table 8—Number of biosites and plants evaluated for ozone-induced foliar injury, by year, Virginia

Year	Biosites	Plants evaluated	Plants injured
		number	
2008	39	2,988	17
2009	40	3,204	3
2010	39	3,656	0

Crowns—Tree crowns are affected by many biotic and abiotic factors such as tree age, soil conditions, precipitation, air pollution, insects, and disease. Therefore, tree crown condition is a potential indicator of forest health. Unusually poor crown conditions, or changes in crown conditions through time, can indicate areas of concern that may warrant further investigation. FIA measures several indicators to assess crown condition and to detect various states of crown decline. Indicators monitored include crown dieback, foliage transparency, crown density, and sapling crown vigor.

Crown dieback is recorded as the percentage of mortality of the terminal portion of branches that are ≤1.0 inch in diameter, and are positioned in the upper portion of the crown (U.S. Department of Agriculture Forest Service 2004a). High levels of dieback may indicate the presence of defoliating agents and a general loss of vigor. Increases in crown dieback indicate stress, possibly caused by root damage, stem damage that interferes with moisture and nutrient transport to the crown, or direct injury to the crown (Schomaker and others 2007). Crown dieback is considered an indication of recent stress because small dead twigs do not persist for long, and because trees typically replace lost twigs and foliage if the stress does not continue.

Crown density is the percentage of light blocked by branches, foliage, and reproductive structures, relative to the total symmetrical crown outline (Zarnoch and others 2004). Average crown density on all plots was 43.2 percent, with survey unit averages ranging from 40.2 to 48.2 percent. American holly, black locust, and swamp tupelo had the lowest percentage of trees with >50 percent crown densities (table 9).

Table 9—Crown density, crown dieback, and foliage transparency of trees (≥5.0 inches d.b.h., n ≥15) by species on P3 plots, Virginia, 2011

		Crown density			Crown dieback			Foliage transparency		
		percent			*percent*			*percent*		
Species	Trees	0–25	26–50	>50	<6	6–15	>15	0–25	26–50	>50
	- n -	*percentage of trees*								
Loblolly pine	738	3.5	87.3	9.2	99.7	0.3	0.0	82.7	16.8	0.5
Yellow-poplar	307	2.3	78.2	19.5	94.8	3.3	2.0	91.5	8.5	0.0
Red maple	298	4.0	81.5	14.4	86.2	7.0	6.7	85.9	13.1	1.0
Chestnut oak	267	3.4	68.9	27.7	89.5	7.5	3.0	72.3	26.2	1.5
Virginia pine	228	3.1	89.5	7.5	89.9	4.8	5.3	62.7	36.0	1.3
White oak	200	4.0	76.0	20.0	88.5	7.0	4.5	86.0	13.5	0.5
Sweetgum	133	3.0	90.2	6.8	91.7	6.8	1.5	97.7	2.3	0.0
Mockernut hickory	119	1.7	72.3	26.1	92.4	5.0	2.5	93.3	6.7	0.0
Black oak	94	5.3	80.9	13.8	81.9	13.8	4.3	72.3	26.6	1.1
Pignut hickory	88	1.1	72.7	26.1	94.3	5.7	0.0	93.2	6.8	0.0
Northern red oak	81	7.4	86.4	6.2	84.0	7.4	8.6	79.0	21.0	0.0
Scarlet oak	76	3.9	84.2	11.8	75.0	13.2	11.8	72.4	26.3	1.3
Blackgum	73	2.7	71.2	26.0	98.6	1.4	0.0	82.2	16.4	1.4
Sourwood	67	6.0	71.6	22.4	86.6	3.0	10.4	73.1	23.9	3.0
Sugar maple	60	0.0	85.0	15.0	93.3	6.7	0.0	88.3	11.7	0.0
Black cherry	58	5.2	89.7	5.2	84.5	10.3	5.2	72.4	25.9	1.7
American beech	56	1.8	71.4	26.8	91.1	3.6	5.4	94.6	5.4	0.0
Sweet birch	50	4.0	74.0	22.0	90.0	8.0	2.0	94.0	6.0	0.0
Eastern white pine	50	0.0	84.0	16.0	96.0	2.0	2.0	94.0	6.0	0.0
Eastern redcedar	46	0.0	52.2	47.8	100.0	0.0	0.0	91.3	8.7	0.0
Southern red oak	42	4.8	88.1	7.1	90.5	0.0	9.5	88.1	9.5	2.4
Black locust	37	8.1	89.2	2.7	62.2	29.7	8.1	73.0	24.3	2.7
Shortleaf pine	32	3.1	90.6	6.3	100.0	0.0	0.0	90.6	9.4	0.0
Swamp tupelo	30	40.0	56.7	3.3	96.7	3.3	0.0	96.7	3.3	0.0
White ash	29	0.0	79.3	20.7	96.6	3.4	0.0	82.8	17.2	0.0
American basswood	24	0.0	75.0	25.0	95.8	4.2	0.0	91.7	8.3	0.0
Green ash	23	4.3	87.0	8.7	78.3	17.4	4.3	91.3	8.7	0.0
American elm	23	0.0	95.7	4.3	91.3	8.7	0.0	82.6	17.4	0.0
American holly	18	0.0	100.0	0.0	100.0	0.0	0.0	94.4	5.6	0.0
Willow oak	16	25.0	68.8	6.3	93.8	0.0	6.3	81.3	12.5	6.3
Black walnut	16	6.3	50.0	43.8	87.5	6.3	6.3	93.8	0.0	6.3
Cucumbertree	15	0.0	73.3	26.7	100.0	0.0	0.0	100.0	0.0	0.0
Sassafras	15	0.0	60.0	40.0	73.3	26.7	0.0	86.7	13.3	0.0

d.b.h. = diameter at breast height; n = number.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

Average crown dieback across all plots was 2.5 percent. This was a slight decrease from the previous survey, when dieback averaged 3.3 percent. By survey unit, average dieback ranged from a low of 1.1 percent in the Coastal Plain to a high of 3.9 percent in the Southern Mountains. Most hardwoods and softwoods had no crown dieback, 81.4 and 95.2 percent, respectively. Crown dieback varied by species, with scarlet oak, sourwood, and southern red oak having the highest percentage of trees with >15 percent dieback (for species where n ≥15) (table 9).

Foliage transparency is the percentage of skylight that is visible through the live, normally foliated part of the crown (Zarnoch and others 2004). High foliage transparency may be due to insect- or weather-related damage. Average foliage transparency for all plots was 21.7 percent. By unit, averages ranged from a low of 19.0 percent in the Southern Mountains to a high of 25.1 percent in the Northern Mountains. Slightly <1 percent of hardwoods and softwoods had >50 percent foliage transparency. Foliage transparency varied by species. Black walnut and willow oak had the highest percentage of trees with >50 percent transparency (table 9).

Crown vigor class is used to rate the crown condition of saplings (trees 1.0 to 4.9 inches d.b.h.). Factors that can impact crown vigor in saplings include overhead competition and stand density. Separating natural stand competition functions from insect damage and disease damage is difficult. About 68 percent of all saplings were in vigor class 1 (good), 28.0 percent were in vigor class 2 (average), and only 3.6 percent were in vigor class 3 (poor). Sourwood had the highest percentage of saplings in vigor class 3 (9.4 percent) (table 10).

Table 10—Crown vigor ratings for saplings (1.0 to 4.9 inches d.b.h., n ≥15) by species on P3 plots, Virginia, 2011

Species	Saplings	Crown vigor		
		Good	Average	Poor
	- n -	*- - - - percentage - - - -*		
Red maple	100	65.0	30.0	5.0
Yellow-poplar	92	78.3	19.6	2.2
Sweetgum	77	75.3	19.5	5.2
Virginia pine	65	72.3	26.2	1.5
Loblolly pine	52	71.2	28.8	0.0
Blackgum	50	60.0	40.0	0.0
American holly	44	79.5	18.2	2.3
Eastern redcedar	44	61.4	36.4	2.3
Flowering dogwood	32	62.5	37.5	0.0
Sourwood	32	40.6	50.0	9.4
Mockernut hickory	30	70.0	23.3	6.7
Black cherry	26	80.8	15.4	3.8
Eastern redbud	23	43.5	52.2	4.3
American hornbeam	21	85.7	9.5	4.8
Pignut hickory	21	90.5	9.5	0.0
Southern red oak	19	78.9	21.1	0.0
American beech	16	87.5	12.5	0.0
Serviceberry spp.	15	60.0	33.3	6.7
White oak	15	73.3	20.0	6.7
Eastern white pine	15	86.7	13.3	0.0

d.b.h. = diameter at breast height; n = number.
0.0 = no sample for the cell or a value of >0.0 but <0.05.

English ivy (*Hedera helix/hibernica*) invasion in old forest, Windy Run Park, Arlington County, VA. (photo © Gary P. Fleming)

Down woody material—An important dynamic of any ecosystem is the return of nutrients to the system through decomposition. In forested ecosystems deadwood can be a significant store of nutrients (Harmon and others 1987, Keenan and others 1993). Standing and down-dead trees are also important habitats for a wide variety of organisms, including invertebrates, small mammals, birds, reptiles, and amphibians. Although many organisms depend on down wood material, the presence of large amounts of deadwood can constitute a fire hazard.

Coarse woody debris (CWD; down-dead logs ≥3.0 inches in diameter and ≥3.0 feet long) is particularly important as habitat and shelter for wildlife. Volume of CWD ranged from an average of 144.4 cubic feet per acre in the Coastal Plain to an average of 868.2 cubic feet per acre in the Northern Mountains. The average for the State was 400.1 cubic feet per acre (table 11). This was an increase from the previous survey when CWD averaged 326.5 cubic feet per acre. However, fewer plots were measured in the 2011 survey, making a direct comparison difficult. Of the three forest-type groups

Table 11—Volume of down woody material on P3 plots by survey unit and fuel class, Virginia, 2011

		FWD				CWD	
Survey unit	Plots	1-hour	10-hour	100-hour	All FWD	1,000-hour	Total
	- n -	*- - - - - - - - - - - - - - - cubic feet per acre - - - - - - - - - - - - - -*					
Coastal Plain	28	4.3	37.1	99.5	140.9	144.4	285.3
Southern Piedmont	35	2.5	27.1	73.5	103.1	178.9	282.0
Northern Piedmont	29	2.4	31.6	102.1	136.1	431.4	567.5
Northern Mountains	27	3.4	39.5	136.4	179.2	868.2	1,047.4
Southern Mountains	26	2.6	42.4	127.3	172.4	451.9	624.3
All	145	3.0	35.0	105.6	143.6	400.1	543.7

FWD = fine woody debris; CWD = coarse woody debris; n = number.

with at least 10 conditions measured, oak-hickory had the most CWD (514.4 cubic feet per acre), loblolly-shortleaf pine had the next most (227.7 cubic feet per acre), and oak-pine had the least (185.2 cubic feet per acre).

Biomass of CWD averaged 3.3 tons per acre Statewide (table 12). The Northern Mountains had the most CWD per acre (6.6 tons per acre), and the Coastal Plain the least (1.1 tons per acre). CWD is classified as a 1,000-hour fuel. Fine woody debris (FWD) is classified into 1-, 10-, and 100-hour fuel categories. These fuel class numbers correspond to the approximate amount of time required for the moisture content to fluctuate within a given piece of deadwood (Brown 1974). Consequently, FWD is an important factor in fire hazard prediction. Overall, FWD biomass averaged 1.9 tons per acre. In addition, CWD and FWD contributed an average of 1.7 and 1.1 tons per acre, respectively, of carbon to the ecosystem.

Table 12—Fuel loadings on P3 plots by survey unit and fuel class, Virginia, 2011

		FWD				CWD	
Survey unit	Plots	1-hour	10-hour	100-hour	All FWD	1,000-hour	Total
	- n -	*- - - - - - - - - - - - - tons per acre - - - - - - - - - - - - -*					
Coastal Plain	28	0.06	0.47	1.27	1.80	1.12	2.92
Southern Piedmont	35	0.03	0.36	0.98	1.37	1.58	2.95
Northern Piedmont	29	0.03	0.43	1.41	1.88	3.86	5.74
Northern Mountains	27	0.05	0.55	1.92	2.51	6.59	9.10
Southern Mountains	26	0.04	0.56	1.73	2.32	3.73	6.05
All	145	0.04	0.47	1.43	1.94	3.26	5.20

FWD = fine woody debris; CWD = coarse woody debris; n = number.

Red spruce forest, Beartown Wilderness (USFS), Tazewell County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Eastern fence lizard (*Sceloporus undulatus*), Powhatan State Park, Powhatan County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

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Green tree frog (*Hyla cinerea*), False Cape State Park, Virginia Beach City, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

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.

Basal area—The cross sectional area of a tree at breast height or of all the trees in a stand, usually expressed in square feet or square feet per acre.

Bioindicator species—A tree, woody shrub, or nonwoody herbaceous species that responds to ambient levels of ozone pollution with distinct visible foliar symptoms that are easy to diagnose.

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.

Red-spotted newt (*Notophthalmus viridescens* var. *viridescens*), Allegheny Mountain, Laurel Fork Special Biologic Area (USFS), Highland County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

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.

Crown—The part of a tree or woody plant bearing live branches or foliage.

Crown vigor class—A visual assessment of the apparent crown vigor of saplings. The purpose is to separate excellent saplings with superior crowns from stressed individuals with poor crowns.

