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Front cover: top left, forests cover more than half of Virginia's total land area. (photo courtesy of John Pemberton, Virginia Department of Forestry); top right, Fall foliage in a rural Virginia landscape. (photo courtesy of John Campbell, Virginia Department of Forestry); bottom, the plot measurements used for this report are collected in collaboration with the Virginia Department of Forestry. (photo courtesy of John Campbell, Virginia Department of Forestry). Back cover: top left, Yellow-poplar (*Liriodendron tulipifera*) is a commonly encountered tree in Virginia's forests. (photo courtesy of John Pemberton, Virginia Department of Forestry); top right, forests cover more than half of Virginia's total land area. (photo courtesy of John Pemberton, Virginia Department of Forestry); bottom, wood decaying fungi play an important role in cycling carbon and nutrients in healthy forest ecosystems. (photo courtesy of John Pemberton, Virginia Department of Forestry).

Deciduous hardwood tree leaves. (photo courtesy of John Pemberton, Virginia Department of Forestry)

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Virginia's Forests, 2016

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Wood decaying fungi play an important role in cycling carbon and nutrients in healthy forest ecosystems. (photo courtesy of John Pemberton, Virginia Department of Forestry)

FOREWORD

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

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

More information about Forest Service resource inventories is available in "Forest Resource Inventories: An Overview" (U.S. Department of Agriculture Forest Service 1992). More detailed information about sampling methodologies used in the annual FIA inventories can be found in "The Enhanced Forest Inventory and Analysis Program—National Sampling Design and Estimation Procedures" (Bechtold and Patterson 2005).

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

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

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The following people made field measurements or checked the quality of the data collected for this most recent survey. SRS FIA appreciates their hard work and their consistent efforts to obtain high-quality data.

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HIGHLIGHTS

• In 2016 Virginia had an estimated 16.1 million acres of forest which covered 58.7 percent of its total land area. The Coastal Plain had the lowest percentage of forest cover at 45.7 percent, while the Southern and Northern Piedmont units were 67.6 and 56.7 percent forested, respectively. The Southern and Northern Mountain units were 65.4 and 66.2 percent forested.

• The area of large diameter, southern-pine forests has increased since 2001, versus the small medium stand size classes which have decreased over the same time frame. In 2001, only 39 percent of the pine forests were classified as large diameter. By 2016, over half of Virginia's pine forests fall in the sawtimber category. Hardwood forests exhibit the same pattern as softwood forests, as larger diameter hardwood stands have increased since 2001 while small and medium stands have declined. This indicates that clearcutting of forests has declined and fewer new stands are being established.

• From 2005 to 2007 between 61,100 and 62,915 acres of forest land were changing each year to developed land uses. After 2007, the rate at which forest land was converted to developed lands decreased continually until reaching a low in 2014 of 23,351 acres annually, a level nearly equal to the rate at which developed land reverted to forest land. On average from 2012 to 2016 there was a net annual gain of 24,170 acres of forest land from agricultural land.

• There were an estimated 11.4 billion trees with a d.b.h. ≥1 inch on forest land in Virginia in 2016. Soft maples (predominately red maple) were the most common hardwoods and loblolly pine was the most commonly encountered softwood. The trees with d.b.h. ≥ 5 inches held over 39.4 billion cubic feet (bcf) of volume and 2.1 billion tons of aboveground live-tree biomass.

• Net volume on timberland has increased steadily for hardwood species, and to a lesser extent softwood species, to reach its current level of 29.6 bcf in hardwoods and 9.8 bcf in softwoods. The softwood volume is almost evenly split between stands that were naturally regenerated (4.7 bcf) and those that were planted (5.1 bcf) while hardwood volume is mostly in naturally regenerated stands.

• Softwood and hardwood average annualized growth have been increasing during the last three periods of annualized forest inventory. In 2016, 58.3 percent of the total net annualized growth of 1.3 bcf per year was on hardwood trees and 41.7 percent on softwoods.

• Average annual volume removed has generally shown declines in both hardwoods and softwoods. Hardwood removals are concentrated in the larger diameter stands, corresponding to the greater use of hardwoods for sawn lumber rather than pulp products. Softwoods show declines in removals from stands with trees used for both sawn lumber and pulp products.

• For hardwoods, growth has exceeded removals with growth to removal ratios of 2.9 in 2007, 4.0 in 2011, and 3.5 in 2016 for medium-diameter stands. In large-diameter stands, however, net growth was only slightly greater than removals during the inventory period of 2002 to 2007 with a growth to removal ratio of only 1.01, then ratios of 2.0 in 2011 and 2.47 in

2016. Softwoods growth has increased and removals decreased over time in medium-diameter stands, with growth to removal ratios increasing from 1.4 in 2007 to 2.4 in 2016. Removals exceeded growth in large-diameter softwood stands in 2007 (growth to removal ratio of 0.5) and 2011 (growth to removal ratio of 0.7). Softwood large-diameter stand growth exceeded removals from 2012 to 2016 with a growth to removal ratio of 1.4.

• Final harvests, either by clear-cutting or partially harvesting the stand, have declined since the forest inventory of 2007, perhaps due to the years of slowed economic activity. Acres thinned, however, have remained stable or increased slightly in recent years, indicating that stand tending activities were not as impacted by the economic downturn as were final harvests.

• From 2012 to 2016, severe weather impacted Virginia's forests more than any other disturbance with an average of 43,300 forest land acres affected per year. This was followed by disturbance due to domestic animals (for example, livestock grazing), forest fires, and other forms of human activities.

• There were 207.5 million standing dead trees ≥ 5.0 inches d.b.h. and an average of 9.0 tons of biomass per acre of down woody materials in Virginia's forests. The forests of Virginia sequester approximately 1.1 billion tons of carbon, of which 38.8 percent was in the forest soil and 37.4 percent in the aboveground portions of living trees.

• In 2007, prior to the establishment of the emerald ash borer, there were 44.5 million live and 2.5 million standing dead ash trees ≥ 5.0 inches d.b.h. across Virginia, a ratio of 17.7 live ash for every one standing dead ash. From 2007 to 2016, the total number of live ash trees ≥ 5.0 inches d.b.h. across the State remained fairly stable, but the number of standing dead ash increased by 60 percent, dropping the overall ratio of live to standing dead ash trees to 10.9. Despite the loss in the overall number of ash trees, growth has continued to outpace removals and mortality. With almost 70 percent of the live ash in Virginia in counties with confirmed or suspected emerald ash borer activity, degradation of the ash resource is likely to continue.

• The hemlock woolly adelgid is found in almost all of hemlock's range in Virginia and the number of live hemlock trees ≥ 5.0 inches d.b.h. steadily declined from 18.3 million in 2001 to 14.0 million in 2016. In contrast, volume of live hemlock trees ≥ 5.0 inches d.b.h., following a period of decline from 2001 to 2011, increased by 3.7 percent between 2011 and 2016. This volume increase was largely due to growth on trees ≥ 19.0 inches d.b.h. In 2016, the number of standing dead hemlock trees ≥ 5.0 inches d.b.h., though much greater than in 2001, remained relatively unchanged from 2011. Overall, the ratio of live to standing dead hemlock trees was 2.9 in 2016, down from 25.4 in 2001.

• Tree of heaven (*Ailanthus altissima*) was the most frequently encountered nonnative tree species on sampled forested plots. Nonnative rose (*Rosa* spp.) the most common shrub species, Japanese honeysuckle (*Lonicera japonica*) the most common vine, Nepalese browntop (*Microstegium vimineum*) the most common nonnative grass, and Chinese or sericea lespedeza (*Lespedeza cuneata*) was the most commonly encountered invasive herb.

INTRODUCTION

This resource bulletin is the fourth report produced by the collaboration of the Virginia Department of Forestry and the U.S. Forest Service, Forest Inventory and Analysis (FIA) program at the Southern Research Station. This and the previous three bulletins (Rose 2007, Rose 2009 and Rose 2013) summarize information gathered from data collected on the FIA program's forest inventory and monitoring plot network. The data used to make the estimates presented in this report come from 4,804 FIA sampling points across the State of Virginia that were surveyed from 2012 to 2016. Of those sampling points, 3,289 were forested and had an FIA forest inventory and monitoring plot. The remaining 1,515 points were not forested and the only data collected there was land use. The data used in this publication were accessed from the FIA database (https://fia.fs.fed.us/tools-data/) from January to April of 2018 unless otherwise indicated.

Notable in this current resource bulletin is relative stability of forest land and timberland acreage and increasing maturity of the trees and stands that comprise it. Net volume on both forest land and timberland has been increasing. Forest stands are more typically comprised of fewer, larger trees. This means that even with unchanged or slight increases in the total forest land acreage, stands are more fully stocked in terms of volume, as also shown in Rose (2013). Net tree growth and mortality in terms of their volume has increased while removals from both harvesting and land clearing to nonforest land uses has shown fluctuations probably related to varying economic conditions like the recent recession (Brandeis and others 2017, Rose 2009, Rose 2013).

Virginia's forests are inventoried and monitored in a collaborative effort by the U.S. Forest Service's Forest Inventory and Analysis program and the Virginia Department of Forestry. (photo courtesy of John Pemberton, Virginia Department of Forestry)

AREA

Forest Land Area and Nonforest Land Uses

Virginia's total land area is 27.4 million acres, 16.1 million (58.7 percent) of which are forested according to the results of the latest forest inventory completed in 2016 (table 1). This current estimate confirms that Virginia's forest land area has remained stable for at least the past two decades. The previous three, 5-year cycles of FIA data collection under the annualized forest inventory have estimates of forest land acreage in the State at 15.9 million in 2001, 15.8 million in 2006, and 15.9 million in 2011.

In 2016, of the five survey units (figs. 1 and 2) the Coastal Plain had the lowest percentage of forest cover at 45.7 percent. The Southern and Northern Piedmont units were 67.6 and 56.7 percent forested, respectively. The Southern and Northern Mountain units were 65.4 and 66.2 percent forested (fig. 3).

Table 1—Area by survey unit and land status, Virginia, 2016

Unit	Total area	All forest	Unreserved			Reserved			Nonforest land	Census water
			Total	Timberland	Unproductive	Total	Productive	Unproductive		
	thousand acres									
Coastal Plain	8,159.5	3,727.1	3,593.0	3,587.3	5.7	134.1	134.1	0.0	2,619.4	1,813.0
Southern Piedmont	5,674.8	3,836.9	3,817.7	3,817.7	0.0	19.2	19.2	0.0	1,751.5	86.4
Northern Piedmont	4,429.3	2,513.4	2,336.5	2,332.6	3.9	177.0	177.0	0.0	1,852.1	63.8
Northern Mountains	4,352.4	2,879.4	2,732.6	2,641.7	90.9	146.8	146.8	0.0	1,456.2	16.8
Southern Mountains	4,759.9	3,112.3	3,019.9	3,007.1	12.8	92.3	86.2	6.1	1,631.3	16.3
All survey units	27,375.9	16,069.1	15,499.7	15,386.4	113.3	569.4	563.4	6.1	9,310.5	1,996.3

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.

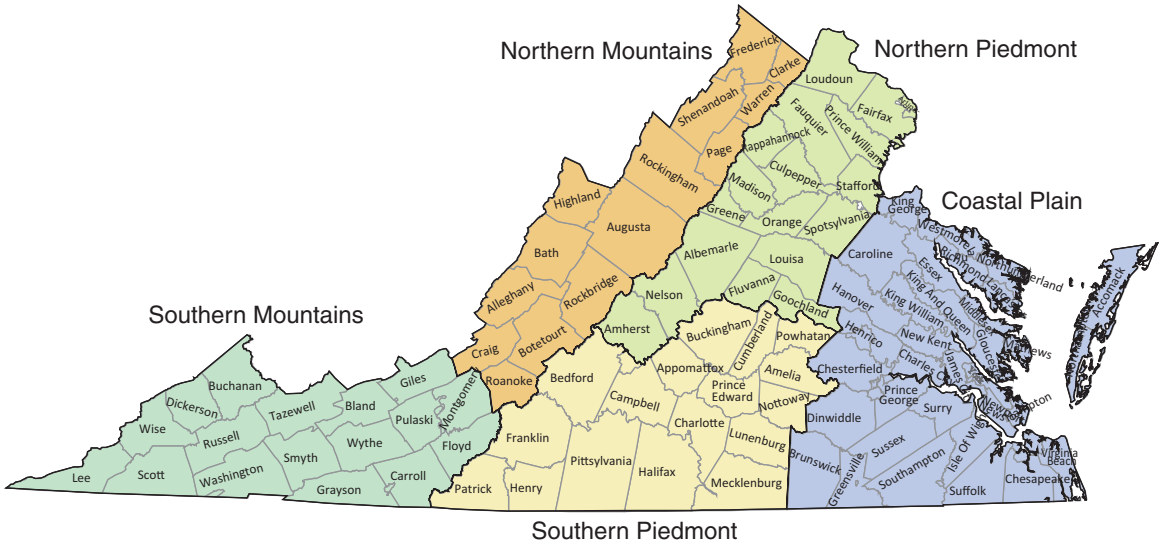

Figure 1—Counties and forest survey units, Virginia, 2016.