Crown density—The amount of crown stem, branches, twigs, shoots, buds, foliage, and reproductive structures that block light penetration through the projected crown outline. Measured as a percentage.

Crown dieback—Recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is only considered when it occurs in the upper and outer portions of the tree. Dead branches in the lower live crown are not considered as part of crown dieback, unless there is continuous dieback from the upper and outer crown down to those branches.

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.

Foliage transparency—The amount of skylight visible through microholes in the live portion of the crown, i.e. where you see foliage, normal or damaged, or remnants of its recent presence. Recently defoliated branches are included in foliage transparency measurements. Macroholes are excluded unless they are the result of recent defoliation. Dieback and dead branches are always excluded from the estimate. Foliage transparency is different from crown density because it emphasizes foliage and ignores stems, branches, fruits, and holes in the crown.

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.)

Old-growth water tupelo, Cypress Bridge State Natural Area Preserve, Southampton County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

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.)

Fuel class—Categories of forest fire fuels defined by the approximate amount of time it takes for moisture conditions to fluctuate. Large coarse woody debris pieces take longer to dry out than smaller fine woody pieces.

1000-hour fuels—Coarse woody debris with a transect diameter ≥3.0 inches in diameter and ≥3.0 feet long.

100-hour fuels—Fine woody debris with a transect diameter between 1.0 and 2.9 inches.

10-hour fuels—Fine woody debris with a transect diameter between 0.25 and 0.9 inches.

1-hour fuels—Fine woody debris with a transect diameter ≤0.24 inches.

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.

Hard 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.

Operability—The viability of operating logging equipment in the vicinity of the condition. Operability classes are as follows:

No problems.

Seasonal access due to water conditions in wet weather.

Mixed wet and dry areas typical of multichanneled streams punctuated with dry islands.

Broken terrain, cliffs, gullies, outcroppings, etc., which would severely limit equipment, access, or use.

Year-round water problems (includes islands).

Slopes 20 to 40 percent.

Slopes >40 percent.

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.

Ozone (O_3)—A gaseous air pollutant produced primarily through sunlight-driven chemical reactions of NO_2 and hydrocarbons in the atmosphere and causing foliar injury to deciduous trees, conifers, shrubs, and herbaceous species.

Ozone bioindicator site—An open area used for ozone injury evaluations on ozone-sensitive species. The area must meet certain site selection guidelines regarding size, condition, and plant counts to be used for ozone injury evaluations in FIA.

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.

Site index—The average total height that dominant and codominant trees in fully-stocked, even-aged stands will obtain at key ages (usually 25 or 50 years).

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.

Tree class—An assessment of the general quality of a tree.

Cull species—Species measured at d.r.c. and timber species (measured at d.b.h.) that would not produce saw-logs. See national list of nonsaw-log species.

Growing stock—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 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), to qualify as growing stock.

Rough cull—Trees that do not contain at least one 12-foot saw log or two 8-foot logs now or prospectively, primarily because of roughness or poor form. Less than 1/3 of its gross board-foot volume meets size, soundness, and grade requirements and <1/2 of the cubic-foot cull is rotten or unsound.

Rotten cull—Trees that do not contain at least one 12-foot saw log or two 8-foot logs now or prospectively and/or do not meet grade specifications for percent sound primarily because of rot. All species not having 1/3 or more of its gross board-foot volume meeting size, soundness, and grade requirements, and over 1/2 of the cubic-foot cull is rotten or unsound.

Tree grade—A classification of the saw-log portion of large-diameter trees based on: (1) the grade of the butt log, or (2) the ability to produce at least one 12-foot or two 8-foot logs in the upper section of the saw-log portion. Tree grade is an indicator of quality; grade 1 is the best quality.

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.

Metric Equivalents

1 acre = 4046.87 m^2 or 0.404686 ha
1 cubic foot = 0.028317 m^3
1 inch = 2.54 cm or 0.0254 m
Breast height (4.5 feet) = 1.4 m above the ground
1 square foot = 929.03 cm^2 or 0.0929 m^2
1 square foot of basal area per acre = 0.229568 m^2 per ha
1 cubic foot per acre = 0.0699722 m^3 per ha
1 pound = 0.454 kg
1 ton = 0.907 metric ton

Maritime swamp with baldcypress, First Landing State Park, Virginia Beach City, VA. (photo © Gary P. Fleming)

Appendix A—Inventory Methods

The Virginia 2011 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 which is slightly offset from the previous panel, so that each panel covers essentially the same sample area (both spatially and in intensity) as the prior panel. In the sixth year the plots that were measured in the first panel are remeasured. This marks the beginning of the next cycle of data collection. After field measurements are completed, a cycle of data is available for the 5-year report.

Phase 1

For the 2011 inventory of Virginia the P1 forest area estimate was based on classifying National Land Cover Database (NLCD) 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 (FIA). These numbers could differ substantially for very small areas. In addition, the 2011 area estimates, especially at the county level, have higher sampling errors than those prior to the 2007 survey because of the switch from dot counts to NLCD for area estimates. Further explanation of this change can be found in Rose (2009).

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 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.

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:

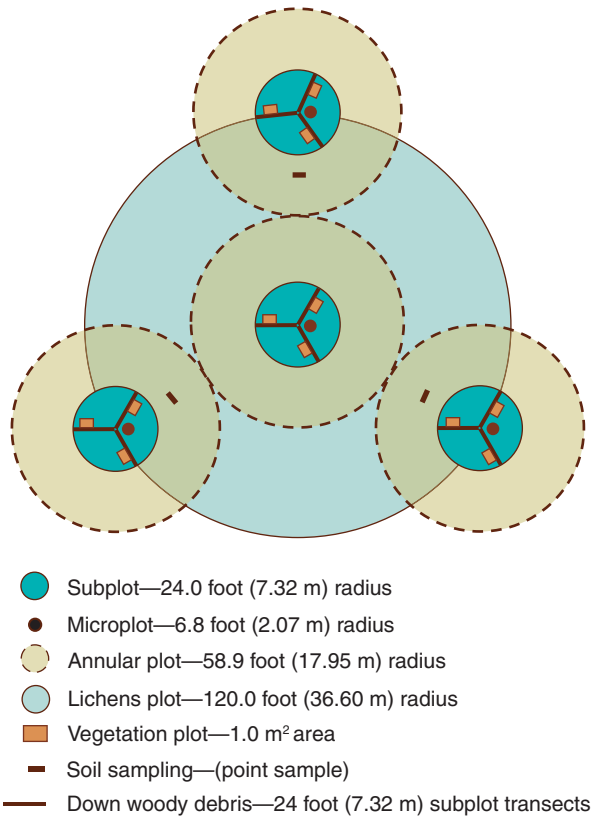

Figure A.1—Layout of fixed-radius plot.

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 1/16th 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 (DWM), and foliar ozone injury. Tree crown health and DWM measurements are collected by using the same plot design used during P2 data collection (fig. A.1).

Biomonitoring sites for ozone data collection are located independently of the FIA grid. Sites must be 1-acre fields or similar open areas adjacent to or surrounded by forest land, and must contain a minimum number of plants of at least two identified bioindicator species (U.S. Department of Agriculture Forest Service 2004a). Plants are evaluated for ozone injury, and voucher specimens are submitted to a regional expert for verification of ozone-induced foliar injury.

Due to budgetary constraints only four-fifths of the P3 data were collected in the 2011 survey. As a result, the number of plots and the comparability of data across surveys were reduced.

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.

Appendix B—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 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 use of nationally standardized field manuals, use of portable data recorders, thorough entry-level training, periodic review training, supervision, use of check plots, editing checks, and an emphasis on careful work. Additionally, data quality is assessed and documented by 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.2, and B.3 show the results of various blind checks for Virginia.

Rich cove forest above Apple Orchard Falls, Apple Orchard Mountain (USFS), Botetourt County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

Table B.1—Results of plot- and condition-level blind checks for Virginia and the Southern Region, 2011

Variable	Virginia	Southern Region	Virginia	Southern Region
	number of observations		*percent within tolerance*	
Plot variables				
Plot status	16	349	100.0	99.1
Distance to road	13	301	69.2	73.8
Water on plot	13	301	76.9	85.4
Latitude/longitude	16	299	93.8	99.7
Plot in correct county	16	309	100.0	100.0
Plot accessibility	16	349	56.3	81.1
Condition variables				
Condition status	26	609	100.0	100.0
Reserved status	15	428	100.0	99.5
Owner group	15	428	100.0	99.3
Forest type	15	427	86.7	84.1
Forest-type group	15	427	86.7	91.3
Stand-size class	15	428	80.0	86.5
Regeneration status	15	428	100.0	96.5
Tree density	15	428	100.0	99.8
Artificial regeneration species	4	66	100.0	98.5
Owner class	15	428	100.0	95.3
Private owner industrial status	15	371	100.0	98.1
Stand age	15	427	66.7	63.5
Disturbance 1	15	428	100.0	91.1
Treatment 1	15	428	100.0	97.9
Treatment year 1	2	59	100.0	94.9
Treatment 2	2	59	100.0	89.8
Treatment year 2	1	20	100.0	90.0
Treatment 3	1	20	100.0	90.0
Treatment year 3	1	9	100.0	100.0
Physiographic class	15	428	86.7	86.5
Present land use	15	428	100.0	99.3
Total acres	15	341	100.0	93.6
Percent forest	15	319	100.0	86.2
Stand structure	15	428	100.0	90.0
Operability	15	428	80.0	83.6
Site class	15	428	93.3	79.9
Fire	15	428	100.0	97.9
Grazing	15	428	100.0	98.4
Subplot variables				
Subplot center condition	64	1,396	93.8	96.8
Microplot center condition	60	1,350	100.0	100.0
Subplot sope	17	669	100.0	98.1
Subplot aspect	17	669	76.5	84.2
Snow/water depth	17	669	100.0	99.3
Boundary variables				
Existence of change	6	111	66.7	84.7
Boundary change	3	38	33.3	86.8
Contrasting condition	6	130	100.0	93.9
Left azimuth	1	38	100.0	65.8
Right azimuth	1	38	100.0	65.8
Existence of corner	1	38	100.0	94.7
Boundary status	6	111	100.0	97.3

Table B.2—Results of various blind checks for Virginia and the Southern Region, 2011

Variable	Virginia	Southern Region	Virginia	Southern Region
	number of observations		*percent within tolerance*	
Tree variables				
Condition number	228	5,238	87.7	95.8
Azimuth	156	4,533	93.0	93.0
Horizontal distance	156	4,506	96.8	97.5
Present tree status	228	5,238	92.5	98.6
Reconcile	29	782	100.0	96.8
Standing dead	23	537	95.7	97.8
Species	228	5,238	97.8	96.9
Genus	228	5,238	99.1	99.1
Live d.b.h.	138	3,783	70.3	76.7
Sound dead d.b.h.	5	48	80.0	75.0
Number of d.r.c. stems	9	329	100.0	95.7
Diameter root collar	9	329	77.8	89.7
Total length	146	4,094	78.1	83.8
Live tree actual length	1	60	100.0	83.3
Dead tree actual length	2	112	0.0	73.2
Crown class	146	4,094	80.1	84.6
Compacted crown ratio	146	4,085	80.8	84.7
Cause of death	1	82	0.0	70.7
Mortality year	1	82	100.0	76.8
Decay class	23	537	95.7	98.9
Tree class	115	3,302	92.2	92.6
Tree grade	31	867	77.4	73.5
Board foot cull	31	867	83.9	81.1
Dieback incidence	89	2,784	100.0	100.0
Utilization class	41	470	46.3	92.8
Seedling variables				
Species	48	1,186	97.9	90.5
Genus	48	1,186	97.9	98.4
Count	48	1,186	70.8	69.6
Invasive cover	10	274	90.0	64.2

d.b.h. = diameter at breast height; d.r.c. = diameter at root collar.

Table B.3—Results of various blind checks for Virginia and the Southern Region, 2011

Variable	Virginia	Southern Region	Virginia	Southern Region	Virginia	Southern Region
	observations found by both		*observations found by just cruiser*		*observations found by just QA*	
Missing/extra tree/ seedling report						
Trees	230	5,302	0	37	2	46
Seedlings	48	1,186	7	160	3	220
Invasives						
Invasive species	10	274	23	303	4	114

QA = quality assurance.

Montane alluvial forest along Laurel Fork, Allegheny Mountain, Highland County, VA. (photo © Virginia Natural Heritage Program, Gary P. Fleming)

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.4)

The size of the sampling error generally increases as the size of the area examined decreases. Also, 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

Table B.4—Statistical reliability for Virginia, 2011

Item	Sample estimate and 68.27-percent confidence interval	Sampling error
		percent
Forest land (*1,000 acres*)		
State	15,907.0 ± 103.4	0.65
Coastal Plain	3,704.0 ± 56.7	1.53
Southern Piedmont	3,791.3 ± 48.1	1.27
Northern Piedmont	2,518.0 ± 42.8	1.70
Northern Mountains	2,778.4 ± 35.6	1.28
Southern Mountains	3,115.3 ± 44.5	1.43
All-live volume on forest land[a] *(million cubic feet)*		
Inventory	35,167.5 ± 453.7	1.29
Softwoods	8,088.6 ± 255.6	3.16
Hardwoods	27,079.0 ± 419.7	1.55
Growth, removals, and mortality[a] *(million cubic feet)*		
Net annual growth	1,037.1 ± 25.8	2.49
Softwoods	383.6 ± 18.0	4.69
Hardwoods	653.5 ± 19.3	2.95
Annual removals	544.9 ± 38.8	7.12
Softwoods	274.0 ± 26.7	9.75
Hardwoods	270.9 ± 24.1	8.90
Annual mortality	302.1 ± 12.6	4.16
Softwoods	101.4 ± 7.0	6.88
Hardwoods	200.7 ± 10.6	5.26

[a] Numbers in this table were run on a newer version of the data than this report is based on and therefore may not exactly match that in other tables.

specific post-defined strata the sampling error can be calculated by 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 in the Coastal Plain is computed as:

$$SE_S = 3.16 \left[\frac{\sqrt{8{,}088.55}}{\sqrt{3{,}318.37}} \right] = 4.93$$

Thus, the estimated sampling error is 4.93 percent, and the resulting 68.27-percent confidence interval for softwood live-tree volume in the Coastal Plain is 3,318.37 ± 163.71 million cubic feet.

Mushrooms (*Amanita muscaria* var. *formosa*), near Kents Store, Fluvanna County, VA. (photo © Gary P. Fleming)

Table C.1—Area by survey unit and land status, Virginia, 2011

Survey unit	Total area[a]	All forest	Unreserved			Reserved			Nonforest land	Census water
			Total	Timberland	Unproductive	Total	Productive	Unproductive		
	thousand acres									
Coastal Plain	8,160.5	3,704.0	3,629.5	3,629.5	0.0	74.6	74.6	0.0	2,577.6	1,878.8
Southern Piedmont	5,680.4	3,791.3	3,775.2	3,775.2	0.0	16.1	16.1	0.0	1,796.4	92.7
Northern Piedmont	4,444.2	2,518.0	2,378.3	2,378.3	0.0	139.7	139.7	0.0	1,858.4	67.8
Northern Mountains	4,302.9	2,778.4	2,662.5	2,650.3	12.2	116.0	116.0	0.0	1,506.4	18.0
Southern Mountains	4,787.4	3,115.3	3,062.1	3,038.5	23.6	53.2	47.0	6.1	1,657.0	15.1
All survey units	27,375.4	15,907.0	15,507.6	15,471.8	35.8	399.4	393.3	6.1	9,395.9	2,072.5

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] Includes census water.

Table C.2—Area of forest land by ownership class and land status, Virginia, 2011

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Unproductive	Total	Productive	Unproductive
	thousand acres						
U.S. Forest Service							
National forest	1,761.3	1,696.9	1,678.6	18.3	64.4	58.3	6.1
Total	1,761.3	1,696.9	1,678.6	18.3	64.4	58.3	6.1
Other Federal							
National Park Service	215.3	0.0	0.0	0.0	215.3	215.3	0.0
U.S. Fish and Wildlife Service	90.3	28.5	28.5	0.0	61.8	61.8	0.0
Dept. of Defense/Dept. of Energy	156.1	156.1	156.1	0.0	0.0	0.0	0.0
Other Federal	57.3	57.3	57.3	0.0	0.0	0.0	0.0
Total	519.0	241.9	241.9	0.0	277.1	277.1	0.0
State and local government							
State	354.4	320.1	320.1	0.0	34.3	34.3	0.0
Local	239.4	215.7	215.7	0.0	23.7	23.7	0.0
Other non-Federal public	1.6	1.6	1.6	0.0	0.0	0.0	0.0
Total	595.3	537.4	537.4	0.0	57.9	57.9	0.0
Forest industry							
Total	195.8	195.8	195.8	0.0	0.0	0.0	0.0
Nonindustrial private							
Total	12,835.6	12,835.6	12,818.1	17.5	0.0	0.0	0.0
All classes	15,907.0	15,507.6	15,471.8	35.8	399.4	393.3	6.1

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

Table C.3—Area of forest land by forest-type group and site productivity class, Virginia, 2011

Forest-type group	All classes	Site productivity class (*cubic feet per acre per year*) 0–19	20–49	50–84	85–119	120–164	165–224	225+
				thousand acres				
Softwood types								
White-red-jack pine	168.2	0.0	15.0	44.6	15.6	93.0	0.0	0.0
Spruce-fir	7.6	0.0	6.1	0.0	1.5	0.0	0.0	0.0
Loblolly-shortleaf pine	2,933.2	7.6	128.1	1,207.2	940.4	465.0	179.2	5.7
Other eastern softwoods	87.8	0.0	24.4	51.3	12.2	0.0	0.0	0.0
Total softwoods	3,196.9	7.6	173.7	1,303.0	969.7	558.0	179.2	5.7
Hardwood types								
Oak-pine	1,696.4	0.0	268.3	750.4	379.9	191.8	99.8	6.1
Oak-hickory	9,705.0	27.0	2,340.5	4,800.1	1,855.7	532.7	141.7	7.2
Oak-gum-cypress	378.8	0.0	127.5	130.8	72.9	25.6	20.6	1.4
Elm-ash-cottonwood	397.1	0.0	52.9	199.1	110.0	32.2	0.0	2.8
Maple-beech-birch	359.3	4.1	83.6	170.7	73.2	27.7	0.0	0.0
Aspen-birch	4.3	0.0	0.0	2.6	0.0	1.6	0.0	0.0
Other hardwoods	42.7	0.0	6.1	21.2	10.9	4.5	0.0	0.0
Exotic hardwoods	33.4	0.0	0.0	22.5	10.8	0.0	0.0	0.0
Total hardwoods	12,616.9	31.1	2,878.9	6,097.5	2,513.5	816.2	262.1	17.6
Nonstocked	93.3	3.2	18.8	32.6	32.6	6.1	0.0	0.0
All groups	15,907.0	41.9	3,071.5	7,433.1	3,515.7	1,380.3	441.2	23.3

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

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

Table C.4—Area of forest land by forest-type group and ownership group, Virginia, 2011

Forest-type group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Non-industrial private
	thousand acres					
Softwood types						
White-red-jack pine	168.2	43.6	4.1	6.1	1.0	113.5
Spruce-fir	7.6	0.0	0.0	6.1	0.0	1.5
Loblolly-shortleaf pine	2,933.2	48.3	72.4	58.9	102.5	2,651.1
Other eastern softwoods	87.8	0.0	0.0	1.5	0.0	86.3
Total softwoods	3,196.9	91.9	76.4	72.6	103.5	2,852.4
Hardwood types						
Oak-pine	1,696.4	177.0	77.0	71.8	31.6	1,339.1
Oak-hickory	9,705.0	1,413.9	299.6	351.3	46.1	7,594.1
Oak-gum-cypress	378.8	0.0	58.6	27.2	8.7	284.3
Elm-ash-cottonwood	397.1	0.0	4.4	38.8	4.4	349.5
Maple-beech-birch	359.3	70.8	0.0	21.0	0.0	267.5
Aspen-birch	4.3	0.0	0.0	0.0	0.0	4.3
Other hardwoods	42.7	6.1	0.0	0.0	1.5	35.0
Exotic hardwoods	33.4	0.0	0.0	6.3	0.0	27.0
Total hardwoods	12,616.9	1,667.8	439.6	516.3	92.3	9,900.8
Nonstocked	93.3	1.6	2.9	6.4	0.0	82.4
All groups	15,907.0	1,761.3	519.0	595.3	195.8	12,835.6

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.5—Area of forest land by forest-type group and stand-size class, Virginia, 2011

Forest-type group	All size classes	Stand-size class: Large diameter	Medium diameter	Small diameter	Non-stocked
		thousand acres			
Softwood types					
White-red-jack pine	168.2	125.4	25.6	17.2	0.0
Spruce-fir	7.6	7.6	0.0	0.0	0.0
Loblolly-shortleaf pine	2,933.2	1,229.1	1,075.1	629.1	0.0
Other eastern softwoods	87.8	15.3	32.7	39.8	0.0
Total softwoods	3,196.9	1,377.4	1,133.4	686.1	0.0
Hardwood types					
Oak-pine	1,696.4	894.1	428.5	373.7	0.0
Oak-hickory	9,705.0	6,874.8	1,804.2	1,025.9	0.0
Oak-gum-cypress	378.8	277.0	51.5	50.2	0.0
Elm-ash-cottonwood	397.1	262.3	75.7	59.0	0.0
Maple-beech-birch	359.3	295.4	36.4	27.6	0.0
Aspen-birch	4.3	0.0	4.3	0.0	0.0
Other hardwoods	42.7	21.4	13.6	7.6	0.0
Exotic hardwoods	33.4	0.0	10.5	22.9	0.0
Total hardwoods	12,616.9	8,625.1	2,424.8	1,567.0	0.0
Nonstocked	93.3	0.0	0.0	0.0	93.3
All groups	15,907.0	10,002.5	3,558.2	2,253.1	93.3

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

Table C.6—Area of forest land by forest-type group and stand-age class, Virginia, 2011

Forest-type group	All classes	Stand-age class (*years*) 1–20	21–40	41–60	61–80	81–100	101–120	121–140	141–160	161–180	181–200	201+	Non-stocked
						thousand acres							
Softwood types													
White-red-jack pine	168.2	38.3	56.8	41.1	14.1	17.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spruce-fir	7.6	0.0	1.5	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	2,933.2	1,255.9	1,083.5	330.2	200.7	36.7	14.8	0.0	0.0	0.0	0.0	0.0	11.4
Other eastern softwoods	87.8	36.6	35.9	13.8	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	3,196.9	1,330.8	1,177.7	385.0	216.3	60.8	14.8	0.0	0.0	0.0	0.0	0.0	11.4
Hardwood types													
Oak-pine	1,696.4	439.4	398.0	297.0	303.5	192.0	40.8	10.3	6.1	0.0	0.0	0.0	9.5
Oak-hickory	9,705.0	1,371.3	1,279.3	1,752.3	2,395.5	2,036.0	675.3	141.0	40.4	0.0	0.0	0.0	13.9
Oak-gum-cypress	378.8	45.2	34.2	86.9	125.3	72.3	14.8	0.0	0.0	0.0	0.0	0.0	0.0
Elm-ash-cottonwood	397.1	63.2	93.6	112.9	85.6	35.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0
Maple-beech-birch	359.3	25.3	44.9	106.1	63.3	59.8	24.4	23.9	6.1	0.0	0.0	0.0	5.4
Aspen-birch	4.3	0.0	1.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	42.7	1.4	13.9	9.1	2.9	12.3	3.2	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	33.4	27.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	12,616.9	1,972.8	1,872.0	2,367.0	2,976.1	2,407.3	765.1	175.1	52.6	0.0	0.0	0.0	28.8
Nonstocked	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.3
All groups	15,907.0	3,303.6	3,049.7	2,752.0	3,192.4	2,468.1	780.0	175.1	52.6	0.0	0.0	0.0	133.5

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

Table C.7—Area of forest land by forest-type group and stand origin, Virginia, 2011

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	thousand acres		
Softwood types			
White-red-jack pine	168.2	125.5	42.7
Spruce-fir	7.6	6.1	1.5
Loblolly-shortleaf pine	2,933.2	940.7	1,992.6
Other eastern softwoods	87.8	87.8	0.0
Total softwoods	3,196.9	1,160.1	2,036.8
Hardwood types			
Oak-pine	1,696.4	1,445.0	251.4
Oak-hickory	9,705.0	9,480.5	224.5
Oak-gum-cypress	378.8	368.4	10.4
Elm-ash-cottonwood	397.1	395.6	1.4
Maple-beech-birch	359.3	352.1	7.2
Aspen-birch	4.3	4.3	0.0
Other hardwoods	42.7	41.3	1.4
Exotic hardwoods	33.4	25.6	7.8
Total hardwoods	12,616.9	12,112.8	504.1
Nonstocked	93.3	75.8	17.5
All groups	15,907.0	13,348.7	2,558.3

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

Table C.8—Area of forest land disturbed annually by forest-type group and disturbance class, Virginia, 2011

Forest-type group	Disturbance class							
	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
	thousand acres							
Softwood types								
White-red-jack pine	1.4	0.0	0.3	0.4	0.8	0.0	0.3	1.4
Spruce-fir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	7.4	0.0	11.9	0.3	6.3	4.3	18.3	3.5
Other eastern softwoods	0.0	0.0	1.5	0.0	0.0	0.0	0.4	1.5
Total softwoods	8.7	0.0	13.7	0.6	7.2	4.3	19.0	6.3
Hardwood types								
Oak-pine	5.5	0.0	2.0	2.0	3.8	0.6	10.6	7.7
Oak-hickory	52.7	3.0	22.3	14.1	27.9	10.6	55.1	24.7
Oak-gum-cypress	0.0	0.0	7.6	0.0	0.0	4.8	1.0	1.4
Elm-ash-cottonwood	0.0	0.0	2.6	0.0	0.0	1.6	0.0	1.1
Maple-beech-birch	4.2	0.0	1.3	0.0	1.3	0.0	1.6	0.0
Aspen-birch	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Other hardwoods	0.0	0.0	0.0	0.0	1.8	0.0	0.6	0.0
Exotic hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Total hardwoods	62.4	3.0	35.9	17.7	34.9	17.5	69.2	35.0
Nonstocked	0.0	0.0	1.5	0.0	0.4	0.7	0.0	0.0
All groups	71.1	3.0	51.1	18.3	42.4	22.5	88.2	41.3

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

Table C.9—Area of forest land treated annually by forest-type group and treatment class, Virginia, 2011