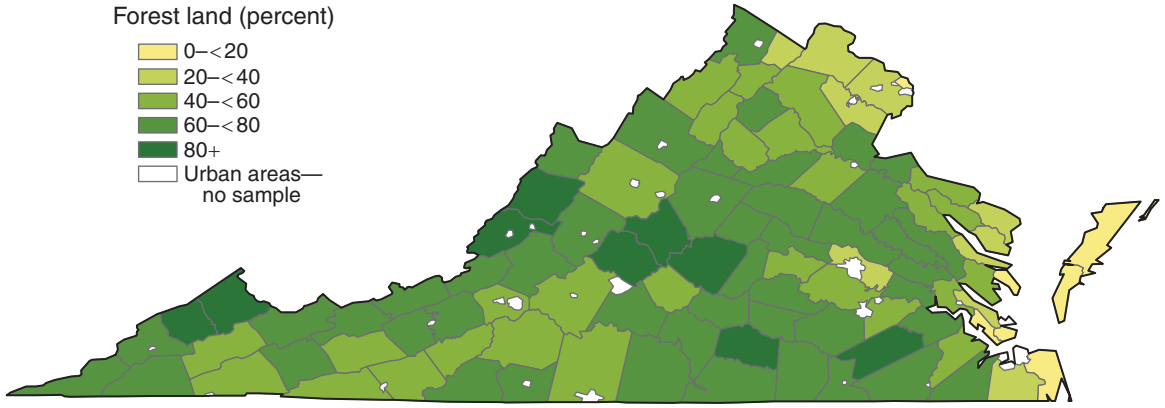

Figure 2—Percentage of county in forest land by county, Virginia, 2016.

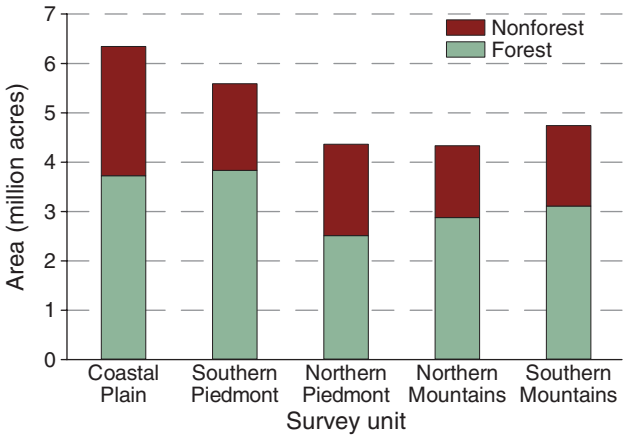

Figure 3—Forest and nonforest land area by survey unit, Virginia, 2016.

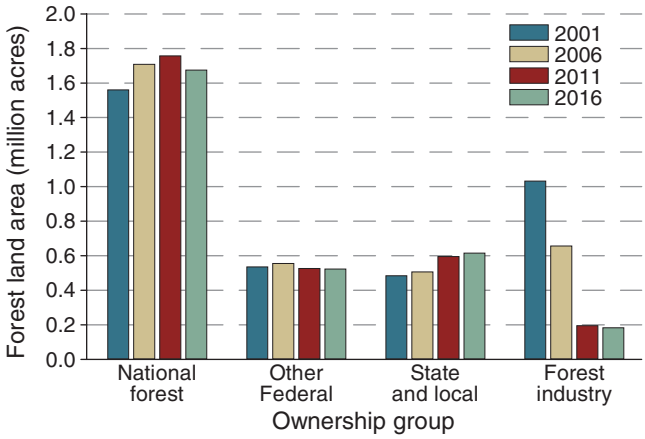

Figure 4—Forest land area by ownership group, Virginia, 2001–16.

Forest Ownership, Forest Types, and Stand Size

Forest Ownership—The FIA program surveys and tracks changes in forest ownership. The most outstanding feature of forest ownership in Virginia is typical of most of the other Southern States, the predominance of nonindustrial private forest ownership (fig. 4). The most notable trend, also seen across the South, has been the divestiture of the forest products industry of its timberland and its acquisition by nonindustrial corporate entities, primarily Timber Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs). In 2001, forest industry owned just over 1 million acres of forest land (Rose 2007). By 2016, that number dropped by 82 percent to 183.4 thousand acres.

Forest Types—The diversity of Virginia's forest-type groups are represented in figure 5. Forest-type groups in which oaks predominate are the most common across the State, with the oak-hickory (60.4 percent) and oak-pine (10.5 percent) comprising over 70 percent of the forest. In the forests of Virginia we see the beginnings of the transition from forest-type groups typical of the Southern United States to

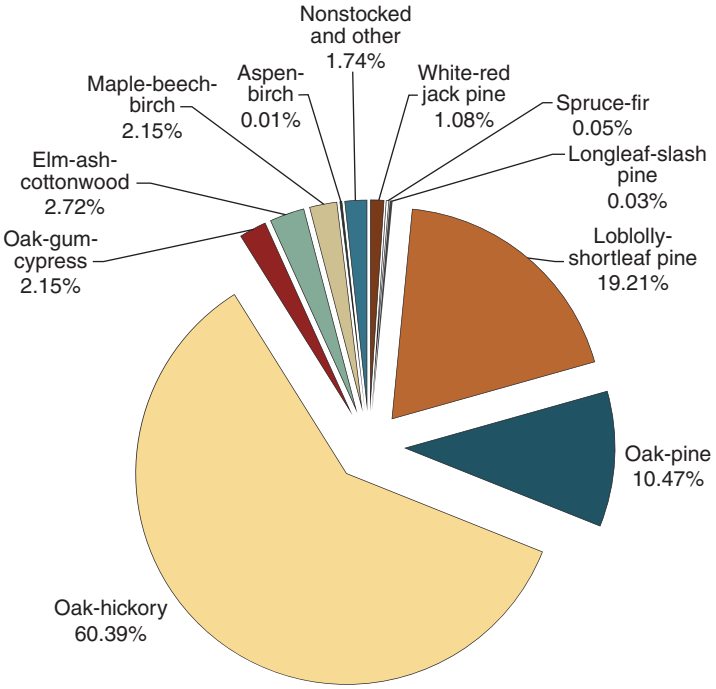

Figure 5—Percentage of forest land area by forest-type group, Virginia, 2016.

those found in the more northern States. Loblolly-shortleaf pine, a forest-type group very common across the South still covers a considerable area (almost 20 percent), but we also see small areas of conifer forest-type groups more typical of the North such as spruce-fir and white-red-jack pine (which primarily consists of eastern white pine in Virginia).

Shortleaf pine in Virginia—Shortleaf pine (*Pinus echinata*) is an economically and ecologically important eastern pine that was once found across Virginia. The State's population of shortleaf pines are near the northern edge of the species' natural distribution, with patches farther north in Pennsylvania, New Jersey, and New York. Species at the far edges of their ranges like shortleaf pine in Virginia can be of special concern. The often naturally sparse populations are prone to loss from land use change or replacement by species whose management is more familiar to land managers. Climate change has the potential to extirpate species from these areas, also. The loss of these trees at the edges of their ranges could represent a significant loss in the genetic diversity and potentially valuable provenances of the species.

According to FIA estimates, the area occupied by shortleaf pine-dominated forests has declined 53 percent since the 1980s (Oswalt 2015). The most significant decline has occurred east of the Mississippi River; whereas, States in the western range (Arkansas, Louisiana, Missouri, Oklahoma, and Texas) still contain concentrated areas of shortleaf dominated forests. Several factors are known to contribute to the decline of shortleaf pine, including land use change and urbanization, species preference for management, fire exclusion, and forest health issues. Evaluating the magnitude of this decline is made possible through FIA data.

Shortleaf pine-dominated forests are defined as the combination of two FIA forest types, shortleaf pine (a forest type within the loblolly-shortleaf pine forest-type group) and shortleaf pine-oak (a forest type within the oak-pine forest-type group). A total of

The forests of Virginia are a diverse mix of hardwood and softwood species. (photo courtesy of John Campbell, Virginia Department of Forestry)

174 plots across the State contained at least one shortleaf pine ≥ 1 inch d.b.h. Twelve plots contained enough stocking of shortleaf pine to be classified as the shortleaf pine forest type while 16 plots were stocked with enough shortleaf pine and oak species to be classified as the shortleaf pine-oak forest type. Shortleaf pine was observed within 21 other forest types but most commonly found to be in association with loblolly pine.

Similar to shortleaf pine resources in many States east of the Mississippi River, shortleaf pine-dominated forests have experienced significant declines in the State of Virginia (fig. 6). During the period between 1992 and 2016 shortleaf pine-dominated timberland declined approximately 55 percent or over 144 thousand acres. (Note—timberland was used as the basis of the estimate of long term change.) Recently

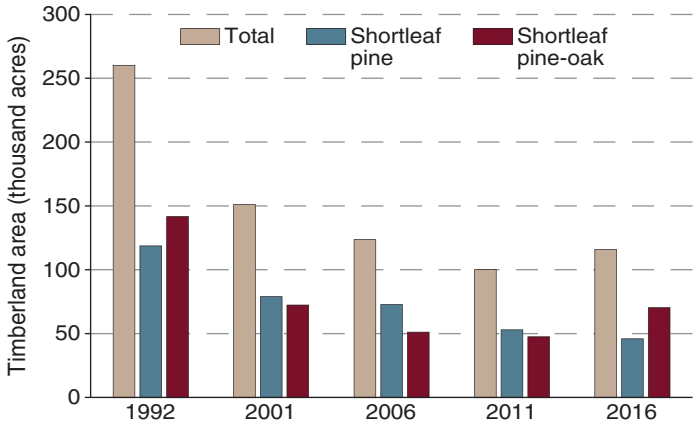

Figure 6—Timberland acres of shortleaf pine and shortleaf pine-oak forest types, Virginia, 1992–2016.

however, between the period of 2011 and 2016, shortleaf pine-dominated systems appear to have experienced a gain of approximately 16 percent wholly within the shortleaf pine-oak forest type.

Currently, the shortleaf pine resource is concentrated in the south-central part of the State (fig. 7). In fact, all the plots with the highest proportion of shortleaf pine stems are found in the Southern Piedmont. As a result, the highest estimated shortleaf pine populations are located in counties within the Southern Piedmont as well (fig. 7).

Stand Size—The average size of forests in Virginia has evolved. A look at the stand size-class distribution of Virginia's forests gives insight into their history and past land use management. Much of the historic change in softwood forests over time can be attributed to Federal incentives such as the Agriculture Conservation Program of the 1930's and the Soil Bank Program of the 1950s. Additionally, the impact of the Conservation Reserve Program (CRP) of the late 1980s is clearly evident even today (Conner and others 2004). In figure 8, we see the area of large diameter, southern-pine forests (stands where the trees are predominately softwoods ≥ 9.0 inches d.b.h., which are also known as sawtimber trees) increasing since 2001, versus the small (1.0 to 4.9 inches in d.b.h.) or medium stand-size classes (5.0 to 8.9 inches d.b.h.) which have decreased over the same time frame. In 2001, only 39 percent of the pine forests were classified as large diameter. By 2016, over half of Virginia's pine forests fall in the sawtimber category. Hardwood forests exhibit the same pattern as softwood forests, as larger diameter hardwood stands (forests where there average d.b.h. is ≥ 11.0 inches) have increased since 2001 while small (1.0 to 4.9 inches in d.b.h.) and medium (5.0 to 10.9 inches d.b.h) stands have declined (fig. 9). This indicates that clearcutting of forests has declined and fewer new stands are being established. Comparing figures 8 and 9 reveals how the average softwood forest and hardwood forests differ. While roughly half of the softwood forests are defined as large diameter, almost three-quarters (73 percent) of the hardwood stands are in the largest classification. This is particularly compelling, as hardwood forests require a larger average d.b.h. to be classified as large diameter.