Forest-type group	Treatment class										
		Cutting									
	Total treated	Final harvest	Partial harvest	Seed tree/ shelter-wood harvest	Com-mercial thinning	Timber stand improve-ment	Salvage cutting	Site prepa-ration	Artificial regen-eration	Natural regen-eration	Other silvi-cultural
	thousand acres										
Softwood types											
White-red-jack pine	2.3	1.9	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.6	0.0
Spruce-fir	1.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	114.6	46.6	13.4	2.8	50.3	1.5	0.0	8.2	49.2	14.4	7.4
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	118.1	48.5	14.6	2.8	50.7	1.5	0.0	8.2	49.2	16.0	7.4
Hardwood types											
Oak-pine	23.3	16.4	6.6	0.0	0.2	0.0	0.0	4.4	11.5	9.9	5.3
Oak-hickory	90.6	39.5	42.6	2.0	1.5	2.7	2.3	8.9	26.7	21.2	9.0
Oak-gum-cypress	2.9	1.7	0.0	1.1	0.1	0.0	0.0	0.0	0.0	1.7	0.0
Elm-ash-cottonwood	3.3	1.7	1.6	0.0	0.0	0.0	0.0	2.3	2.3	1.3	1.2
Maple-beech-birch	3.7	1.3	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Total hardwoods	124.1	60.9	53.3	3.1	1.8	2.7	2.3	15.6	41.2	34.1	15.5
Nonstocked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.6
All groups	242.2	109.4	67.8	5.9	52.6	4.2	2.3	23.8	93.0	50.2	23.6

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.10—Number of live trees on forest land by species group and diameter class, Virginia, 2011

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																
Loblolly and shortleaf pines	1,250.2	465.8	271.0	189.8	152.9	86.8	45.6	20.5	9.4	4.6	1.9	1.5	0.3	0.0	0.0	0.0
Other yellow pines	523.6	242.4	127.1	54.2	40.2	28.9	18.7	7.7	3.0	1.1	0.3	0.0	0.0	0.0	0.0	0.0
Eastern white and red pines	179.4	86.9	32.3	19.6	14.5	8.8	5.8	4.1	2.8	1.7	1.2	1.0	0.3	0.3	0.0	0.0
Spruce and fir	5.2	0.9	2.2	0.3	0.6	0.1	0.2	0.4	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Eastern hemlock	41.1	17.7	7.3	6.3	3.9	2.3	1.2	1.1	0.4	0.4	0.2	0.2	0.1	0.0	0.0	0.0
Cypress	3.7	1.3	1.3	0.2	0.1	0.1	0.0	0.1	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0
Other eastern softwoods	266.9	181.2	45.3	21.3	10.4	4.8	2.0	1.1	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Total softwoods	2,270.1	996.3	486.5	291.8	222.6	131.9	73.5	35.1	16.2	8.3	3.8	3.0	0.8	0.4	0.0	0.1
Hardwood																
Select white oaks	427.0	196.6	71.1	38.7	32.1	22.9	19.5	15.4	11.6	8.6	4.6	4.2	1.1	0.3	0.3	0.1
Select red oaks	157.2	73.7	16.8	12.7	11.1	9.1	7.8	6.5	5.2	4.5	3.0	4.1	1.6	0.6	0.3	0.2
Other white oaks	382.1	99.6	64.0	50.7	46.2	37.8	27.8	20.2	14.6	8.3	5.6	4.6	1.7	0.5	0.3	0.0
Other red oaks	549.5	305.8	75.6	43.2	32.6	28.6	20.1	15.3	11.0	6.7	4.3	4.0	1.5	0.4	0.1	0.1
Hickory	418.7	242.8	62.2	37.1	25.7	18.4	12.0	8.4	5.7	3.3	1.7	1.1	0.3	0.1	0.0	0.0
Yellow birch	10.9	5.9	1.8	0.9	0.5	0.9	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	166.2	106.7	27.6	11.4	6.9	4.7	3.4	2.2	1.6	0.9	0.2	0.5	0.0	0.1	0.0	0.0
Soft maple	1,409.3	937.9	236.5	97.8	57.1	32.9	20.1	11.5	6.5	4.3	1.9	1.6	0.9	0.3	0.0	0.0
Beech	240.9	153.9	45.4	14.6	8.7	5.8	3.7	2.9	1.9	1.3	0.9	1.1	0.4	0.1	0.0	0.0
Sweetgum	761.1	526.4	131.9	46.0	22.8	12.9	8.5	5.7	3.2	2.0	0.9	0.8	0.1	0.0	0.0	0.0
Tupelo and blackgum	671.7	492.2	109.6	33.8	14.5	8.6	5.2	3.1	2.0	1.2	0.8	0.5	0.3	0.0	0.0	0.0
Ash	187.7	115.1	27.4	15.3	9.6	7.0	5.2	3.2	2.0	1.4	0.8	0.5	0.1	0.1	0.0	0.0
Cottonwood and aspen	12.9	8.9	2.2	0.4	0.8	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Basswood	21.9	8.6	3.0	2.7	2.1	1.6	0.9	0.9	0.7	0.5	0.5	0.4	0.0	0.0	0.0	0.0
Yellow-poplar	899.3	525.5	131.3	65.4	45.4	34.9	25.6	21.2	19.0	12.2	7.8	7.1	2.8	0.8	0.2	0.1
Black walnut	21.1	5.0	3.2	3.7	2.8	2.1	1.4	1.3	0.9	0.4	0.2	0.1	0.1	0.0	0.0	0.0
Other eastern soft hardwoods	664.1	432.9	121.2	46.1	25.8	14.2	9.5	5.5	3.8	2.1	1.3	0.9	0.2	0.2	0.0	0.1
Other eastern hard hardwoods	985.3	746.2	154.5	40.3	20.0	10.7	6.2	3.9	1.8	0.7	0.6	0.3	0.1	0.0	0.0	0.0
Eastern noncommercial hardwoods	1,226.6	932.7	202.7	54.4	22.7	8.2	2.9	1.7	0.8	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Total hardwoods	9,213.4	5,916.3	1,488.1	615.2	387.8	261.7	180.0	129.2	92.4	58.8	35.3	31.7	11.3	3.5	1.2	0.7
All species	11,483.5	6,912.6	1,974.6	907.0	610.4	393.6	253.5	164.3	108.6	67.1	39.1	34.8	12.1	3.9	1.2	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.11—Net[a] volume of live trees on forest land by ownership class and land status, Virginia, 2011

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
	million cubic feet						
U.S. Forest Service							
National forest	4,166.4	4,032.2	4,006.2	26.0	134.3	125.5	8.8
Total	4,166.4	4,032.2	4,006.2	26.0	134.3	125.5	8.8
Other Federal							
National Park Service	539.1	0.0	0.0	0.0	539.1	539.1	0.0
U.S. Fish and Wildlife Service	223.5	80.6	80.6	0.0	142.9	142.9	0.0
Dept. of Defense/Dept. of Energy	545.7	545.7	545.7	0.0	0.0	0.0	0.0
Other Federal	160.5	160.5	160.5	0.0	0.0	0.0	0.0
Total	1,468.8	786.8	786.8	0.0	682.0	682.0	0.0
State and local government							
State	867.9	753.1	753.1	0.0	114.8	114.8	0.0
Local	592.3	531.0	531.0	0.0	61.4	61.4	0.0
Other non-Federal public	8.8	8.8	8.8	0.0	0.0	0.0	0.0
Total	1,469.1	1,292.9	1,292.9	0.0	176.1	176.1	0.0
Forest industry							
Total	301.1	301.1	301.1	0.0	0.0	0.0	0.0
Nonindustrial private							
Total	27,762.0	27,762.0	27,749.4	12.6	0.0	0.0	0.0
All classes	35,167.5	34,175.1	34,136.5	38.6	992.4	983.6	8.8

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 ownership group, Virginia, 2011

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Non-industrial private
	million cubic feet					
Softwood						
Loblolly and shortleaf pines	5,068.7	5.9	208.9	134.7	136.3	4,582.9
Other yellow pines	1,640.4	228.9	78.6	73.8	15.5	1,243.5
Eastern white and red pines	887.5	250.2	25.6	11.9	9.2	590.6
Spruce and fir	42.8	14.6	0.0	14.8	0.0	13.4
Eastern hemlock	168.7	36.7	0.9	6.9	1.8	122.5
Cypress	63.7	0.0	4.1	0.1	0.0	59.4
Other eastern softwoods	216.8	0.0	4.1	16.4	0.9	195.4
Total softwoods	8,088.5	536.2	322.2	258.7	163.7	6,807.7
Hardwood						
Select white oaks	3,250.9	246.3	81.9	130.5	9.6	2,782.5
Select red oaks	1,815.5	523.2	143.6	80.6	0.8	1,067.3
Other white oaks	3,372.8	1,252.8	116.6	124.4	15.6	1,863.4
Other red oaks	2,967.3	455.1	101.9	109.2	12.0	2,289.1
Hickory	1,595.6	126.9	54.4	63.2	10.8	1,340.4
Yellow birch	34.3	20.9	0.0	2.2	0.0	11.2
Hard maple	423.3	85.2	4.2	25.5	2.2	306.2
Soft maple	2,357.8	268.0	161.6	107.9	7.1	1,813.3
Beech	619.0	11.5	11.6	43.5	4.0	548.4
Sweetgum	1,190.2	0.0	105.8	39.2	3.6	1,041.6
Tupelo and blackgum	636.2	54.8	50.2	49.8	25.7	455.7
Ash	622.9	30.7	30.5	34.3	0.0	527.5
Cottonwood and aspen	25.1	0.0	0.0	0.1	0.0	25.1
Basswood	206.5	47.0	18.5	31.2	0.0	109.7
Yellow-poplar	5,571.6	293.6	196.0	240.5	27.3	4,814.2
Black walnut	164.4	0.7	0.1	6.6	2.3	154.7
Other eastern soft hardwoods	1,158.0	79.8	34.3	67.7	13.1	963.2
Other eastern hard hardwoods	640.1	89.1	27.1	26.4	0.4	497.1
Eastern noncommercial hardwoods	427.3	44.7	8.4	27.4	3.0	343.8
Total hardwoods	27,079.0	3,630.2	1,146.7	1,210.3	137.5	20,954.3
All species	35,167.5	4,166.4	1,468.8	1,469.1	301.1	27,762.0

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.13—Aboveground dry weight of live trees on forest land by ownership class and land status, Virginia, 2011

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
	thousand tons						
U.S. Forest Service							
National forest	115,458.5	111,415.1	110,642.9	772.2	4,043.3	3,765.2	278.1
Total	115,458.5	111,415.1	110,642.9	772.2	4,043.3	3,765.2	278.1
Other Federal							
National Park Service	14,383.7	0.0	0.0	0.0	14,383.7	14,383.7	0.0
U.S. Fish and Wildlife Service	5,678.1	1,974.2	1,974.2	0.0	3,703.9	3,703.9	0.0
Dept. of Defense/Dept. of Energy	14,007.0	14,007.0	14,007.0	0.0	0.0	0.0	0.0
Other Federal	4,044.4	4,044.4	4,044.4	0.0	0.0	0.0	0.0
Total	38,113.2	20,025.7	20,025.7	0.0	18,087.6	18,087.6	0.0
State and local government							
State	23,356.1	20,321.8	20,321.8	0.0	3,034.3	3,034.3	0.0
Local	15,452.4	13,784.2	13,784.2	0.0	1,668.2	1,668.2	0.0
Other non-Federal public	204.4	204.4	204.4	0.0	0.0	0.0	0.0
Total	39,012.9	34,310.4	34,310.4	0.0	4,702.5	4,702.5	0.0
Forest industry							
Total	8,579.1	8,579.1	8,579.1	0.0	0.0	0.0	0.0
Nonindustrial private							
Total	746,880.5	746,880.5	746,462.9	417.7	0.0	0.0	0.0
All classes	948,044.2	921,210.8	920,020.9	1,189.8	26,833.4	26,555.3	278.1

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.14—Total carbon[a] of live trees on forest land by ownership class and land status, Virginia, 2011

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Un-productive	Total	Productive	Un-productive
	thousand tons						
U.S. Forest Service							
National forest	57,729.2	55,707.6	55,321.5	386.1	2,021.7	1,882.6	139.1
Total	57,729.2	55,707.6	55,321.5	386.1	2,021.7	1,882.6	139.1
Other Federal							
National Park Service	7,191.8	0.0	0.0	0.0	7,191.8	7,191.8	0.0
U.S. Fish and Wildlife Service	2,839.1	987.1	987.1	0.0	1,852.0	1,852.0	0.0
Dept. of Defense/Dept. of Energy	7,003.5	7,003.5	7,003.5	0.0	0.0	0.0	0.0
Other Federal	2,022.2	2,022.2	2,022.2	0.0	0.0	0.0	0.0
Total	19,056.6	10,012.8	10,012.8	0.0	9,043.8	9,043.8	0.0
State and local government							
State	11,678.0	10,160.9	10,160.9	0.0	1,517.1	1,517.1	0.0
Local	7,726.2	6,892.1	6,892.1	0.0	834.1	834.1	0.0
Other non-Federal public	102.2	102.2	102.2	0.0	0.0	0.0	0.0
Total	19,506.4	17,155.2	17,155.2	0.0	2,351.2	2,351.2	0.0
Forest industry							
Total	4,289.5	4,289.5	4,289.5	0.0	0.0	0.0	0.0
Nonindustrial private							
Total	373,440.3	373,440.3	373,231.4	208.8	0.0	0.0	0.0
All classes	474,022.1	460,605.4	460,010.5	594.9	13,416.7	13,277.6	139.1

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] Estimates of carbon calculated by multiplying aboveground dry tree biomass by 0.5.