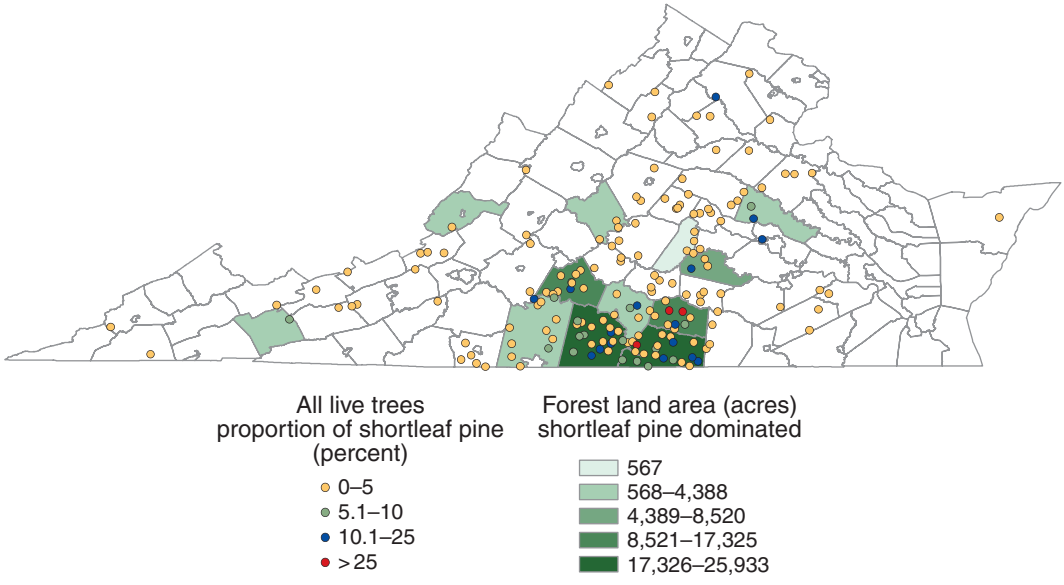

Figure 7—Distribution and density of shortleaf pine trees and forest land acres, Virginia, 2016.

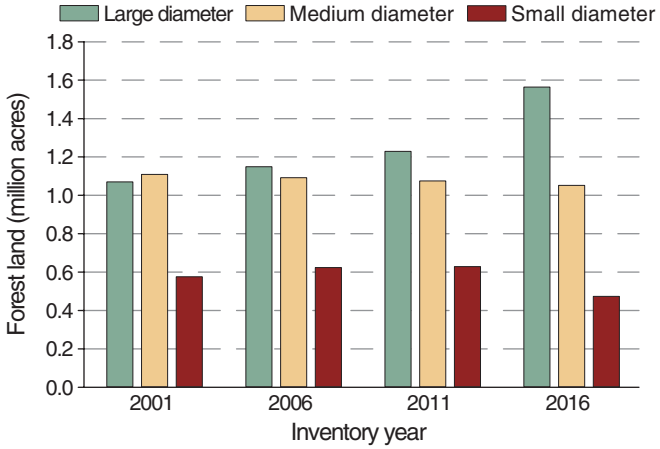

Figure 8—Southern pine forest (stands where the forest types are predominately pine species) land acreage by stand-size class, Virginia, 2001–16.

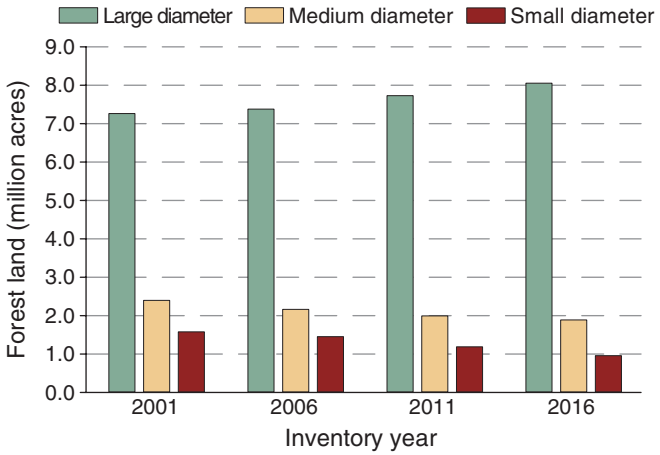

Figure 9—Hardwood forest (stands where the forest types are predominately hardwood species) forest land acreage by stand-size class, Virginia, 2001–16.

Poletimber-sized planted loblolly pine trees forming a medium-diameter stand-size class. (photo courtesy of John Pemberton, Virginia Department of Forestry)

Forests and Land Use Change

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

For example, if a previously forested plot is found to have been cleared for development when remeasured, the 6,000 acres that plot represented will be seen as changing from forest to developed land. If the elapsed time period between plot measurements was 5 years, then that plot would represent 1,200 acres per year of forest land area that

changed to a developed land use. If only half the plot was cleared for development, that change in condition would be mapped and the plot would represent 3,000 acres changing land use and 3,000 acres staying in forest, with an annualized change of 600 acres per year. All of these annually changed acres were then summed for statewide annual change totals.

There are limitations to FIA's ability to estimate land use change due to the lack of detailed nonforest land use mapping on FIA plots. These limitations are described in more detail in Brandeis and others (2018) and by referring to the FIA field guide on field plot data collection and the FIA plot layout (U.S. Department of Agriculture Forest Service 2014). When we look at this plot-derived land use change information, it is with the understanding that some complex nonforest land use scenarios on forest and nonforest plots are simplified and not recorded in as much detail as land use change in forested areas.

Annualized area change was estimated in Virginia from 2005 to 2016. Looking at land use change over time shows us not only how many acres changed land use on average each year but also trends in the rate of those changes. For example, figure 10 shows that from 2005 to 2007 between 61,100 and 62,915 acres of forest land were changing each year to developed land uses. After 2007, coincident with the economic downturn (generally dated from 2007 to 2011), the rate at which forest land was converted to developed lands decreased continually until reaching a low in 2014 of 23,351 acres annually, a level nearly equal to the rate at which developed land reverted to forest land.

After 2005, more acres of forest land were converted to agriculture than the reverse. The rate of this conversion dropped steadily until 2009 and since then has remained very stable. The rate at which Virginia gained forest land from agricultural land has been relatively steady during this

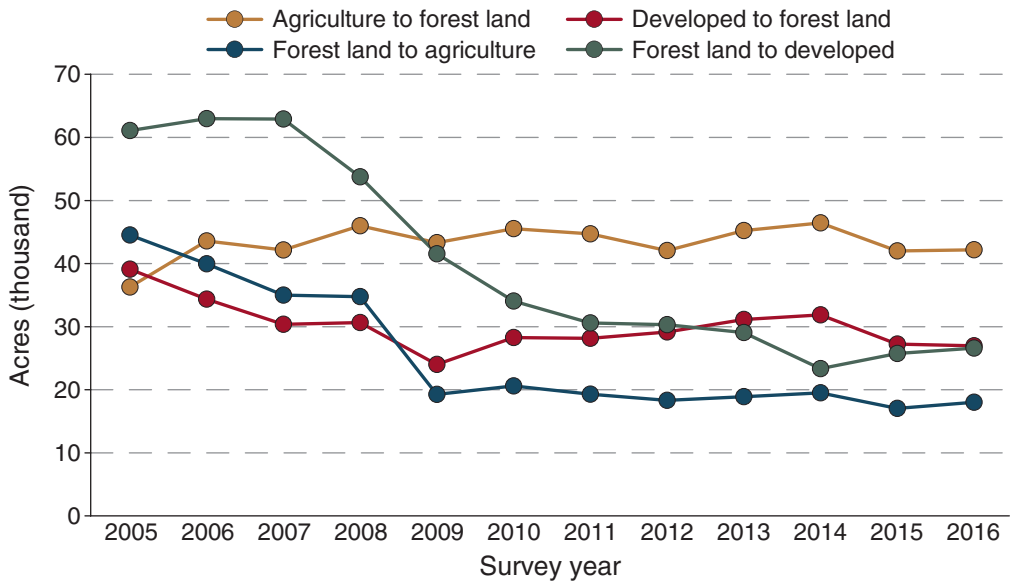

Figure 10—Annualized land-use change, Virginia, 2005–16.

The conversion of forest to agricultural land uses, and vice versa, has slowed in recent years to relatively minor levels when compared to the total acres in those land uses. (photo courtesy of John Campbell, Virginia Department of Forestry)

study period. On average, based on plots remeasured from 2012 to 2016, there was a net annual gain of 24,170 acres of forest land from agricultural land. As mentioned in Brandeis and others (2018), it should be remembered that these changes are relatively small when compared to the total forest and land areas of the State. An annual gain of 24,170 acres still only represents a change of only 0.15 percent of the State's total forest land area of 16.1 million acres. Overall, and as observed across the southern states except in localized areas, land use has been relatively stable in recent years.

Currently, softwood forests originating from artificial regeneration account for 19 percent of all softwood stands (table 2) and land use change within these forested acres reflects important management practice changes over time. Twenty percent of the softwood forests controlled by private

Table 2—Area of softwood stands by ownership group and stand origin (with percentages in parentheses) in Virginia forests, 2016

Ownership group	Total		Natural		Planted	
	thousand acres					
National Forest	1,675	(10)	1,675	(12)	0	(0)
Other Federal	524	(3)	499	(4)	26	(1)
State and local government	616	(4)	571	(4)	45	(2)
Private landowner	13,254	(82)	10,663	(80)	2,591	(97)
Total	16,069	(100)	13,408	(100)	2,661	(100)

Young, vigorously-growing loblolly pine trees in a plantation. (photo courtesy of John Pemberton, Virginia Department of Forestry)

landowners are classified as originating from artificial regeneration. This differs greatly from publically owned forests in Virginia which range from <1 percent (National forests) to 7 percent (State and local governments) artificially established (planted). Figure 11 shows that from 2005 to 2016, the rate at which natural pine stands were harvested and then artificially regenerated decreased steadily from 2005 to 2010. From 2010 onward there has been a relatively steady conversion rate of around 90–100 thousand acres per year until a recent drop in 2016. Fewer acres each year revert back to naturally regenerated pine stands, and the rate at which that occurs has been fairly consistent over the past 10 years.

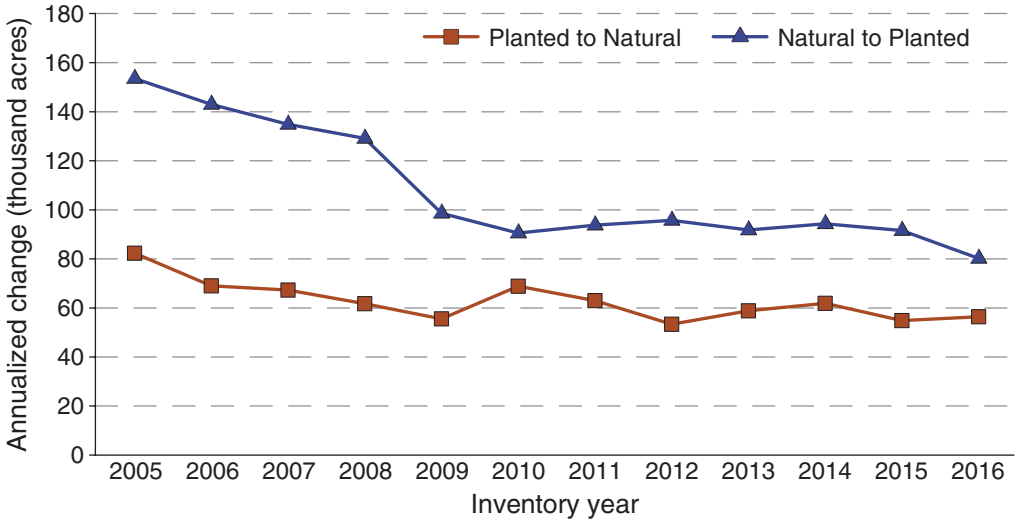

Figure 11—Annualized acres of pine forest stand-origin change, Virginia, 2005–16.

NUMBER OF TREES, VOLUME, AND BIOMASS

Of the 11.4 billion trees with a d.b.h. ≥1 inch estimated to be on forest land in Virginia, species in the group classified as soft maples (predominately red maple) were the most common hardwoods and loblolly pine was the most commonly encountered softwood (tables 3 and C.25). The trees with d.b.h. ≥5 inches hold over 39.4 billion cubic feet (bcf) of volume and 2.1 billion tons of aboveground live-tree biomass (table 3). While the soft maple species group has the greatest number of trees, they only account for 6.4 percent of total wood

Table 3—Number of live trees (d.b.h. ≥1 inch), net volume (in trees with d.b.h. ≥5 inches) and aboveground green weight (in trees with d.b.h. ≥1 inch) on forest land by species group, Virginia, 2016

Species group	Number of live trees	Net volume	Aboveground green weight
	million trees	*million cubic feet*	*thousand tons*
Softwood			
Longleaf and slash pines	1.8	0.0	4.0
Loblolly and shortleaf pines	1,265.3	6,560.8	304,543.6
Other yellow pines	469.8	1,658.3	81,324.6
Eastern white and red pines	179.6	1,010.1	39,070.0
Spruce and balsam fir	3.6	40.2	1,767.1
Eastern hemlock	40.2	174.9	9,925.9
Cypress	4.3	73.3	3,682.1
Other eastern softwoods	270.0	243.8	14,671.7
Total softwoods	2,234.6	9,761.3	454,989.0
Hardwoods			
Select white oaks	415.9	3,478.0	200,432.2
Select red oaks	151.0	1,973.4	112,042.7
Other white oaks	353.4	3,664.9	199,176.8
Other red oaks	494.9	3,067.3	184,991.3
Hickory	415.9	1,724.8	99,535.9
Yellow birch	8.0	24.8	1,473.6
Hard maple	170.5	472.7	29,892.7
Soft maple	1,411.3	2,519.3	148,656.7
Beech	275.0	696.8	45,334.3
Sweetgum	793.5	1,310.9	69,465.6
Tupelo and blackgum	667.1	685.0	39,735.9
Ash	189.6	649.8	26,631.9
Cottonwood and aspen	10.0	25.6	1,247.7
Basswood	26.9	260.2	11,658.9
Yellow-poplar	894.4	6,429.8	284,296.6
Black walnut	26.5	198.1	13,179.4
Other eastern soft hardwoods	663.7	1,310.0	68,667.4
Other eastern hard hardwoods	979.1	661.6	52,204.5
Eastern noncommercial hardwoods	1,202.5	485.3	40,191.4
Total hardwoods	9,149.0	29,638.2	1,628,815.9
All species	11,383.6	39,399.5	2,083,804.9

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

volume in Virginia's forests. There were greater volumes of wood in yellow-poplar (16.3 percent of total volume) and oak trees (30.9 percent of total volume).

If we look at timberland, a subset of all forest land which excludes lands reserved from timber harvesting by statute, we can examine trends in wood volume further back in time by including those forest inventories in Virginia that were previously limited to timberland. Net volume has increased steadily for hardwood species, and to a lesser extent softwood species (fig. 12), to reach its current level of 29.6 bcf in hardwoods and 9.8 bcf in softwoods (table 4). The softwood volume

Figure 12—All-live net volume on timberland by major species group, Virginia, 1977–2016.

Trees such as this yellow-poplar are valued by the hardwood products industry in the State of Virginia. (photo courtesy of John Campbell, Virginia Department of Forestry)

Table 4—Net volume of live trees on forest land by species group and stand origin, Virginia, 2012–16

Species group	Total	Stand origin	
		Planted	Natural
	million cubic feet		
Softwood			
Loblolly and shortleaf pine	6,560.82	2,116.85	4,443.97
Other yellow pines	1,658.29	1,564.80	93.49
Eastern white and red pine	1,010.09	884.26	125.83
Spruce and balsam fir	40.18	26.83	13.35
Eastern hemlock	174.86	173.08	1.78
Cypress	73.32	71.77	1.55
Other eastern softwoods	243.76	234.23	9.53
Total softwoods	9,761.32	5,071.82	4,689.50
Hardwoods			
Select white oaks	3,478.00	3,426.96	51.05
Select red oaks	1,973.38	1,952.69	20.68
Other white oaks	3,664.92	3,653.03	11.89
Other red oaks	3,067.26	2,992.71	74.55
Hickory	1,724.80	1,713.95	10.85
Yellow birch	24.76	24.65	0.11
Hard maple	472.70	472.70	—
Soft maple	2,519.26	2,449.45	69.81
Beech	696.81	676.58	20.23
Sweetgum	1,310.91	1,214.86	96.05
Tupelo and blackgum	685.02	670.06	14.96
Ash	649.80	645.25	4.54
Cottonwood and aspen	25.56	22.05	3.51
Basswood	260.17	260.17	—
Yellow-poplar	6,429.75	6,248.20	181.55
Black walnut	198.12	197.06	1.05
Other eastern soft hardwoods	1,310.01	1,276.39	33.62
Other eastern hard hardwoods	661.64	645.92	15.72
Eastern noncommercial hardwoods	485.32	476.54	8.78
Total hardwoods	29,638.18	29,019.22	618.96
All species	39,399.50	34,091.04	5,308.46

— = no sample for the cell.

is almost evenly split between stands that were naturally regenerated (4.7 bcf) and those that were planted (5.1 bcf). Hardwood volume is predominately in naturally regenerated stands and perhaps even the relatively small percentage of hardwood volume in planted stands could be hardwood trees that regenerated naturally within softwood plantations rather than planted hardwood trees.

In an ownership pattern common across the Southern United States, the majority of the wood volume (80 percent) is owned by nonindustrial private landowners (fig. 13). One percent of the volume is on lands owned by forest industries, while 19 percent of the volume is on public lands.

How this wood volume is distributed across tree diameter classes has important

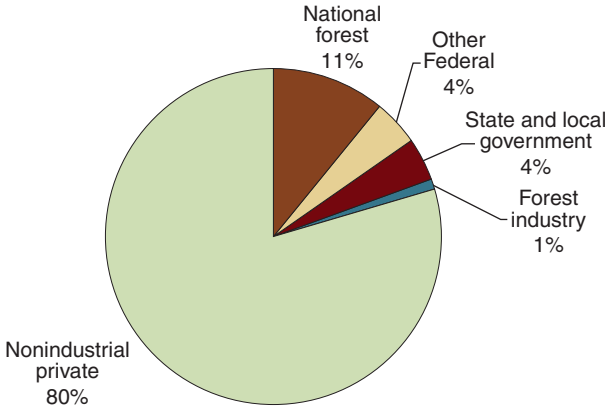

Figure 13—All-live net volume of live trees on forest land by ownership class, Virginia, 2016.

implications for forest management planning and the wood products industries. While total volume on timberland has increased over time, most of that increase has occurred in the larger diameter classes while the smaller diameter classes have remained relatively unchanged (figs. 14 and 15). For softwood volume, there has been a slight downward trend in the smallest diameter class (5.0–6.9 inches) while trees with diameters of 9.0 inches and greater hold an increasing proportion of the total volume (fig. 14). For hardwoods, trees with diameters of 15.0 inches and greater have held an increasing proportion of the total volume over time (fig. 15). Generally, hardwood trees with d.b.h. ≥ 11 inches and softwood trees ≥ 9 inches are considered to have the potential for producing sawn lumber. As volume in the larger diameter classes increases, the amount of volume in sawtimber trees increases as well as seen for both hardwoods and softwoods in table 5.

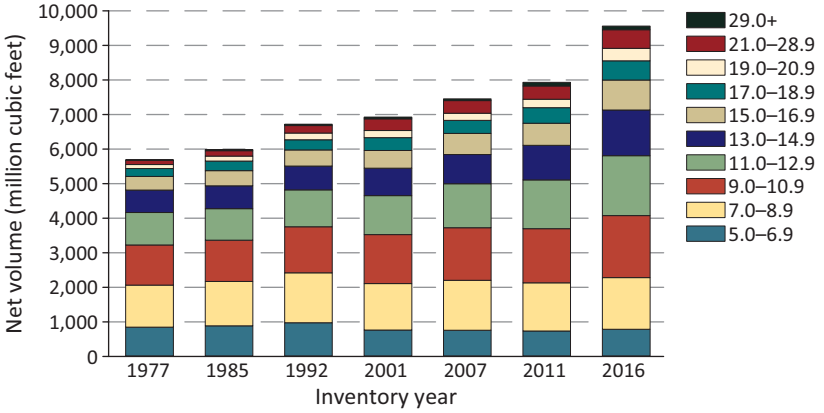

Figure 14—All-live net softwood volume on timberland by diameter class, Virginia, 1977–2016.

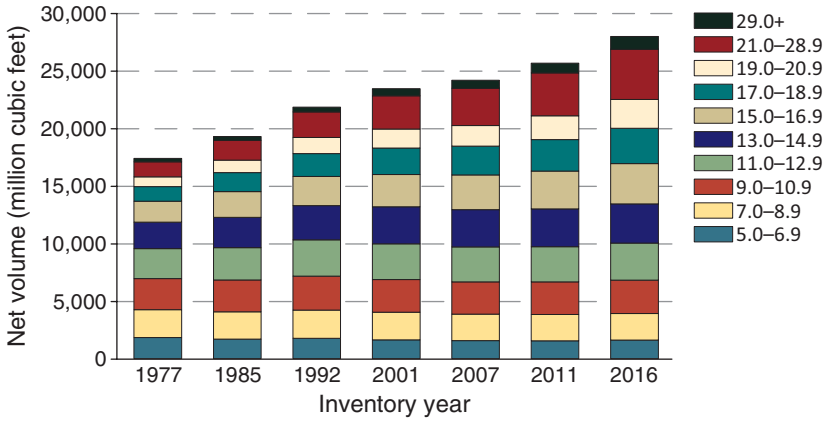

Figure 15—All-live net hardwood volume on timberland by diameter class, Virginia, 1977–2016.

Table 5—Net volume in the saw-log portion of sawtimber trees, in cubic feet, on timberland, Virginia, 1977–2016

Inventory year	Total	Softwoods	Hardwoods
	million cubic feet		
1977	10,558	3,169	7,389
1985	11,407	3,187	8,220
1992	15,307	3,801	11,507
2001	16,699	4,158	12,541
2007	17,371	4,498	12,873
2011	19,571	5,077	14,494
2016	22,971	6,448	16,523

GROWTH, REMOVALS, AND MORTALITY

In 2016, 58.3 percent of the total net annualized growth of 1.3 bcf per year was on hardwood trees and 41.7 percent on softwoods (table 6). Yellow-poplar trees accumulated the most volume annually over the 2012 to 2016 inventory period (31.2 percent of the total hardwood growth) but many other hardwood species like oaks (34.9 percent cumulatively) and maples also contributed significantly to total hardwood growth, In contrast, softwood net growth was heavily concentrated in one species, loblolly pine, and that growth was on trees in planted stands.

Both softwood and hardwood average annualized growth have been increasing

Table 6—Net average annual growth of live trees on forest land by species group and stand origin, Virginia, 2012–16

Species group	Total	Stand origin	
		Natural	Planted
	million cubic feet		
Softwood			
Loblolly and shortleaf pine	474.55	78.16	396.39
Other yellow pines	22.59	14.85	7.74
Eastern white and red pine	38.73	29.60	9.12
Spruce and balsam fir	0.78	0.82	-0.04
Eastern hemlock	1.62	1.44	0.18
Cypress	1.30	1.03	0.27
Other eastern softwoods	8.43	8.23	0.20
Total softwoods	547.99	134.12	413.87
Hardwood			
Select white oaks	83.96	82.16	1.80
Select red oaks	41.80	44.06	-2.26
Other white oaks	74.29	73.87	0.41
Other red oaks	66.56	61.36	5.19
Hickory	36.33	37.23	-0.90
Yellow birch	-0.37	-0.39	0.02
Hard maple	12.50	12.57	-0.07
Soft maple	58.48	55.26	3.22
Beech	16.68	15.36	1.32
Sweetgum	39.30	34.37	4.93
Tupelo and blackgum	10.31	9.60	0.70
Ash	13.44	13.08	0.36
Cottonwood and aspen	0.29	0.13	0.16
Basswood	11.09	11.09	—
Yellow-poplar	238.95	227.32	11.63
Black walnut	9.07	8.86	0.21
Other eastern soft hardwoods	40.80	39.98	0.82
Other eastern hard hardwoods	10.06	9.37	0.69
Eastern noncommercial hardwoods	14.99	13.90	1.09
Other	-13.71	-12.27	-1.44
Total hardwoods	764.81	736.90	27.91
All species	1,312.80	871.02	441.78

— = no sample for the cell.

during the last three periods of annualized forest inventory, with a notable increase from 2011 to 2016 (fig. 16). Softwood and hardwood removals, on the other hand, have been decreasing while mortality remained constant. In agreement with the previous observations that volume has been increasing proportionately greater in larger diameter trees, growth has increased in larger diameter hardwood stands (where the trees are ≥11 inches d.b.h.) while remaining relatively stable in medium (5.0 to 10.9 inches d.b.h.) and small-diameter stands (< 5.0 inches d.b.h.) (fig. 17). In softwoods, net annual growth has been increasing in all stand-size classes over time. The highest cumulative levels of growth has been occurring in medium-diameter stands, but net growth has increased over time for large-diameter stands and in 2016 has nearly reached the level of growth in medium-diameter stands.