Table C.15—Average annual growth of live trees by ownership class and land status, Virginia, 2011

Ownership class	Land status	
	Timberland	Forest land
	million cubic feet	
U.S. Forest Service		
National forest	87.6	73.1
Total	87.6	73.1
Other Federal		
National Park Service	0.2	10.9
U.S. Fish and Wildlife Service	20.8	-3.0
Dept. of Defense/Dept. of Energy	5.2	5.2
Other Federal	2.4	2.4
Total	28.5	15.5
State and local government		
State	22.4	20.4
Local	9.4	10.8
Other non-Federal public	0.3	0.3
Total	32.0	31.4
Forest industry		
Total	20.2	20.2
Nonindustrial private		
Total	902.6	896.9
All classes	1,070.8	1,037.0

Table C.16—Average annual removals of live trees by ownership class and land status, Virginia, 2011

Ownership class	Land status	
	Timberland	Forest land
	million cubic feet	
U.S. Forest Service		
National forest	11.3	4.6
Total	11.3	4.6
Other Federal		
National Park Service	3.1	0.3
U.S. Fish and Wildlife Service	0.0	2.1
Dept. of Defense/Dept. of Energy	3.5	3.5
Other Federal	0.7	0.7
Total	7.3	6.6
State and local government		
State	6.9	6.9
Local	2.0	2.0
Total	8.9	8.9
Forest industry		
Total	22.9	22.9
Nonindustrial private		
Total	502.1	502.1
All classes	552.4	545.0

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

Table C.17—Average annual mortality of live trees by ownership class and land status, Virginia, 2011

Ownership class	Land status	
	Timberland	Forest land
	million cubic feet	
U.S. Forest Service		
National forest	24.4	28.9
Total	24.4	28.9
Other Federal		
National Park Service	0.0	3.5
U.S. Fish and Wildlife Service	0.0	8.6
Dept. of Defense/Dept. of Energy	7.8	7.8
Other Federal	1.9	1.9
Total	9.7	21.8
State and local government		
State	5.5	6.1
Local	7.0	7.3
Total	12.5	13.5
Forest industry		
Total	2.3	2.3
Nonindustrial private		
Total	235.3	235.7
All classes	284.1	302.2

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

Table C.18a—Area of sampled land and water by county code, name, and land class, Virginia, 2011

County code and name	Total	Land class			
		Accessible forest	Non-forest	Non-census water	Census water
		acres			
51001 Accomack	894,312	106,593	216,333	—	571,386
51003 Albemarle	493,116	290,073	199,691	3,351	—
51005 Alleghany	295,371	252,526	41,253	1,592	—
51007 Amelia	224,660	156,845	64,944	2,870	—
51009 Amherst	309,013	239,535	69,479	—	—
51011 Appomattox	214,054	125,537	86,309	2,208	—
51013 Arlington	11,152	—	11,152	—	—
51015 Augusta	625,858	339,779	286,079	—	—
51017 Bath	365,416	316,180	43,276	—	5,961
51019 Bedford	494,751	292,521	185,279	5,741	11,209
51021 Bland	239,373	179,521	59,851	—	—
51023 Botetourt	342,937	245,688	91,142	—	6,106
51025 Brunswick	353,798	266,075	87,723	—	—
51027 Buchanan	336,466	290,484	45,982	—	—
51029 Buckingham	375,492	314,008	60,091	1,393	—
51031 Campbell	352,483	230,894	120,129	1,460	—
51033 Caroline	322,326	241,552	76,897	3,877	—
51035 Carroll	325,910	192,501	128,529	1,361	3,519
51036 Charles City	138,557	90,787	39,544	—	8,226
51037 Charlotte	294,464	219,533	71,321	—	3,610
51041 Chesterfield	311,783	153,705	146,124	1,870	10,084
51043 Clarke	112,164	30,128	82,035	—	—
51045 Craig	206,477	154,759	51,718	—	—
51047 Culpeper	229,859	100,944	122,364	6,552	—
51049 Cumberland	190,990	114,247	62,507	4,542	9,695
51051 Dickenson	236,770	201,410	35,361	—	—
51053 Dinwiddie	303,227	226,940	74,862	—	1,426
51057 Essex	166,907	88,409	71,265	—	7,233
51059 Fairfax	273,472	84,370	189,102	—	—
51061 Fauquier	427,562	218,257	208,998	307	—
51063 Floyd	241,170	122,348	118,823	—	—
51065 Fluvanna	164,041	100,133	56,892	—	7,016
51067 Franklin	459,879	263,417	192,938	—	3,524
51069 Frederick	263,437	155,659	107,778	—	—
51071 Giles	245,503	194,886	47,099	—	3,519
51073 Gloucester	196,007	88,055	42,685	7,233	58,035
51075 Goochland	175,766	110,916	63,212	—	1,638
51077 Grayson	284,239	162,182	117,020	1,519	3,519
51079 Greene	110,713	74,474	34,672	1,567	—
51081 Greensville	171,903	125,411	40,409	6,083	—
51083 Halifax	531,481	370,917	150,869	—	9,695
51085 Hanover	286,203	186,698	98,079	—	1,426
51087 Henrico	181,415	54,239	123,784	1,426	1,966

continued

Table C.18a—Area of sampled land and water by county code, name, and land class, Virginia, 2011 (continued)

County code and name	Total	Land class			
		Accessible forest	Non-forest	Non-census water	Census water
		acres			
51089 Henry	270,787	195,607	67,909	—	7,271
51091 Highland	290,143	220,714	69,429	—	—
51093 Isle of Wight	224,677	110,469	101,272	—	12,935
51095 James City	130,746	58,955	57,325	—	14,465
51097 King and Queen	199,180	141,148	52,329	—	5,703
51099 King George	107,607	75,982	31,625	—	—
51101 King William	178,641	107,110	64,298	—	7,233
51103 Lancaster	134,841	45,671	51,457	1,549	36,164
51105 Lee	286,084	185,253	100,831	—	—
51107 Loudoun	340,655	113,951	224,642	2,062	—
51109 Louisa	338,093	198,694	117,177	3,276	18,946
51111 Lunenburg	281,059	243,546	37,514	—	—
51113 Madison	195,250	94,412	100,838	—	—
51115 Mathews	176,388	25,218	20,980	—	130,189
51117 Mecklenburg	437,655	290,935	129,824	—	16,896
51119 Middlesex	134,758	49,715	43,177	5,703	36,164
51121 Montgomery	261,977	163,346	98,631	—	—
51125 Nelson	301,372	254,599	45,135	1,638	—
51127 New Kent	123,887	84,812	24,992	8,658	5,425
51131 Northampton	572,869	25,639	137,941	—	409,288
51133 Northumberland	195,633	58,251	68,527	—	68,855
51135 Nottoway	196,104	146,581	49,523	—	—
51137 Orange	228,460	143,395	77,752	297	7,016
51139 Page	176,918	99,334	71,623	—	5,961
51141 Patrick	295,422	202,201	85,773	5,741	1,707
51143 Pittsylvania	658,466	376,840	271,931	—	9,695
51145 Powhatan	180,204	101,878	67,117	1,514	9,695
51147 Prince Edward	222,475	145,785	66,995	—	9,695
51149 Prince George	189,800	104,128	66,168	10,846	8,658
51153 Prince William	225,882	86,903	118,395	—	20,584
51155 Pulaski	214,836	131,476	80,720	—	2,639
51157 Rappahannock	197,346	135,890	61,456	—	—
51159 Richmond	149,383	79,524	48,161	—	21,698
51161 Roanoke	201,691	84,942	116,749	—	—
51163 Rockbridge	396,224	259,603	136,622	—	—
51165 Rockingham	557,084	352,529	202,596	1,958	—
51167 Russell	284,702	142,508	142,194	—	—
51169 Scott	341,749	246,628	90,083	5,037	—
51171 Shenandoah	329,598	189,848	138,370	1,381	—
51173 Smyth	289,827	191,046	98,781	—	—
51175 Southampton	363,434	245,124	111,077	—	7,233
51177 Spotsylvania	252,074	148,937	88,907	1,638	12,592

continued

Table C.18a—Area of sampled land and water by county code, name, and land class, Virginia, 2011 (continued)

County code and name	Total	Land class			
		Accessible forest	Non-forest	Non-census water	Census water
		acres			
51179 Stafford	170,394	122,513	47,881	—	—
51181 Surry	198,726	145,599	27,152	4,277	21,698
51183 Sussex	321,560	264,855	56,705	—	—
51185 Tazewell	314,981	224,978	88,484	—	1,519
51187 Warren	139,540	76,748	62,792	—	—
51191 Washington	362,543	209,910	151,100	1,532	—
51193 Westmoreland	158,223	90,488	58,012	1,065	8,658
51195 Wise	242,298	163,932	77,953	—	413
51197 Wythe	278,924	112,861	159,989	6,074	—
51199 York	201,016	43,969	39,897	—	117,149
51550 Chesapeake City	297,348	95,810	148,184	—	53,354
51650 Hampton City	88,487	1,288	43,802	—	43,396
51700 Newport News City	73,893	5,703	39,260	—	28,931
51800 Suffolk City	272,980	175,683	75,991	—	21,305
51810 Virginia Beach City	340,005	40,438	139,021	—	160,546
Total	27,375,378	15,907,041	9,276,669	119,198	2,072,470

— = no value for the cell.

Table C.18b—Sampling error for area of sampled land and water by county and land class, Virginia, 2011

County code and name	Total	Land class			
		Accessible forest	Non-forest	Non-census water	Census water
			percent		
51001 Accomack	7.21	22.57	15.49	—	8.53
51003 Albemarle	10.34	13.15	15.82	69.94	—
51005 Alleghany	13.75	14.55	34.53	112.19	—
51007 Amelia	16.02	18.63	28.51	102.21	—
51009 Amherst	13.31	14.63	25.80	—	—
51011 Appomattox	16.44	20.25	23.93	101.24	—
51013 Arlington	72.81	—	72.81	—	—
51015 Augusta	9.03	12.20	12.65	—	—
51017 Bath	12.20	12.88	34.13	—	112.19
51019 Bedford	10.55	13.22	16.42	102.21	71.42
51021 Bland	15.29	17.32	29.22	—	—
51023 Botetourt	12.70	14.84	23.90	—	109.55
51025 Brunswick	12.64	14.46	24.79	—	—
51027 Buchanan	12.73	13.25	27.08	—	—
51029 Buckingham	12.12	12.84	26.48	99.48	—
51031 Campbell	12.62	15.34	20.52	101.24	—
51033 Caroline	13.22	14.78	25.17	62.40	—
51035 Carroll	13.00	15.82	18.69	104.37	149.27
51036 Charles City	20.58	24.27	35.23	—	81.08
51037 Charlotte	13.88	15.54	25.39	—	99.48
51041 Chesterfield	13.56	18.37	19.03	81.86	68.50
51043 Clarke	22.73	43.02	26.11	—	—
51045 Craig	16.66	18.87	32.36	—	—
51047 Culpeper	15.63	23.39	20.91	95.27	—
51049 Cumberland	17.41	22.00	29.20	99.48	81.09
51051 Dickenson	15.33	16.28	35.14	—	—
51053 Dinwiddie	13.71	15.52	26.54	—	102.55
51057 Essex	18.76	25.14	27.87	—	91.13
51059 Fairfax	14.20	25.16	16.74	—	—
51061 Fauquier	11.16	15.46	15.44	97.38	—
51063 Floyd	15.29	20.88	21.14	—	—
51065 Fluvanna	18.68	22.60	29.21	—	96.50
51067 Franklin	10.91	13.82	16.01	—	71.79
51069 Frederick	14.69	18.65	22.02	—	—
51071 Giles	15.05	16.56	33.40	—	149.27
51073 Gloucester	17.28	24.81	34.49	91.13	31.68
51075 Goochland	18.00	22.01	28.63	—	95.27
51077 Grayson	13.98	17.55	20.43	98.78	149.27
51079 Greene	22.88	26.92	38.93	95.27	—
51081 Greensville	18.44	20.97	36.07	78.22	—
51083 Halifax	10.14	11.79	17.93	—	81.09
51085 Hanover	14.15	16.79	22.64	—	102.55
51087 Henrico	17.93	30.21	21.12	102.55	102.55

continued

Table C.18b—Sampling error for area of sampled land and water by county and land class, Virginia, 2011 (continued)

County code and name	Total	Land class			
		Accessible forest	Non-forest	Non-census water	Census water
		percent			
51089 Henry	14.57	16.78	28.27	—	81.09
51091 Highland	13.92	15.75	28.19	—	—
51093 Isle of Wight	16.09	21.98	22.81	—	68.12
51095 James City	21.25	30.98	31.35	—	64.31
51097 King and Queen	17.10	19.88	31.63	—	102.55
51099 King George	23.40	26.75	39.40	—	—
51101 King William	18.09	22.29	28.12	—	91.13
51103 Lancaster	20.94	32.83	31.29	98.51	40.43
51105 Lee	13.94	16.94	22.43	—	—
51107 Loudoun	12.60	21.20	15.00	77.19	—
51109 Louisa	12.75	15.97	20.32	95.27	52.91
51111 Lunenburg	14.17	15.00	35.76	—	—
51113 Madison	17.08	24.03	23.13	—	—
51115 Mathews	17.98	46.01	49.98	—	20.75
51117 Mecklenburg	11.27	13.38	19.58	—	58.72
51119 Middlesex	20.95	34.12	36.54	102.55	40.43
51121 Montgomery	14.62	18.32	23.57	—	—
51125 Nelson	13.40	14.31	34.79	95.27	—
51127 New Kent	21.83	25.10	43.42	77.98	91.13
51131 Northampton	9.33	46.12	19.83	—	10.79
51133 Northumberland	17.33	30.11	28.01	—	29.19
51135 Nottoway	17.21	19.47	32.05	—	—
51137 Orange	15.76	19.00	24.84	102.99	96.50
51139 Page	18.14	23.92	27.96	—	112.19
51141 Patrick	13.88	16.46	25.06	102.21	99.48
51143 Pittsylvania	8.90	11.54	13.07	—	81.09
51145 Powhatan	18.01	22.67	27.32	99.48	81.09
51147 Prince Edward	16.15	19.51	28.07	—	81.09
51149 Prince George	17.56	22.69	28.38	70.21	77.98
51153 Prince William	15.82	24.37	21.10	—	52.67
51155 Pulaski	16.31	19.73	24.34	—	149.27
51157 Rappahannock	16.94	20.05	29.88	—	—
51159 Richmond	19.87	26.69	33.85	—	52.41
51161 Roanoke	16.89	25.15	21.46	—	—
51163 Rockbridge	11.78	14.30	19.61	—	—
51165 Rockingham	9.69	12.13	15.76	96.94	—
51167 Russell	13.93	19.29	18.98	—	—
51169 Scott	12.69	14.67	24.42	108.44	—
51171 Shenandoah	12.96	16.85	19.39	104.72	—
51173 Smyth	13.87	16.56	22.57	—	—
51175 Southampton	12.49	14.79	21.49	—	91.13
51177 Spotsylvania	14.97	18.83	24.22	95.27	70.59

continued

Table C.18b—Sampling error for area of sampled land and water by county and land class, Virginia, 2011 (continued)

County code and name	Total	Land class			
		Accessible forest	Non-forest	Non-census water	Census water
			percent		
51179 Stafford	18.29	20.68	31.26	—	—
51181 Surry	17.13	19.49	41.70	102.55	52.41
51183 Sussex	13.23	14.51	30.59	—	—
51185 Tazewell	13.27	15.27	23.61	—	98.78
51187 Warren	20.44	25.80	28.08	—	—
51191 Washington	12.28	15.85	18.72	98.23	—
51193 Westmoreland	19.26	24.22	29.93	102.55	77.98
51195 Wise	15.11	17.56	23.78	—	98.78
51197 Wythe	13.80	22.24	17.67	98.78	—
51199 York	16.94	34.88	37.07	—	21.86
51550 Chesapeake City	13.80	24.56	19.15	—	33.38
51650 Hampton City	25.81	102.55	36.42	—	36.83
51700 Newport News City	28.38	102.55	38.97	—	45.29
51800 Suffolk City	14.53	17.67	26.55	—	51.57
51810 Virginia Beach City	12.87	35.71	19.99	—	18.46
Total	0.02	0.65	1.12	18.53	1.42

— = no value for the cell.

Table C.19a—Area of timberland by county and major ownership group, Virginia, 2011

County code and name	Total	Major ownership group	
		Public	Private
		acres	
51001 Accomack	102,315	—	102,315
51003 Albemarle	278,197	12,317	265,880
51005 Alleghany	240,331	141,339	98,992
51007 Amelia	156,845	—	156,845
51009 Amherst	236,746	59,150	177,596
51011 Appomattox	125,537	15,241	110,296
51015 Augusta	327,584	197,125	130,458
51017 Bath	310,082	185,831	124,251
51019 Bedford	288,141	17,520	270,621
51021 Bland	173,392	91,943	81,448
51023 Botetourt	235,045	77,778	157,267
51025 Brunswick	266,075	14,932	251,144
51027 Buchanan	286,400	5,694	280,706
51029 Buckingham	314,008	23,142	290,866
51031 Campbell	230,894	—	230,894
51033 Caroline	241,552	46,712	194,840
51035 Carroll	182,287	6,130	176,158
51036 Charles City	90,787	3,099	87,688
51037 Charlotte	219,533	—	219,533
51041 Chesterfield	153,705	18,533	135,171
51043 Clarke	30,128	—	30,128
51045 Craig	136,465	104,021	32,444
51047 Culpeper	100,944	—	100,944
51049 Cumberland	114,247	17,520	96,726
51051 Dickenson	201,410	17,266	184,144
51053 Dinwiddie	226,940	1,458	225,482
51057 Essex	88,409	1,426	86,984
51059 Fairfax	66,635	16,097	50,538
51061 Fauquier	218,257	17,735	200,522
51063 Floyd	122,348	—	122,348
51065 Fluvanna	100,133	—	100,133
51067 Franklin	263,417	4,542	258,876
51069 Frederick	155,659	—	155,659
51071 Giles	182,627	78,013	104,614
51073 Gloucester	88,055	5,530	82,525
51075 Goochland	110,916	—	110,916
51077 Grayson	151,236	25,092	126,144
51079 Greene	57,699	—	57,699
51081 Greensville	125,411	—	125,411
51083 Halifax	370,917	16,612	354,305
51085 Hanover	186,698	—	186,698
51087 Henrico	54,239	14,256	39,983

continued

Table C.19a—Area of timberland by county and major ownership group, Virginia, 2011 (continued)

County code and name	Total	Major ownership group	
		Public	Private
		acres	
51089 Henry	189,766	2,424	187,343
51091 Highland	220,714	103,675	117,038
51093 Isle of Wight	110,469	—	110,469
51095 James City	58,955	11,405	47,550
51097 King and Queen	141,148	11,405	129,743
51099 King George	75,982	5,703	70,279
51101 King William	107,110	4,515	102,595
51103 Lancaster	45,671	1,323	44,348
51105 Lee	171,688	18,334	153,354
51107 Loudoun	113,951	11,183	102,768
51109 Louisa	198,694	—	198,694
51111 Lunenburg	243,546	—	243,546
51113 Madison	66,494	—	66,494
51115 Mathews	25,218	—	25,218
51117 Mecklenburg	290,935	53,457	237,478
51119 Middlesex	49,715	5,703	44,013
51121 Montgomery	157,217	29,808	127,409
51125 Nelson	248,314	16,968	231,346
51127 New Kent	84,812	4,730	80,082
51131 Northampton	25,639	—	25,639
51133 Northumberland	58,251	—	58,251
51135 Nottoway	146,581	11,896	134,686
51137 Orange	143,395	5,592	137,803
51139 Page	74,943	21,516	53,427
51141 Patrick	196,361	15,517	180,844
51143 Pittsylvania	376,840	4,380	372,460
51145 Powhatan	101,878	5,840	96,038
51147 Prince Edward	145,785	15,927	129,858
51149 Prince George	104,128	1,426	102,702
51153 Prince William	71,140	22,367	48,773
51155 Pulaski	125,347	29,115	96,231
51157 Rappahannock	96,748	—	96,748
51159 Richmond	73,326	—	73,326
51161 Roanoke	82,026	18,294	63,732
51163 Rockbridge	248,663	73,532	175,132
51165 Rockingham	322,040	154,556	167,484
51167 Russell	142,508	11,353	131,154
51169 Scott	246,628	39,310	207,318
51171 Shenandoah	183,750	78,250	105,500
51173 Smyth	178,787	90,441	88,346
51175 Southampton	245,124	—	245,124
51177 Spotsylvania	141,948	8,351	133,596

continued

Table C.19a—Area of timberland by county and major ownership group, Virginia, 2011 (continued)

County code and name	Total	Major ownership group	
		Public	Private
	acres		
51179 Stafford	116,922	28,918	88,003
51181 Surry	145,599	6,595	139,004
51183 Sussex	264,855	—	264,855
51185 Tazewell	224,978	6,130	218,849
51187 Warren	53,880	6,098	47,783
51191 Washington	209,910	60,044	149,866
51193 Westmoreland	84,785	—	84,785
51195 Wise	156,657	20,086	136,571
51197 Wythe	106,787	67,370	39,417
51199 York	43,969	32,564	11,405
51550 Chesapeake City	43,992	8,787	35,205
51650 Hampton City	1,288	—	1,288
51700 Newport News City	5,703	5,703	—
51800 Suffolk City	141,468	—	141,468
51810 Virginia Beach City	39,569	4,277	35,292
Total	15,384,842	2,370,921	13,013,921

— = no value for the cell.

Table C.19b—Sampling error for area of timberland by county and major ownership group, Virginia, 2011

County code and name	Total	Major ownership group	
		Public	Private
		percent	
51001 Accomack	23.17	—	23.17
51003 Albemarle	13.41	62.87	13.79
51005 Alleghany	14.95	19.90	23.50
51007 Amelia	18.63	—	18.63
51009 Amherst	14.71	30.97	17.06
51011 Appomattox	20.25	59.64	21.59
51015 Augusta	12.44	16.65	19.32
51017 Bath	13.03	17.27	21.02
51019 Bedford	13.29	58.31	13.72
51021 Bland	17.64	24.86	25.62
51023 Botetourt	15.23	27.17	18.70
51025 Brunswick	14.46	57.87	14.90
51027 Buchanan	13.31	101.98	13.42
51029 Buckingham	12.84	50.33	13.36
51031 Campbell	15.34	—	15.34
51033 Caroline	14.78	34.42	16.57
51035 Carroll	16.25	98.23	16.48
51036 Charles City	24.27	98.51	24.89
51037 Charlotte	15.54	—	15.54
51041 Chesterfield	18.37	52.81	19.69
51043 Clarke	43.02	—	43.02
51045 Craig	20.14	23.59	39.80
51047 Culpeper	23.39	—	23.39
51049 Cumberland	22.00	58.31	23.89
51051 Dickenson	16.28	57.81	17.03
51053 Dinwiddie	15.52	102.55	15.61
51057 Essex	25.14	102.55	25.50
51059 Fairfax	28.04	58.28	32.12
51061 Fauquier	15.46	57.80	16.13
51063 Floyd	20.88	—	20.88
51065 Fluvanna	22.60	—	22.60
51067 Franklin	13.82	99.48	13.97
51069 Frederick	18.65	—	18.65
51071 Giles	17.15	26.84	23.00
51073 Gloucester	24.81	102.55	25.60
51075 Goochland	22.01	—	22.01
51077 Grayson	18.18	46.52	19.81
51079 Greene	30.40	—	30.40
51081 Greensville	20.97	—	20.97
51083 Halifax	11.79	58.30	12.09
51085 Hanover	16.79	—	16.79
51087 Henrico	30.21	61.45	34.78

continued

Table C.19b—Sampling error for area of timberland by county and major ownership group, Virginia, 2011 (continued)

County code and name	Total	Major ownership group	
		Public	Private
	percent		
51089 Henry	17.04	81.09	17.23
51091 Highland	15.75	23.09	22.00
51093 Isle of Wight	21.98	—	21.98
51095 James City	30.98	72.46	34.35
51097 King and Queen	19.88	72.46	20.73
51099 King George	26.75	102.55	27.75
51101 King William	22.29	102.55	22.86
51103 Lancaster	32.83	106.63	33.66
51105 Lee	17.64	56.77	18.64
51107 Loudoun	21.20	72.70	22.22
51109 Louisa	15.97	—	15.97
51111 Lunenburg	15.00	—	15.00
51113 Madison	28.54	—	28.54
51115 Mathews	46.01	—	46.01
51117 Mecklenburg	13.38	31.08	14.97
51119 Middlesex	34.12	102.55	36.23
51121 Montgomery	18.70	43.88	20.89
51125 Nelson	14.47	58.59	15.05
51127 New Kent	25.10	102.55	25.92
51131 Northampton	46.12	—	46.12
51133 Northumberland	30.11	—	30.11
51135 Nottoway	19.47	70.95	20.30
51137 Orange	19.00	102.99	19.37
51139 Page	27.59	51.08	33.04
51141 Patrick	16.70	58.57	17.50
51143 Pittsylvania	11.54	101.24	11.59
51145 Powhatan	22.67	101.24	23.29
51147 Prince Edward	19.51	59.09	20.74
51149 Prince George	22.69	102.55	22.97
51153 Prince William	26.97	51.23	31.69
51155 Pulaski	20.17	43.93	22.88
51157 Rappahannock	23.91	—	23.91
51159 Richmond	27.74	—	27.74
51161 Roanoke	25.83	57.18	29.12
51163 Rockbridge	14.66	28.25	17.59
51165 Rockingham	12.76	18.89	17.86
51167 Russell	19.29	69.59	20.15
51169 Scott	14.67	37.82	15.99
51171 Shenandoah	17.13	27.14	22.67
51173 Smyth	17.13	25.10	23.99
51175 Southampton	14.79	—	14.79
51177 Spotsylvania	19.22	76.94	19.78

continued

Table C.19b—Sampling error for area of timberland by county and major ownership group, Virginia, 2011 (continued)

County code and name	Total	Major ownership group	
		Public	Private
		percent	
51179 Stafford	21.15	45.12	24.17
51181 Surry	19.49	83.35	20.06
51183 Sussex	14.51	—	14.51
51185 Tazewell	15.27	98.23	15.49
51187 Warren	30.28	99.30	31.76
51191 Washington	15.85	30.81	18.75
51193 Westmoreland	24.95	—	24.95
51195 Wise	17.76	50.70	19.06
51197 Wythe	22.84	29.29	37.06
51199 York	34.88	39.80	72.46
51550 Chesapeake City	35.99	72.96	41.20
51650 Hampton City	102.55	—	102.55
51700 Newport News City	102.55	102.55	—
51800 Suffolk City	19.66	—	19.66
51810 Virginia Beach City	36.44	102.55	38.96
Total	0.73	4.16	1.07

— = no value for the cell.