The distribution of average annual removals from the forests of Virginia from 2012 to 2016 is similar to that of net annual growth (table 7). Softwood removals were concentrated in planted loblolly pine as was net growth while hardwood removals were spread across many species as was net growth. Average annual volume removed has generally shown declines in both hardwoods and softwoods (fig. 18). Hardwood removals are concentrated in the larger diameter stands, corresponding to the greater use of hardwoods for sawn lumber rather than pulp products. Softwoods show declines in removals from stands with trees used for both sawn lumber and pulp products. The drop in removal volumes is particularly notable in the large-diameter hardwood stands from 2007 to 2011. Plots measured over this time period would reflect the overall economic downturn experienced across the country. Harvesting activity across the Southern United States show declines during this time as the demand for wood products decreased. Continued monitoring will show whether the minor decrease from 2011 to 2016 may be indicating some recovery of harvesting activity.

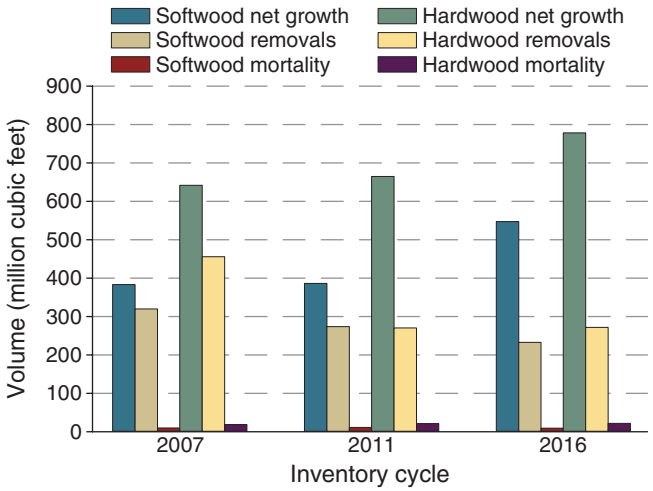

Figure 16—All-live average annual cubic-foot volume growth, removals and mortality on forest land by survey year, Virginia, 2007–16.

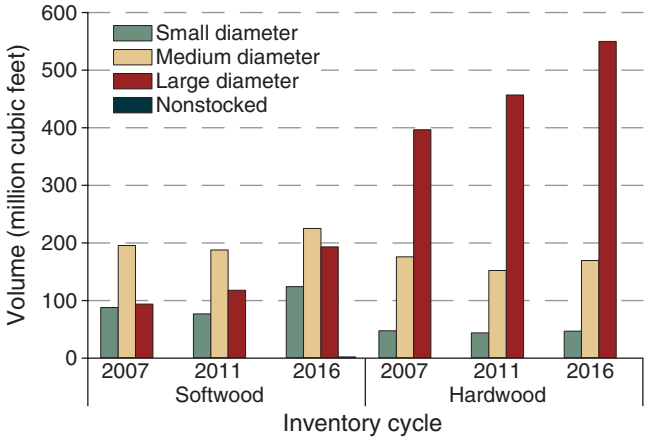

Figure 17—All-live net growth by major species group and stand-size class, Virginia, 2007–16.

Tracking average annual mortality over time reveals an increase in the amount of hardwood volume lost in trees that died in larger diameter stands (fig. 19). While this at first might appear to indicate a forest health issue, both total volume and net annual growth are also on the increase in these stands and there does not appear to be a disproportionate increase in mortality. Note also the scale of annual mortality against that of net growth and removals. The 13.6 bcf of hardwood mortality in large-diameter stands is only 3.4 percent of the 396.7 bcf of net growth.

Table 7—Average annual removals of live trees on forest land by species group and stand origin, Virginia, 2012–16

Species group	Total	Stand origin	
		Natural	Planted
	million cubic feet		
Softwood			
Loblolly and shortleaf pine	192.13	25.97	166.16
Other yellow pines	24.65	20.73	3.92
Eastern white and red pine	12.97	8.33	4.64
Spruce and balsam fir	—	—	—
Eastern hemlock	0.10	0.10	—
Cypress	0.58	0.58	—
Other eastern softwoods	2.75	2.70	0.05
Total softwoods	233.18	58.41	174.77
Hardwood			
Select white oaks	43.92	42.83	1.09
Select red oaks	9.97	9.80	0.17
Other white oaks	15.15	15.06	0.10
Other red oaks	33.54	29.42	4.13
Hickory	13.73	13.57	0.16
Yellow birch	—	—	—
Hard maple	1.33	1.33	—
Soft maple	23.15	21.58	1.57
Beech	4.20	4.18	0.02
Sweetgum	17.16	14.14	3.02
Tupelo and blackgum	1.68	1.62	0.06
Ash	5.52	5.47	0.05
Cottonwood and aspen	0.14	—	0.14
Basswood	0.16	0.16	—
Yellow-poplar	76.74	71.19	5.54
Black walnut	2.40	1.90	0.51
Other eastern soft hardwoods	15.50	14.43	1.08
Other eastern hard hardwoods	5.46	5.27	0.19
Eastern noncommercial hardwoods	2.52	2.18	0.35
Other	—	—	—
Total hardwoods	272.28	254.11	18.17
All species	505.46	312.52	192.94

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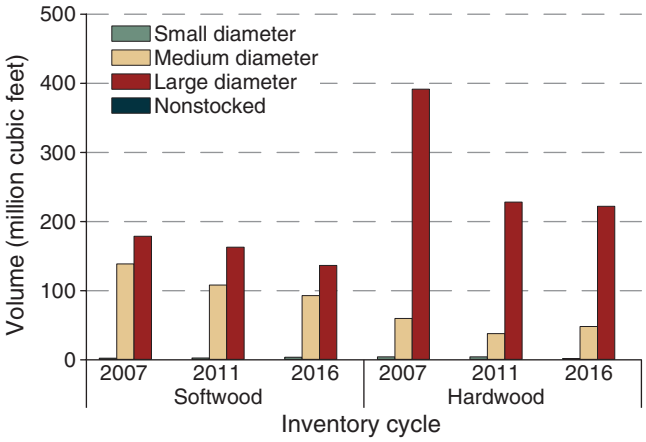

Figure 18—Removals volume by major species group and stand-size class, Virginia, 2007–16.

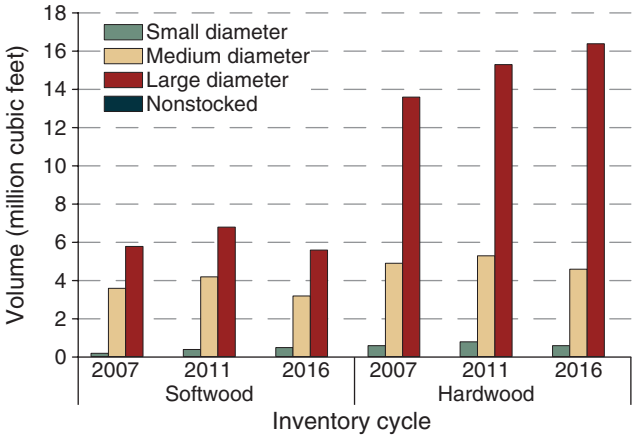

Figure 19—Mortality volume by major species group and stand-size class, Virginia, 2007–16.

Additionally, net growth is exceeding removals for both softwoods and hardwoods, an indication of timber harvest sustainability. When the ratio of growth to removals is greater than 1.0, that means annual growth exceeds annual removals. A growth to removals ratio of 2.0 means twice as much wood volume is grown annually as is removed annually. For hardwoods, growth has exceeded removals for the entire study period (2002 to 2016) with growth to removal ratios of 2.9 in 2007, 4.0 in 2011 and 3.5 in 2016 for medium-diameter stands (fig. 20). In large-diameter stands, however, net growth was only slightly greater than removals during the inventory period of 2002 to 2007 with a growth to removal ratio of only 1.01, then ratios of 2.0 in 2011 and 2.47 in 2016. Softwoods have shown a different pattern. Growth has increased and removals decreased over time in medium-diameter stands, with growth to removal ratios increasing from 1.4 in 2007 to 2.4 in 2016 (fig. 21). Removals exceeded growth in large-diameter softwood stands in 2007 (growth to removal ratio of 0.5) and

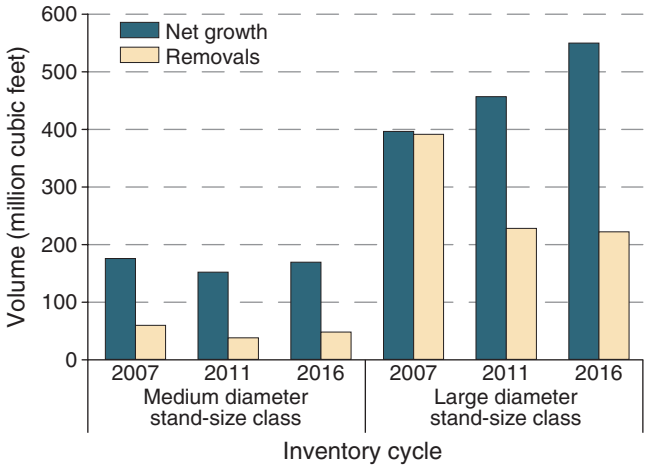

Figure 20—Hardwood net growth to removals volume for medium- and large-diameter stand-size classes, Virginia, 2007–16.

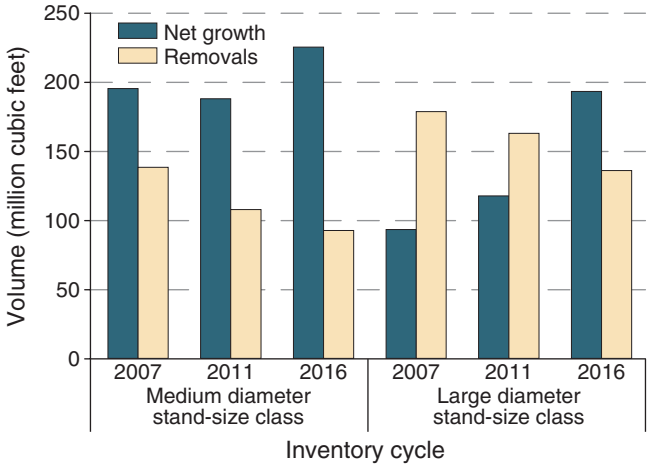

Figure 21—Softwood net growth to removals volume for medium- and large-diameter stand-size classes, Virginia, 2007–16.

2011 (growth to removal ratio of 0.7). Softwood large-diameter stand growth exceeded removals from 2012 to 2016 with a growth to removal ratio of 1.4.

Treated Acres

The SRS FIA program not only notes harvesting activity on remeasured plots, it also categorizes the type of harvesting that took place. Clearcut harvesting is where the majority of the merchantable trees in a stand are removed and utilized, with residual stand stocking lowered to under 50 percent. Partial harvest is when primarily the highest quality trees are removed and the residual stand consists of lower quality trees in the case of high grading or selection harvest. This cutting type can also include silvicultural systems that involve partial harvesting but not necessarily the retention of lower quality trees like uneven-aged management. Seed-tree/shelterwood harvesting, where crop trees are harvested leaving seed source trees either in a shelterwood or seed tree, are also noted but not often recorded in the Southern States. Commercial thinning involves 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 of note are timber stand improvements and salvage cutting (see the Glossary for more details on SRS FIA harvesting categories).

Timber harvesting in Virginia shows trends similar to those in most Southern States. We see that final harvests, either by clear-cutting or partially harvesting the stand, have declined since the forest inventory of 2007 (fig. 22). This relatively short 9-year time period encompasses the years of slowed economic activity, generally considered to have been from 2007 to 2011. Acres thinned, however, have remained stable or increased slightly in recent years, indicating that stand tending activities were not as impacted by the economic downturn as were final harvests.

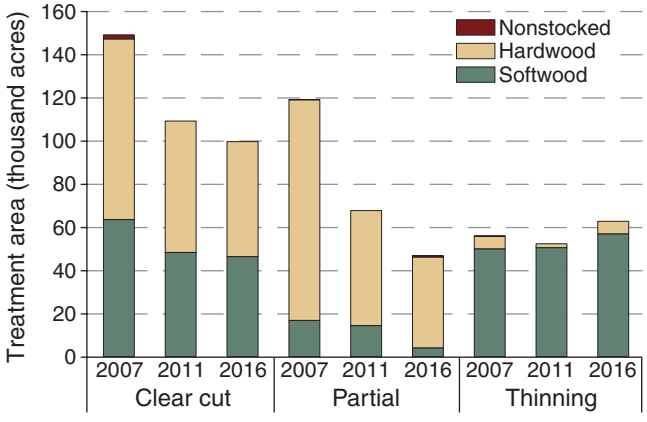

Figure 22—Area of forest land treated annually by forest-type group and cutting treatment class, Virginia, 2007–16.

DISTURBANCE AND FOREST HEALTH INDICATORS

Disturbance

From 2012 to 2016, severe weather impacted Virginia's forests more than any other disturbance with an average of 43,300 forest land acres affected per year (table 8). This was followed by disturbance due to domestic animals (for example, livestock grazing), forest fires, and other forms of human activities. Overall, disturbance has been relatively infrequent and annually affects a small percentage of Virginia's forest land.

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

All of the carbon and nutrients stored in a tree during its lifetime eventually return to the soil and atmosphere from which the tree originally sequestered them. Many trees will remain standing for years after their deaths providing valuable nesting and feeding habitat for a variety of forest-dwelling animals. The FIA program continues to measure these dead trees, also known as snags, for as long as they are standing. The number of standing

Table 8—Area of forest land disturbed annually by forest-type group and disturbance class, Virginia, 2016

Forest-type group[b]	Disturbance class[a]							
	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
	thousand acres							
Softwood types								
White-red-jack pine	0.0	0.0	1.5	0.3	0.0	0.0	1.5	0.0
Longleaf-slash pine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	3.7	1.1	6.2	1.9	2.9	1.4	3.8	3.6
Other eastern softwoods	0.0	0.0	0.0	0.0	0.9	0.0	1.5	0.0
Total softwoods	3.7	1.1	7.6	2.2	3.8	1.4	6.8	3.6
Hardwood types								
Oak-pine	4.4	1.0	4.0	3.2	3.0	1.1	8.2	1.1
Oak-hickory	10.7	1.0	26.5	20.7	27.5	4.2	10.8	10.3
Oak-gum-cypress	1.7	0.0	2.8	0.0	0.0	4.3	0.7	0.0
Elm-ash-cottonwood	0.0	0.0	1.4	0.0	1.5	3.6	0.3	0.0
Maple-beech-birch	4.6	0.0	1.0	0.0	0.7	0.0	0.7	3.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0
Exotic hardwoods	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total hardwoods	21.5	2.0	35.7	24.0	34.1	13.2	20.8	14.5
Nonstocked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All groups	25.2	3.0	43.3	26.2	37.9	14.6	27.6	18.1

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

dead trees ≥ 5.0 inches d.b.h. in forests of Virginia was 207.5 million in 2016 (table 9). Decreasing numbers of standing dead trees as diameters increase reflect the distribution of live trees across the landscape.

Once these standing dead trees fall to the ground, they are considered to be down woody materials (DWM), along with small twigs and branches falling from live trees. Down woody materials provide shelter and feeding sites for many wildlife species similar to standing dead trees. While both standing dead trees and DWM are an important part of wildlife habitats,

Table 9—Number of standing dead trees on forest land by species group and diameter class, Virginia, 2016

Species group	All classes	Diameter class (inches) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–24.9	25.0–28.9	29.0+
						million trees						
Softwood												
Loblolly and shortleaf pines	14.7	6.1	4.1	2.4	1.3	0.3	0.3	0.2	0.0	0.0	0.0	0.0
Other yellow pines	32.0	11.3	9.2	5.9	3.1	1.6	0.7	0.2	0.0	0.0	0.0	0.0
Eastern white and red pines	6.5	2.4	1.5	0.8	0.7	0.4	0.1	0.2	0.1	0.2	0.1	0.0
Spruce and balsam fir	0.4	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eastern hemlock	5.8	2.2	1.6	0.8	0.6	0.1	0.1	0.2	0.1	0.1	0.0	0.0
Cypress	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern softwoods	7.6	4.4	1.6	1.0	0.2	0.2	0.1	0.0	0.1	0.0	0.0	0.0
Total softwoods	67.1	26.5	18.3	10.9	5.8	2.6	1.4	0.8	0.4	0.3	0.1	0.0
Hardwood												
Select white oaks	9.2	3.9	2.0	1.0	0.7	0.5	0.4	0.4	0.1	0.2	0.0	0.0
Select red oaks	5.9	2.0	0.8	0.9	0.6	0.4	0.3	0.1	0.2	0.4	0.2	0.0
Other white oaks	16.1	5.4	3.2	2.5	1.6	1.1	0.9	0.6	0.2	0.3	0.1	0.2
Other red oaks	19.7	6.3	4.2	3.2	2.0	1.4	0.9	0.8	0.5	0.3	0.1	0.0
Hickory	4.8	1.3	1.0	0.7	0.6	0.4	0.2	0.2	0.3	0.1	0.0	0.0
Yellow birch	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	1.0	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Soft maple	12.1	5.4	3.0	1.4	1.0	0.5	0.4	0.2	0.1	0.1	0.0	0.0
Beech	0.6	0.2	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Sweetgum	3.7	1.9	1.0	0.3	0.2	0.2	0.0	0.0	0.1	0.0	0.0	0.0
Tupelo and blackgum	2.0	1.0	0.4	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Ash	4.9	1.9	1.5	0.4	0.5	0.3	0.1	0.1	0.0	0.1	0.0	0.0
Cottonwood and aspen	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basswood	0.4	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow-poplar	7.7	3.8	1.6	1.0	0.7	0.2	0.1	0.2	0.0	0.1	0.0	0.0
Black walnut	0.6	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern soft hardwoods	15.6	7.4	4.2	1.5	1.4	0.4	0.4	0.2	0.1	0.0	0.0	0.0
Other eastern hard hardwoods	27.6	11.2	7.0	4.9	2.2	1.2	0.3	0.3	0.3	0.1	0.1	0.0
Eastern noncommercial hardwoods	7.4	4.4	1.8	0.9	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total hardwoods	140.3	56.6	32.5	19.4	12.5	6.9	4.3	3.2	2.0	1.7	0.6	0.6
All species	207.5	83.1	50.8	30.4	18.3	9.5	5.7	4.0	2.4	2.0	0.7	0.6

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

The down woody materials being measured here as part of the FIA forest inventory are important to wildlife and the cycling of nutrients and carbon in forested ecosystems. (photo courtesy of John Campbell, Virginia Department of Forestry)

DWM biomass also has an important role in forest productivity and the recycling of the nutrients and carbon. When sufficiently dry, DWM is also part of a forest's fire fuel load.

Natural decomposition of DWM in temperate forests like Virginia's may proceed at relatively predictable rates, which will vary by climate, local conditions, forest type, stand age, forest management regime, and many other factors. But the amount of DWM can change rapidly as natural disturbances such as forest fires and storm events can quickly increase the amounts of DWM on the forest floor. Also a human-caused disturbance like wood product harvesting can dramatically change DWM pools in a very short period of time. The irregular frequency and localized nature of these disturbances make forest DWM pools dynamic and heterogeneous across the landscape.

Quantities of DWM are expressed by FIA in terms of total tons and tons per acre in various size classes. Time-lag fuel hour size classes, which are 1, 10, 100 and 1,000 hours, represent the time it would take for two-thirds of the piece of DWM to dry to the same moisture that is in the surrounding air. One-hour fuels are up to 0.01 to 0.24 inch in diameter, 10-hour fuels are 0.25 to 0.9 inch in diameter, 100-hour fuels are 1.0 to 2.9 inches in diameter, and 1,000-hour fuels are 3.0 to 8.0 inches in diameter. Where DWM has been piled after harvesting or other human activity and cannot be practically separated into individual pieces, the total volume and mass of the pile is estimated and presented as slash. Details on how these data are collected and what type of material are included in each size class can be found in the FIA National core field guide (U.S. Department of Agriculture Forest Service 2014).

Table 10 presents the mean fuel loading on forest land by forest-type group and fuel class for Virginia in 2016. Table 11 has mean fuel loading on a per acre basis. Note that the forest land acres used to make the calculations in table 11 differ from those that appear in other places in this publication. For example, appendix table C.3 will show there were an estimated 9,703,400 acres of oak-hickory forest in Virginia in 2016 but the area of this forest type used to estimate DWM tons per acre was 10,707,998 acres (table 11). This is because separate forest land area estimates had to be made using only those plots where DWM were inventoried, approximately 1/16 of the FIA plots. These forest land area estimates are less accurate because they are based on fewer plots but must be used to correctly calculate the tons per acre of DWM. If we had used the oak-hickory forest land acreage in table C.3, the tons per acres of DWM for that forest type would have been overestimated. Details for these DWM estimation procedures can be found in Woodall and Monleon (2008) and Woodall and others (2011). Based on the FIA plots where DWM was sampled, the forests of Virginia hold an average of 9.0 tons of biomass per acre of DWM (the sum of the 1-hour, 10-hour, 100-hour fuels and slash, table 11). These current DWM estimates agree well with those presented in previous forest inventory reports (Rose 2007, 2009, 2013).

The forest floor organic material that is too small to be recorded as individual pieces of DWM is also measured and monitored by FIA. Litter is the layer of freshly fallen leaves, needles, twigs, cones, detached bark, dead moss, dead lichens and all other detached tree and plant parts that cover the forest floor (U.S. Department of Agriculture Forest Service 2014). Duff is the layer below the litter, located just above the uppermost layer of mineral soil, consisting of organic material derived from the decomposition of the litter (U.S. Department of Agriculture Forest Service 2014). [As with DWM,

Table 10—Mean fuel loading on forest land by forest-type group and fuel class, Virginia, 2016

Forest-type group	Down and dead wood by time-lag fuel hour classes				Forest floor fuels		
	1 hour	10 hour	100 hour	1000+ hour	Slash	Duff	Litter
				tons			
White-red-jack pine	4,089.3	51,247.1	180,858.8	229,212.2	0.0	779,810.7	1,835,347.7
Oak-hickory	363,818.5	4,005,252.6	15,641,187.2	39,695,777.4	539,812.0	101,527,245.7	77,832,608.2
Exotic hardwoods	895.2	26,716.2	1,177.5	56,509.2	0.0	36,360.5	45,321.6
Maple-beech-birch	13,813.4	245,459.7	1,070,055.2	2,599,378.6	0.0	5,210,135.8	2,366,332.0
Oak-gum-cypress	7,399.2	54,511.8	250,926.9	513,468.2	0.0	1,728,942.3	203,819.4
Other eastern softwoods	951.0	7,358.1	26,280.1	0.0	0.0	16,868.3	45,911.7
Oak-pine	53,238.2	512,694.5	2,741,366.4	6,032,780.7	47,212,320.7	15,789,022.0	11,472,658.4
Elm-ash-cottonwood	4,639.2	25,919.7	117,539.2	118,808.1	15,004,499.4	212,343.7	624,944.9
Nonstocked	115.2	7,133.7	50,957.5	0.0	0.0	0.0	262,707.4
Other hardwoods	99.7	1,349.8	1,377.4	0.0	0.0	98,744.7	26,297.4
Loblolly-shortleaf pine	89,124.1	758,530.7	2,635,895.0	3,672,957.8	1,930,061.6	33,798,663.2	18,784,178.4
All groups	538,183.0	5,696,173.8	22,717,621.1	52,918,892.2	64,686,693.6	159,198,137.0	113,500,127.1

Numbers in columns do not sum to totals.