Table C.20a—Volume[a] of live trees on timberland by county and major species group, Virginia, 2011

County code and name	Total	Major species group	
		Softwoods	Hardwoods
	million cubic feet		
51001 Accomack	393.6	258.8	134.8
51003 Albemarle	657.3	75.1	582.2
51005 Alleghany	472.2	81.3	390.9
51007 Amelia	325.6	134.3	191.4
51009 Amherst	497.4	109.4	388.0
51011 Appomattox	207.2	35.4	171.8
51015 Augusta	636.4	122.9	513.5
51017 Bath	743.4	101.3	642.1
51019 Bedford	724.2	98.1	626.1
51021 Bland	425.2	51.8	373.4
51023 Botetourt	453.6	70.9	382.7
51025 Brunswick	488.1	253.7	234.4
51027 Buchanan	654.6	20.2	634.5
51029 Buckingham	506.0	170.5	335.5
51031 Campbell	406.7	125.8	280.9
51033 Caroline	641.8	201.7	440.0
51035 Carroll	377.5	124.5	252.9
51036 Charles City	256.3	90.5	165.8
51037 Charlotte	373.3	137.7	235.6
51041 Chesterfield	394.3	118.9	275.5
51043 Clarke	75.5	0.0	75.5
51045 Craig	261.8	44.7	217.1
51047 Culpeper	219.3	30.5	188.8
51049 Cumberland	244.4	115.3	129.1
51051 Dickenson	411.3	14.8	396.4
51053 Dinwiddie	378.4	140.6	237.8
51057 Essex	171.6	89.2	82.4
51059 Fairfax	199.9	5.8	194.1
51061 Fauquier	491.0	48.4	442.6
51063 Floyd	320.8	78.5	242.3
51065 Fluvanna	199.6	48.6	151.0
51067 Franklin	609.3	100.6	508.7
51069 Frederick	312.8	50.8	262.0
51071 Giles	469.2	10.0	459.2
51073 Gloucester	313.2	88.6	224.6
51075 Goochland	295.5	92.9	202.6
51077 Grayson	379.6	80.5	299.1
51079 Greene	154.8	3.9	150.9
51081 Greensville	312.2	129.8	182.4
51083 Halifax	601.0	269.8	331.2
51085 Hanover	500.6	148.4	352.2
51087 Henrico	104.4	27.1	77.3

continued

Table C.20a—Volume[a] of live trees on timberland by county and major species group, Virginia, 2011 (continued)

County code and name	Total	Major species group	
		Softwoods	Hardwoods
		million cubic feet	
51089 Henry	379.2	158.9	220.2
51091 Highland	569.0	108.4	460.5
51093 Isle of Wight	232.6	90.6	142.1
51095 James City	146.1	38.5	107.6
51097 King and Queen	291.2	98.6	192.6
51099 King George	233.0	17.8	215.2
51101 King William	197.7	65.2	132.5
51103 Lancaster	100.9	37.9	63.0
51105 Lee	404.5	13.9	390.6
51107 Loudoun	278.9	26.8	252.1
51109 Louisa	441.1	127.6	313.5
51111 Lunenburg	380.0	158.2	221.8
51113 Madison	191.5	43.4	148.0
51115 Mathews	56.0	23.6	32.4
51117 Mecklenburg	701.2	237.7	463.5
51119 Middlesex	84.8	28.2	56.6
51121 Montgomery	287.5	50.1	237.4
51125 Nelson	586.8	73.1	513.8
51127 New Kent	183.7	70.7	112.9
51131 Northampton	83.7	61.7	22.0
51133 Northumberland	135.2	28.8	106.5
51135 Nottoway	222.8	96.6	126.1
51137 Orange	377.4	37.4	340.0
51139 Page	152.8	14.6	138.2
51141 Patrick	497.5	51.6	445.9
51143 Pittsylvania	646.7	184.2	462.5
51145 Powhatan	234.8	88.8	146.0
51147 Prince Edward	209.6	96.8	112.7
51149 Prince George	191.7	98.7	92.9
51153 Prince William	221.2	32.8	188.4
51155 Pulaski	252.2	37.9	214.3
51157 Rappahannock	260.6	17.2	243.4
51159 Richmond	150.2	55.0	95.2
51161 Roanoke	157.5	28.9	128.6
51163 Rockbridge	578.1	74.1	504.0
51165 Rockingham	685.3	87.1	598.2
51167 Russell	365.8	31.6	334.2
51169 Scott	655.8	34.8	621.0
51171 Shenandoah	385.5	22.2	363.3
51173 Smyth	456.1	29.5	426.6
51175 Southampton	555.6	272.7	282.8
51177 Spotsylvania	400.8	140.0	260.8

continued

Table C.20a—Volume[a] of live trees on timberland by county and major species group, Virginia, 2011 (continued)

County code and name	Total	Major species group	
		Softwoods	Hardwoods
	million cubic feet		
51179 Stafford	367.8	18.5	349.2
51181 Surry	292.6	138.6	154.0
51183 Sussex	376.1	234.3	141.9
51185 Tazewell	489.9	4.8	485.2
51187 Warren	132.3	7.9	124.4
51191 Washington	588.3	44.9	543.4
51193 Westmoreland	204.8	36.4	168.4
51195 Wise	295.2	17.3	277.9
51197 Wythe	188.6	37.2	151.5
51199 York	168.2	40.9	127.2
51550 Chesapeake City	113.8	61.2	52.6
51650 Hampton City	12.2	6.2	6.0
51700 Newport News City	17.7	13.5	4.3
51800 Suffolk City	275.2	147.5	127.7
51810 Virginia Beach City	112.8	62.7	50.1
Total	33,919.0	7,965.9	25,953.1

[a] Volume in this table was run on a newer version of the data than this report is based on and the total will therefore not match exactly that in other tables.

Table C.20b—Sampling error for volume of live trees on timberland by county and major species group, Virginia, 2011

County code and name	Total	Major species group	
		Softwoods	Hardwoods
		percent	
51001 Accomack	25.26	28.90	28.30
51003 Albemarle	15.46	30.87	16.42
51005 Alleghany	16.61	26.75	17.62
51007 Amelia	22.60	34.46	26.21
51009 Amherst	17.07	28.65	18.17
51011 Appomattox	23.69	36.13	26.14
51015 Augusta	13.89	22.64	14.76
51017 Bath	14.14	26.41	14.84
51019 Bedford	14.85	32.26	15.77
51021 Bland	21.29	34.56	22.18
51023 Botetourt	17.98	31.47	19.38
51025 Brunswick	20.42	25.85	25.41
51027 Buchanan	15.87	43.07	15.95
51029 Buckingham	14.86	22.70	17.87
51031 Campbell	19.66	26.35	23.57
51033 Caroline	17.87	24.12	21.50
51035 Carroll	18.23	26.74	18.37
51036 Charles City	28.21	39.86	31.13
51037 Charlotte	20.87	27.66	26.92
51041 Chesterfield	20.89	33.62	23.05
51043 Clarke	51.32	—	51.32
51045 Craig	21.96	27.88	23.69
51047 Culpeper	25.87	40.40	27.35
51049 Cumberland	25.04	33.15	30.73
51051 Dickenson	18.46	50.36	18.84
51053 Dinwiddie	19.96	25.48	21.92
51057 Essex	27.75	36.14	33.74
51059 Fairfax	30.87	61.33	31.00
51061 Fauquier	17.83	38.26	18.70
51063 Floyd	23.92	37.33	25.28
51065 Fluvanna	23.16	34.81	25.60
51067 Franklin	16.49	33.60	16.68
51069 Frederick	20.37	35.36	20.99
51071 Giles	19.01	45.64	19.19
51073 Gloucester	27.42	37.17	28.96
51075 Goochland	24.86	37.87	28.30
51077 Grayson	21.25	30.13	23.38
51079 Greene	37.30	60.06	37.91
51081 Greensville	25.68	36.33	27.70
51083 Halifax	14.88	20.52	18.42
51085 Hanover	18.89	23.83	21.58
51087 Henrico	34.55	46.22	33.35

continued

Table C.20b—Sampling error for volume of live trees on timberland by county and major species group, Virginia, 2011 (continued)

County code and name	Total	Major species group	
		Softwoods	Hardwoods
	percent		
51089 Henry	20.72	27.07	24.01
51091 Highland	16.85	31.22	17.37
51093 Isle of Wight	27.68	34.77	30.47
51095 James City	35.27	45.76	36.08
51097 King and Queen	23.17	29.64	28.61
51099 King George	29.38	53.00	30.15
51101 King William	26.97	36.73	32.41
51103 Lancaster	34.62	44.05	37.73
51105 Lee	21.67	48.68	22.10
51107 Loudoun	21.85	47.38	22.62
51109 Louisa	18.44	27.96	20.54
51111 Lunenburg	19.31	26.92	21.72
51113 Madison	35.27	60.68	35.70
51115 Mathews	56.60	68.45	73.31
51117 Mecklenburg	15.89	21.83	19.11
51119 Middlesex	45.83	74.75	46.15
51121 Montgomery	20.06	35.86	21.34
51125 Nelson	16.31	34.99	17.50
51127 New Kent	26.15	33.07	32.11
51131 Northampton	58.15	61.70	72.47
51133 Northumberland	32.08	58.07	30.81
51135 Nottoway	23.65	31.37	27.00
51137 Orange	23.37	37.28	24.20
51139 Page	31.68	47.36	31.42
51141 Patrick	18.72	35.26	19.03
51143 Pittsylvania	15.72	26.38	17.34
51145 Powhatan	25.09	39.12	28.86
51147 Prince Edward	24.26	31.36	30.14
51149 Prince George	25.78	35.68	27.93
51153 Prince William	29.69	49.26	29.97
51155 Pulaski	22.04	27.61	22.65
51157 Rappahannock	25.82	62.17	26.62
51159 Richmond	33.28	50.36	35.39
51161 Roanoke	29.58	37.64	33.56
51163 Rockbridge	16.37	29.36	17.13
51165 Rockingham	15.37	32.79	15.82
51167 Russell	21.46	51.65	21.70
51169 Scott	17.74	35.22	18.21
51171 Shenandoah	19.06	35.26	19.33
51173 Smyth	20.94	42.86	21.40
51175 Southampton	18.94	22.86	24.73
51177 Spotsylvania	22.98	32.18	25.81

continued

Table C.20b—Sampling error for volume of live trees on timberland by county and major species group, Virginia, 2011 (continued)

County code and name	Total	Major species group	
		Softwoods	Hardwoods
		percent	
51179 Stafford	22.52	47.56	22.81
51181 Surry	22.75	26.18	31.34
51183 Sussex	21.90	26.85	27.27
51185 Tazewell	17.93	47.45	17.98
51187 Warren	32.61	66.56	32.97
51191 Washington	17.81	40.46	18.16
51193 Westmoreland	31.82	43.15	32.99
51195 Wise	24.16	41.94	24.87
51197 Wythe	25.84	31.39	27.28
51199 York	39.85	41.81	41.82
51550 Chesapeake City	43.09	46.97	49.81
51650 Hampton City	102.55	102.55	102.55
51700 Newport News City	102.55	102.55	102.55
51800 Suffolk City	26.93	31.95	30.81
51810 Virginia Beach City	42.69	56.59	49.45
Total	1.35	3.21	1.62

— = no value for the cell.