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

Table 11—Mean fuel loading on forest land by forest-type group and fuel class, Virginia, 2016

Forest-type group	Forest land area	Down and dead wood by time-lag fuel hour classes				Forest floor fuels		
		1 hour	10 hour	100 hour	1000+ hour	Slash	Duff	Litter
	acres	*tons/acre*						
White-red-jack pine	128,864.0	0.0	0.4	1.4	1.8	0.0	6.1	12.3
Oak-hickory	10,707,998.0	0.0	0.4	1.5	3.7	0.1	9.5	9.3
Exotic hardwoods	55,617.0	0.0	0.5	0.0	1.0	0.0	0.7	2.8
Oak-gum-cypress	249,531.0	0.0	0.2	1.0	2.1	0.0	6.9	4.7
Maple-beech-birch	506,500.0	0.0	0.5	2.1	5.1	0.0	10.3	3.0
Other eastern softwoods	21,639.0	0.0	0.3	1.2	0.0	0.0	0.8	12.2
Oak-pine	1,577,624.0	0.0	0.3	1.7	3.8	29.9	10.0	5.1
Elm-ash-cottonwood	217,174.0	0.0	0.1	0.5	0.5	69.1	1.0	10.5
Nonstocked	20,513.0	0.0	0.3	2.5	0.0	0.0	0.0	14.2
Other hardwoods	3,791.0	0.0	0.4	0.4	0.0	0.0	26.0	12.6
Loblolly-shortleaf pine	2,784,632.0	0.0	0.3	0.9	1.3	0.7	12.1	10.6
All groups	16,273,884.0	0.0	0.4	1.4	3.3	4.0	9.8	97.3

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

more detailed duff and litter definitions can be found in the Glossary and data collection details can be found in the FIA National core field guide (U.S. Department of Agriculture Forest Service 2014).] Both of these biomass deposits play important roles in forest ecosystem functioning similar to those of the DWM. Virginia's forests have on average 107.1 tons of duff and litter biomass per acre (table 11). This estimate is notably higher than previous ones due to much higher tons per acre of litter on the plots used to generate the 2016 estimate. Previous reports cite duff estimates of 9.9 and 10.4 tons per acre (Rose 2007, Rose 2009) which agree well with the 9.8 tons per acre found in this inventory cycle. Litter estimates, however, of 97.3 tons per acre were considerably higher than the previously reported 3.6 and 3.5 tons per acre (Rose 2007; Rose 2009). Domke and others (2016) cite studies that show the high variability of this forest floor litter across forested landscape and how it complicates the estimation of this carbon pool. Continued monitoring should clarify the range of litter values we should expect in Virginia's forests.

These forest floor biomass deposits are important forest carbon storage pools. The FIA program reports DWM in size categories useful for monitoring carbon cycling in the forest. Fine woody debris (FWD) is counted in 3 size classes according to its diameter. Small FWD ranges from 0.01 to 0.24 inch, medium FWD is 0.25 to 0.9 inch, and large FWD is 1.0 to 2.9 inches, the same as the 1-, 10-, and 100-hour fuel classes. Coarse woody debris (CWD) is 3.0 inches and greater in diameter, unlike the 1,000-hour fuel category which ends at 8.0 inches. Once the number of tons of biomass in DWM is estimated, it is converted to tons of carbon stored, taking into account decay reduction factors for CWD. This conversion is described in detail in Woodall and Monleon (2008). In Virginia, these data gave a total of 73.1 million tons of carbon stored in DWM and another 136.3 million tons in duff and litter (table 12). These estimates can be broken down further into forest-type groups and ownership categories which highlights the importance of the State's oak-hickory forests in terms of carbon storage and sequestration (table 13).

Table 12—Carbon stocks of dead, down woody materials by forest-type group on forest land, Virginia, 2016

Forest-type group	Forest floor		Fine woody debris			Coarse woody debris	Slash
	Duff	Litter	Small	Medium	Large	CWD	Slash
	thousand tons						
White-red-jack pine	389.9	917.7	2.0	25.6	90.4	115.0	0.0
Loblolly-shortleaf pine	16,899.3	9,392.1	44.6	379.3	1,318.0	1,876.9	965.0
Other eastern softwoods	8.4	23.0	0.5	3.7	13.1	0.0	0.0
Oak-pine	7,894.5	5,736.3	26.6	256.4	1,370.7	3,046.0	23,606.2
Oak-hickory	50,763.6	38,916.3	181.9	2,002.6	7,820.6	19,649.7	269.9
Oak-gum-cypress	864.5	101.9	3.7	27.3	125.5	252.1	0.0
Elm-ash-cottonwood	106.2	312.5	2.3	13.0	58.8	58.3	7,502.3
Maple-beech-birch	2,605.1	1,183.2	6.9	122.7	535.0	1,285.2	0.0
Other hardwoods	49.4	13.2	0.1	0.7	0.7	0.0	0.0
Exotic hardwoods	18.2	22.7	0.5	13.4	0.6	27.8	0.0
Nonstocked	0.0	131.4	0.1	3.6	25.5	0.0	0.0
All groups	79,599.1	56,750.1	269.1	2,848.1	11,358.8	26,311.1	32,343.4

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

Table 13—Biomass and carbon mass of down wood[a] by forest-type group on forest land, Virginia, 2016

Forest-type group	USDA Forest Service		Other Federal		State and local government		Corporate		Noncorporate	
	Biomass	Carbon	Biomass	Carbon	Biomass	Carbon	Biomass	Carbon	Biomass	Carbon
	thousand tons									
White-red-jack pine	229.2	115.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	932.7	479.3	81.1	42.3	0.0	0.0	33.6	17.2	2,625.5	1,338.1
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oak-pine	670.9	342.6	185.5	91.1	0.0	0.0	0.0	0.0	5,176.4	2,612.3
Oak-hickory	7,230.8	3,572.9	1,090.1	536.3	43.5	21.3	0.0	0.0	31,331.4	15,519.1
Oak-gum-cypress	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	513.5	252.1
Elm-ash-cottonwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.8	58.3
Maple-beech-birch	1,471.3	731.3	0.0	0.0	0.0	0.0	0.0	0.0	1,128.1	553.9
Other hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	2.5	1.3	0.0	0.0	0.0	0.0	0.0	0.0	54.0	26.5
Nonstocked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All groups	10,537.4	5,242.5	1,356.7	669.6	43.5	21.3	33.6	17.2	40,947.7	20,360.5

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] Down wood includes all pieces with a diameter more than 3 inches at the point of intersection. Thus, only includes coarse woody debris (CWD).

The 2016 DWM, duff and litter estimates mostly fall within the broad range of values previously observed for the Southern United States and Virginia. Woodall and others (2013) present State-level DWM estimates derived from field-based FIA measurements taken from 2002 to 2010 under different data collection protocols. The estimate for total DWM in Virginia 2010 was 59.2 million tons (Woodall and others 2013).

Carbon

The need for information about forest carbon pools has increased in recent years due to concerns about global climate change. The FIA program has responded to these information needs by converting field-measured estimates like tree volume to carbon and using models or ancillary sources of data to estimate carbon stored in other pools like tree roots and nontree understory vegetation. The FIA program used models to estimate DWM, duff and litter carbon quantities prior to having field-based measurements. The models used geographic region, stand age, and species composition as predictive variables and were implemented as part of the larger Component Ratio Method (CRM) suite of forest carbon pool estimators. See U.S. Environmental Protection Agency (2012), Smith and Heath (2002), and Woodall and others (2011) for details on the modeling procedures for DWM and forest floor carbon. There are notable differences when the field-based estimates to the model-based estimates for Virginia in 2016 are compared. At a national level, field-based litter estimates were 44 percent lower than model-based estimates (Domke and others 2016), while for CWD the model-based estimates were 9 percent higher than field-based estimates (Domke and others 2013).

For this report we chose to present the total quantities and percentages of forest carbon by carbon pool using the model-based estimates of forest floor litter and DWM (fig. 23). This is because they are more comparable to the previous modeled estimates and one cannot directly replicate the same categories of forest carbon produced by the models. For example, the model-based DWM estimate is part of a larger category that includes coarse tree roots and stumps. While the exact quantities

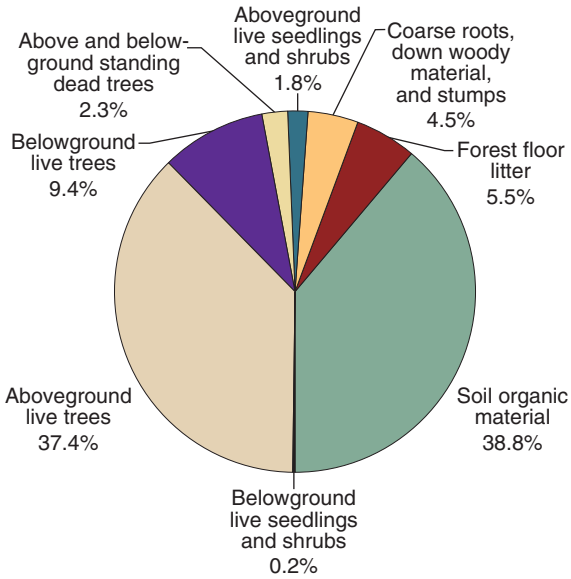

Figure 23—Percentage of forest carbon by carbon pool, Virginia, 2016.

are not the same, the distribution of carbon across the pools remains similar, again with almost half of forest carbon stored in the soil and about a third in the aboveground portions of live trees. The forests of Virginia sequester approximately 1.1 billion tons of carbon (table 14), of which 38.8 percent was in the forest soil and 37.4 percent in the aboveground portions of living trees (fig. 23).

Pests, Diseases and Species of Concern

The forests of Virginia are subject to a number of stresses that impact growth and vitality. Pressure from insects and diseases, especially those introduced from other areas of the world, are particularly great. Two such insects that have had devastating effects in Virginia are the emerald ash borer and the hemlock woolly adelgid.

Emerald Ash Borer—The emerald ash borer is a wood-boring beetle native to Asia that was first identified in the United States in 2002 (Herms and McCullough 2014). Feeding galleries created underneath the bark by the beetle larvae disrupt nutrient and water transportation throughout the tree resulting in crown dieback and eventual tree mortality. Since its accidental introduction near Detroit, Michigan, infestations of the beetle have spread to 31 States and killed hundreds of millions of ash trees. In Virginia, the emerald ash borer was detected and successfully eradicated from Fairfax County in 2003, but in 2008, the

Table 14—Carbon pool on forest land by forest-type group and carbon pool groups, Virginia, 2016

Forest-type group[a]	Carbon pool groups								
	Above ground trees	Below ground trees	Standing dead trees	Above ground understory	Below ground understory	Down dead material	Forest floor Litter	Soil organic matter	Total
	thousand short tons								
Softwood types									
White-red-jack pine	3,554.0	990.0	396.0	201.0	22.0	635.0	921.0	4,066.0	10,785.0
Spruce-fir	290.0	65.0	29.0	8.0	1.0	39.0	54.0	569.0	1,054.0
Longleaf-slash pine	0.0	0.0	0.0	8.0	1.0	12.0	14.0	222.0	257.0
Loblolly-shortleaf pine	67,690.0	18,975.0	2,614.0	4,386.0	487.0	10,819.0	13,680.0	100,425.0	219,076.0
Other eastern softwoods	839.0	210.0	180.0	111.0	12.0	200.0	394.0	1,236.0	3,182.0
Exotic softwoods	14.0	3.0	6.0	4.0	0.0	6.0	9.0	207.0	251.0
Total softwoods	72,387.0	20,243.0	3,225.0	4,718.0	523.0	11,711.0	15,072.0	106,725.0	234,605.0
Hardwood types									
Oak-pine	35,320.0	9,125.0	1,806.0	2,184.0	243.0	4,304.0	7,535.0	46,098.0	106,615.0
Oak-hickory	262,471.0	63,270.0	16,552.0	11,204.0	1,245.0	28,621.0	32,014.0	195,880.0	611,257.0
Oak-gum-cypress	8,392.0	2,383.0	697.0	213.0	24.0	1,160.0	1,177.0	24,334.0	38,379.0
Elm-ash-cottonwood	7,825.0	2,047.0	1,097.0	283.0	31.0	1,125.0	1,171.0	18,657.0	32,235.0
Maple-beech-birch	9,731.0	2,108.0	1,005.0	395.0	44.0	975.0	1,225.0	9,718.0	25,201.0
Aspen-birch	0.0	12.0	5.0	1.0	0.0	4.0	4.0	41.0	67.0
Other hardwoods	909.0	270.0	143.0	71.0	8.0	121.0	164.0	4,448.0	6,133.0
Exotic hardwoods	152.0	49.0	17.0	18.0	2.0	34.0	53.0	2,046.0	2,371.0
Total hardwoods	324,800.0	79,264.0	21,322.0	14,369.0	1,597.0	36,344.0	43,343.0	301,222.0	822,258.0
Nonstocked	52.0	14.0	17.0	175.0	19.0	17.0	130.0	4,576.0	4,999.0
All groups	397,239.0	99,521.0	24,564.0	19,262.0	2,139.0	48,072.0	58,545.0	412,523.0	1,061,862.0

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

beetle reappeared and by the end of 2016 had spread to 48 counties (fig. 24) (Virginia Department of Forestry 2008, 2018). All four species of ash recorded in Virginia, white ash, green ash, Carolina ash, and blue ash, are susceptible to emerald ash borer.