Table C.21—Tree species tallied (≥5.0 inches d.b.h.) in the FIA sample by FIA species code, common name, and scientific name, Virginia, 2011

FIA species code	Common name	Scientific name	Trees measured
			number
16	Fraser fir	*Abies fraseri*	3
43	Atlantic white-cedar	*Chamaecyparis thyoides*	16
68	Eastern redcedar	*Juniperus virginiana*	1,364
97	Red spruce	*Picea rubens*	83
110	Shortleaf pine	*Pinus echinata*	690
123	Table Mountain pine	*P. pungens*	303
126	Pitch pine	*P. rigida*	602
128	Pond pine	*P. serotina*	19
129	Eastern white pine	*P. strobus*	1,920
131	Loblolly pine	*P. taeda*	17,966
132	Virginia pine	*P. virginiana*	5,313
221	Baldcypress	*Taxodium distichum*	37
241	Northern white-cedar	*Thuja occidentalis*	1
261	Eastern hemlock	*Tsuga canadensis*	604
262	Carolina hemlock	*T. caroliniana*	9
311	Florida maple	*Acer barbatum*	26
313	Boxelder	*A. negundo*	130
315	Striped maple	*A. pensylvanicum*	88
316	Red maple	*A. rubrum*	7,417
318	Sugar maple	*A. saccharum*	910
332	Yellow buckeye	*Aesculus flava*	143
341	Tree-of-heaven	*Ailanthus altissima*	477
345	Mimosa, silktree	*Albizia julibrissin*	1
356	Serviceberry spp.	*Amelanchier* spp.	122
367	Pawpaw	*Asimina triloba*	2
370	Birch spp.	*Betula* spp.	1
371	Yellow birch	*B. alleghaniensis*	99
372	Sweet birch	*B. lenta*	903
373	River birch	*B. nigra*	297
379	Gray birch	*B. populifolia*	1
391	American hornbeam	*Carpinus caroliniana*	323
400	Hickory spp.	*Carya* spp.	3
402	Bitternut hickory	*C. cordiformis*	243
403	Pignut hickory	*C. glabra*	1,506
404	Pecan	*C. illinoinensis*	8
405	Shellbark hickory	*C. laciniosa*	2
407	Shagbark hickory	*C. ovata*	246
409	Mockernut hickory	*C. alba*	1,473
421	American chestnut	*Castanea dentata*	22
451	Southern catalpa	*Catalpa bignonioides*	2
452	Northern catalpa	*C. speciosa*	2
462	Hackberry	*Celtis occidentalis*	85
471	Eastern redbud	*Cercis canadensis*	121
491	Flowering dogwood	*Cornus florida*	205

continued

Table C.21—Tree species tallied (≥5.0 inches d.b.h.) in the FIA sample by FIA species code, common name, and scientific name, Virginia, 2011 (continued)

FIA species code	Common name	Scientific name	Trees measured
			number
500	Hawthorn spp.	*Crataegus* spp.	10
502	Downy hawthorn	*C. mollis*	2
520	Persimmon spp.	*Diospyros* spp.	1
521	Common persimmon	*D. virginiana*	125
531	American beech	*Fagus grandifolia*	1,249
541	White ash	*Fraxinus americana*	906
544	Green ash	*F. pennsylvanica*	547
545	Pumpkin ash	*F. profunda*	1
546	Blue ash	*F. quadrangulata*	8
548	Carolina ash	*F. caroliniana*	3
552	Honeylocust	*Gleditsia triacanthos*	12
591	American holly	*Ilex opaca*	618
601	Butternut	*Juglans cinerea*	30
602	Black walnut	*J. nigra*	399
611	Sweetgum	*Liquidambar styraciflua*	3,381
621	Yellow-poplar	*Liriodendron tulipifera*	7,648
641	Osage-orange	*Maclura pomifera*	25
651	Cucumbertree	*Magnolia acuminata*	232
652	Southern magnolia	*M. grandiflora*	1
653	Sweetbay	*M. virginiana*	43
654	Bigleaf magnolia	*M. macrophylla*	8
655	Mountain or Fraser magnolia	*M. fraseri*	120
658	Umbrella magnolia	*M. tripetala*	12
660	Apple spp.	*Malus spp.*	17
662	Southern crab apple	*M. angustifolia*	1
680	Mulberry spp.	*Morus* spp.	1
681	White mulberry	*M. alba*	8
682	Red mulberry	*M. rubra*	29
691	Water tupelo	*Nyssa aquatica*	88
693	Blackgum	*N. sylvatica*	1,647
694	Swamp tupelo	*N. biflora*	450
701	Eastern hophornbeam	*Ostrya virginiana*	90
711	Sourwood	*Oxydendrum arboreum*	1,447
712	Paulownia, empress-tree	*Paulownia tomentosa*	65
721	Redbay	*Persea borbonia*	5
731	American sycamore	*Platanus occidentalis*	339
742	Eastern cottonwood	*Populus deltoides*	8
743	Bigtooth aspen	*P. grandidentata*	58
760	Cherry and plum spp.	*Prunus* spp.	1
761	Pin cherry	*P. pensylvanica*	46
762	Black cherry	*P. serotina*	1,129
763	Chokecherry	*P. virginiana*	1
771	Sweet cherry, domesticated	*P. avium*	15
802	White oak	*Quercus alba*	4,936

continued

Table C.21—Tree species tallied (≥5.0 inches d.b.h.) in the FIA sample by FIA species code, common name, and scientific name, Virginia, 2011 (continued)

FIA species code	Common name	Scientific name	Trees measured
			number
804	Swamp white oak	*Quercus bicolor*	1
806	Scarlet oak	*Q. coccinea*	2,421
812	Southern red oak	*Q. falcata*	1,010
813	Cherrybark oak	*Q. pagoda*	40
816	Scrub oak	*Q. ilicifolia*	18
817	Shingle oak	*Q. imbricaria*	5
819	Turkey oak	*Q. laevis*	2
820	Laurel oak	*Q. laurifolia*	11
822	Overcup oak	*Q. lyrata*	7
823	Bur oak	*Q. macrocarpa*	1
824	Blackjack oak	*Q. marilandica*	14
825	Swamp chestnut oak	*Q. michauxii*	94
826	Chinkapin oak	*Q. muehlenbergii*	86
827	Water oak	*Q. nigra*	164
830	Pin oak	*Q. palustris*	56
831	Willow oak	*Q. phellos*	337
832	Chestnut oak	*Q. prinus*	6,474
833	Northern red oak	*Q. rubra*	2,127
834	Shumard oak	*Q. shumardii*	2
835	Post oak	*Q. stellata*	225
837	Black oak	*Q. velutina*	1,726
901	Black locust	*Robinia pseudoacacia*	1,550
920	Willow spp.	*Salix* spp.	5
922	Black willow	*S. nigra*	38
927	White willow	*S. alba*	12
929	Weeping willow	*S. sepulcralis*	1
931	Sassafras	*Sassafras albidum*	540
935	American mountain-ash	*Sorbus americana*	1
951	American basswood	*Tilia americana*	311
971	Winged elm	*Ulmus alata*	176
972	American elm	*U. americana*	339
974	Siberian elm	*U. pumila*	1
975	Slippery elm	*U. rubra*	194
977	Rock elm	*U. thomasii*	1
998	Unknown hardwood	Tree broadleaf	7
999	Other or unknown tree	Tree unknown	4

d.b.h. = diameter at breast height; FIA = Forest Inventory and Analysis.

Table C.22—Tree species tallied (≥1.0 but <5.0 inches d.b.h.) in the FIA sample by FIA species code, common name, and scientific name, Virginia, 2011

FIA species code	Common name	Scientific name	Trees measured
			number
68	Eastern redcedar	*Juniperus virginiana*	618
97	Red spruce	*Picea rubens*	8
110	Shortleaf pine	*Pinus echinata*	44
123	Table Mountain pine	*P. pungens*	7
126	Pitch pine	*P. rigida*	22
128	Pond pine	*P. serotina*	1
129	Eastern white pine	*P. strobus*	317
131	Loblolly pine	*P. taeda*	1,964
132	Virginia pine	*P. virginiana*	1,106
221	Baldcypress	*Taxodium distichum*	6
261	Eastern hemlock	*Tsuga canadensis*	70
262	Carolina hemlock	*T. caroliniana*	2
311	Florida maple	*Acer barbatum*	24
313	Boxelder	*A. negundo*	32
315	Striped maple	*A. pensylvanicum*	249
316	Red maple	*A. rubrum*	3,287
318	Sugar maple	*A. saccharum*	314
319	Mountain maple	*A. spicatum*	1
332	Yellow buckeye	*Aesculus flava*	28
341	Tree-of-heaven	*Ailanthus altissima*	193
345	Mimosa, silktree	*Albizia julibrissin*	2
356	Serviceberry spp.	*Amelanchier* spp.	194
367	Pawpaw	*Asimina triloba*	96
371	Yellow birch	*Betula alleghaniensis*	23
372	Sweet birch	*B. lenta*	209
373	River birch	*B. nigra*	82
391	American hornbeam	*Carpinus caroliniana*	815
402	Bitternut hickory	*Carya cordiformis*	25
403	Pignut hickory	*C. glabra*	352
404	Pecan	*C. illinoinensis*	1
407	Shagbark hickory	*C. ovata*	21
409	Mockernut hickory	*C. alba*	397
421	American chestnut	*Castanea dentata*	49
422	Allegheny chinkapin	*C. pumila*	3
424	Chinese chestnut	*C. mollissima*	1
462	Hackberry	*Celtis occidentalis*	45
471	Eastern redbud	*Cercis canadensis*	480
491	Flowering dogwood	*Cornus florida*	840
500	Hawthorn spp.	*Crataegus* spp.	86
502	Downy hawthorn	*C. mollis*	3
520	Persimmon spp.	*Diospyros* spp.	1
521	Common persimmon	*D. virginiana*	45
531	American beech	*Fagus grandifolia*	505

continued

Table C.22—Tree species tallied (≥1.0 but <5.0 inches d.b.h.) in the FIA sample by FIA species code, common name, and scientific name, Virginia, 2011 (continued)

FIA species code	Common name	Scientific name	Trees measured
			number
541	White ash	*Fraxinus americana*	223
543	Black ash	*F. nigra*	1
544	Green ash	*F. pennsylvanica*	157
552	Honeylocust	*Gleditsia triacanthos*	4
591	American holly	*Ilex opaca*	1,220
601	Butternut	*Juglans cinerea*	1
602	Black walnut	*J. nigra*	28
611	Sweetgum	*Liquidambar styraciflua*	1,824
621	Yellow-poplar	*Liriodendron tulipifera*	1,866
651	Cucumbertree	*Magnolia acuminata*	41
652	Southern magnolia	*M. grandiflora*	5
653	Sweetbay	*M. virginiana*	68
654	Bigleaf magnolia	*M. macrophylla*	2
655	Mountain or Fraser magnolia	*M. fraseri*	58
658	Umbrella magnolia	*M. tripetala*	20
660	Apple spp.	*Malus* spp.	29
662	Southern crab apple	*M. angustifolia*	8
663	Sweet crab apple	*M. coronaria*	1
681	White mulberry	*Morus alba*	2
682	Red mulberry	*M. rubra*	10
691	Water tupelo	*Nyssa aquatica*	2
693	Blackgum	*N. sylvatica*	1,475
694	Swamp tupelo	*N. biflora*	53
701	Eastern hophornbeam	*Ostrya virginiana*	96
711	Sourwood	*Oxydendrum arboreum*	735
712	Paulownia, empress-tree	*Paulownia tomentosa*	19
721	Redbay	*Persea borbonia*	44
731	American sycamore	*Platanus occidentalis*	30
742	Eastern cottonwood	*Populus deltoides*	1
743	Bigtooth aspen	*P. grandidentata*	39
744	Swamp cottonwood	*P. heterophylla*	1
760	Cherry and plum spp.	*Prunus* spp.	1
761	Pin cherry	*P. pensylvanica*	18
762	Black cherry	*P. serotina*	511
763	Chokecherry	*P. virginiana*	1
771	Sweet cherry, domesticated	*P. avium*	3
802	White oak	*Quercus alba*	758
806	Scarlet oak	*Q. coccinea*	256
812	Southern red oak	*Q. falcata*	310
813	Cherrybark oak	*Q. pagoda*	6
816	Scrub oak	*Q. ilicifolia*	8
817	Shingle oak	*Q. imbricaria*	3
820	Laurel oak	*Q. laurifolia*	1

continued

Table C.22—Tree species tallied (≥1.0 but <5.0 inches d.b.h.) in the FIA sample by FIA species code, common name, and scientific name, Virginia, 2011 (continued)

FIA species code	Common name	Scientific name	Trees measured
			number
823	Bur oak	*Quercus macrocarpa*	1
824	Blackjack oak	*Q. marilandica*	4
825	Swamp chestnut oak	*Q. michauxii*	7
826	Chinkapin oak	*Q. muehlenbergii*	4
827	Water oak	*Q. nigra*	149
830	Pin oak	*Q. palustris*	10
831	Willow oak	*Q. phellos*	149
832	Chestnut oak	*Q. prinus*	372
833	Northern red oak	*Q. rubra*	234
835	Post oak	*Q. stellata*	72
837	Black oak	*Q. velutina*	228
901	Black locust	*Robinia pseudoacacia*	245
920	Willow spp.	*Salix* spp.	2
922	Black willow	*S. nigra*	5
929	Weeping willow	*S. sepulcralis*	1
931	Sassafras	*Sassafras albidum*	406
951	American basswood	*Tilia americana*	33
971	Winged elm	*Ulmus alata*	162
972	American elm	*U. americana*	115
975	Slippery elm	*U. rubra*	38
977	Rock elm	*U. thomasii*	1
999	Other or unknown tree	Tree unknown	7

d.b.h. = diameter at breast height; FIA = Forest Inventory and Analysis.

Rose, Anita K. 2013. Virginia's forests, 2011. Resour. Bull. SRS–197. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 92 p.

Between 2007 and 2011, the U.S. Department of Agriculture Forest Service's Forest Inventory and Analysis (FIA) program conducted the ninth inventory of the forests of Virginia. About 15.9 million acres, or 62 percent, of Virginia was forested. The majority (13.0 million acres) of Virginia's forest land was in private forest ownership. Public ownership accounted for 2.9 million acres (18 percent). Red maple dominated the number of live stems (≥1.0 inch diameter at breast height) with 1.4 billion stems (12 percent of total). Loblolly pine was second, with 1.2 billion live stems. Yellow-poplar was the most dominant species for live-tree volume with 5.6 billion cubic feet (15.8 percent of total), but as a genus, oaks accounted for 32 percent of the live-tree volume (11.4 billion cubic feet). Biomass of coarse woody debris on forest health plots averaged 3.3 tons per acre for the State. The amount of carbon in coarse woody debris and fine woody debris averaged 1.7 and 1.1 tons per acre, respectively. The Forest Service's FIA is the only program that conducts forest assessments across all land in the United States. Increasing demands on the resource and anthropogenic-related impacts on forests have intensified the need to conduct ecosystem-based inventories such as these.

Keywords: Forest health, forest inventory, FIA, forest land, forest survey, timberland, Virginia.

The Forest Service, U.S. Department of Agriculture (USDA), is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

November 2013

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A mother bear and her three cubs, City of Chesapeake, Virginia.
(photo by John Pemberton, Virginia Department of Forestry)

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