In 2007, prior to the establishment of the emerald ash borer, there were 44.5 million live and 2.5 million standing dead ash trees ≥ 5.0 inches d.b.h. across Virginia, a ratio of 17.7 live ash for every one standing dead ash. From 2007 to 2016, the total number of live ash trees ≥ 5.0 inches d.b.h. across the State remained fairly stable (approximately 44.0 million trees), but the number of standing dead ash increased by 60 percent, dropping the overall ratio of live to standing dead ash trees to 10.9. In counties where the emerald ash borer was detected prior to 2017 (fig. 24), the 2016 live to standing dead ratio was 8.5, a ratio similar to that observed for ash in neighboring Maryland (8.6) and West Virginia (8.5) where the borer has been active since 2006 and 2007, respectively. Despite the loss in the overall number of ash trees, growth has continued to outpace removals and mortality (fig. 25), resulting in an increase in total standing volume of live ash trees ≥ 5.0 inches d.b.h. from 567.3 million cubic feet in 2007 to 649.8 million cubic feet in 2016.

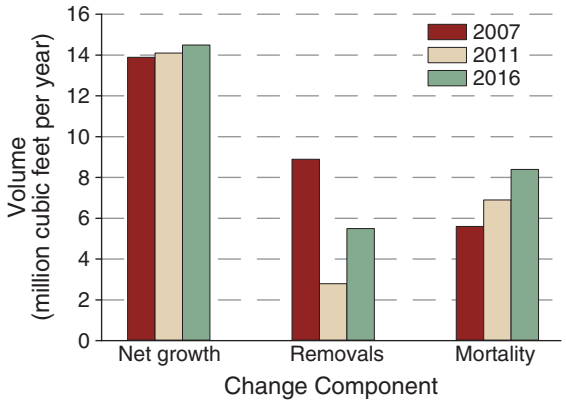

Figure 25—Average annual net growth, removals, and mortality of live ash trees ≥ 5.0 inches d.b.h. on forest land by survey year, Virginia, 2007–16.

With almost 70 percent of the live ash in Virginia in counties with confirmed or suspected emerald ash borer activity (fig. 24), degradation of the ash resource is likely to continue. Because the emerald ash borer can colonize and kill stems as small as 1.0 inch d.b.h. (Klooster and others 2014), it is unclear how ash will endure in the landscape long-term. Though some ash seeds may persist in the seed bank for up to 8 years, studies suggest that they generally remain viable for only 2 to 3 years (Aubin and others 2015, Klooster and others 2014). This seed bank will be rapidly depleted as mortality of overstory ash, which typically

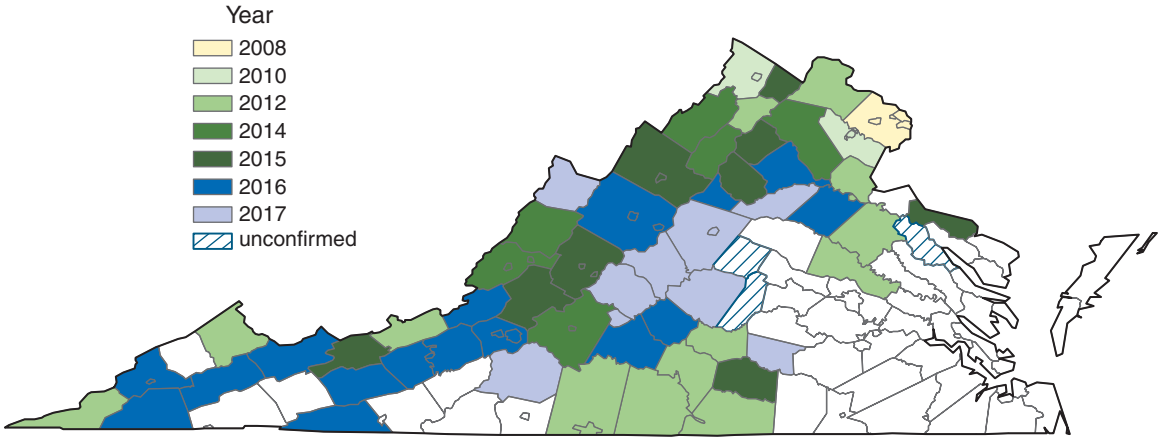

Figure 24—Counties with emerald ash borer, by year of infestation. (Data source: Virginia Department of Forestry 2018).

approaches 100 percent in the presence of the emerald ash borer, continues. Ultimately then, the long-term persistence of ash in the Virginia landscape will depend on the ability of the current ash seedlings and saplings, 1.3 billion and 145.6 million, respectively, to survive to sexual maturity (Aubin and others 2015). Both green ash and white ash may begin flowering when they reach 3 to 4 inches d.b.h., though typically white ash must reach 8 to 10 inches d.b.h. to flower abundantly (Kennedy 1990, Schlesinger 1990). Whether or not the current cohort of ash regeneration survives to maturity will depend upon a number of interrelated factors including, environmental conditions, management practices, individual tree resistance to the insect, and borer-ash dynamics following infestation (Aubin and others 2015, Klooster and others 2014).

Hemlock Wooly Adelgid—First observed in eastern North America in Virginia in the 1950s, the hemlock woolly adelgid is an aphid-like insect native to Japan that feeds at the base of eastern and Carolina hemlock needles causing desiccation, defoliation, and eventual mortality of the entire tree, often within 4 years of infestation (McClure and others 1996). Since its introduction, the hemlock woolly adelgid has spread throughout the range of hemlock, from Georgia to Maine, and is found in almost all of hemlock's range in Virginia (U.S. Department of Agriculture Forest Service 2015).

In Virginia, hemlock is concentrated in the Northern and Southern Mountains. Statewide, the number of live hemlock trees ≥ 5.0 inches d.b.h. steadily declined from 18.3 million in 2001 to 14.0 million in 2016 (fig. 26). In contrast, volume of live hemlock trees ≥ 5.0 inches d.b.h., following a period of decline from 2001 to 2011, increased by 3.7 percent between 2011 and 2016 (fig. 26). This volume increase was largely due to growth on trees ≥ 19.0 inches d.b.h. In 2016, the number of

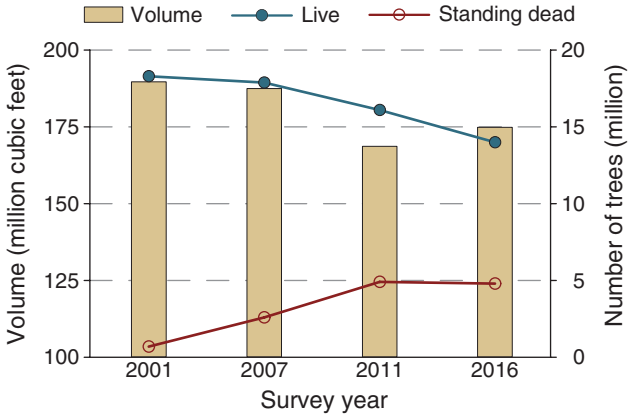

Figure 26—Volume and number of live and standing dead hemlock trees ≥ 5.0 inches d.b.h. on forest land by survey year, Virginia, 2001–16.

standing dead hemlock trees ≥ 5.0 inches d.b.h., though much greater than in 2001, remained relatively unchanged from 2011 (fig. 26). Overall, the ratio of live to standing dead hemlock trees was 2.9 in 2016, down from 25.4 in 2001. Across survey units, the proportion of live and standing dead hemlock trees has shifted over time with both becoming more prevalent in the Southern Mountains (fig. 27). The proportional shift for live hemlocks between 2001 and 2016 is due to a 47-percent reduction in live hemlocks in the Northern Mountains and a relatively

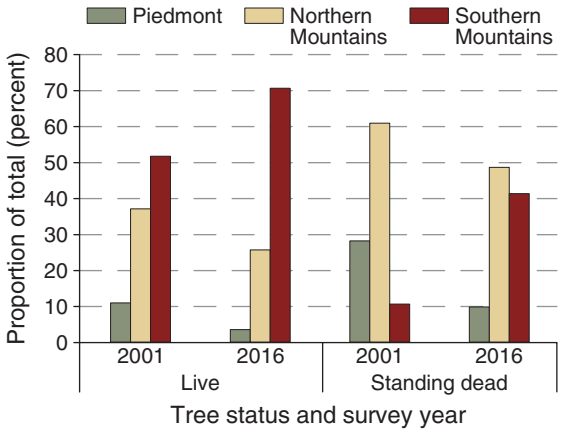

Figure 27—Proportion of the total number of live and standing dead hemlock trees ≥ 5.0 inches d.b.h. on forest land for survey years 2001 and 2016, by survey unit, Virginia. (Piedmont = Northern Piedmont and Southern Piedmont combined.)

Long-term monitoring of forest resources are vital to their informed, sustainable management. (photo courtesy of John Campbell, Virginia Department of Forestry)

stable inventory of live hemlocks in the Southern Mountains. A continued shift of the proportion of standing dead trees between the Northern and Southern Mountains is likely to occur as the hemlock woolly adelgid progresses through the western-most part of the State.

Although hemlock is a relatively small component of the overall forest, composing < 1 percent of trees ≥ 5.0 inches d.b.h. in Virginia, it plays a very important role in riparian and cove habitats. Its decline in these areas will have multiple consequences, including changes in soil ecosystem processes, hydrological regimes, and forest structure (Brantley and others 2013). The extent to which these factors are altered in the long-term largely depends on the abundance of rhododendron in the understory and whether or not hemlock regenerates or is replaced with other evergreens, deciduous species, or a mixture of both (Brantley and others 2013). Given that the hemlock woolly adelgid is capable of feeding on hemlocks of all sizes, only a small portion of the current cohort of 26.2 million hemlock saplings, if any, may survive to maturity.

Nonnative Invasive Plants—Virginia's forests, like all those across the Southern United States, are being changed by the increasing numbers and prevalence of nonnative invasive plants. Table 15 lists by frequency those invasive species of trees, shrubs, vines, grasses and herbs encountered on FIA plots in Virginia during the 2016 survey period. The list includes two distinct samples, recorded as 4.0 and 6.0, to reflect a change from FIA field manual version 4.0 guidelines (U.S. Department of Agriculture Forest Service 2012) to field manual version 6.0 guidelines (U.S. Department of Agriculture Forest Service 2014) between the previous and current survey cycles. The predominant change between the two manuals is the identification of additional species as nonnative invasives.

Tree of heaven (*Ailanthus altissima*) and Princesstree (*Paulownia tomentosa*) were the most frequently encountered nonnative tree species on sampled forested plots. Nonnative rose (*Rosa* spp.) and Chinese/European privets (*Ligustrum* spp.), were the most common shrub species and Japanese honeysuckle (*Lonicera japonica*) the most common vine. The most frequently detected invasive grass was Nepalese browntop (*Microstegium vimineum*), and Chinese or sericea lespedeza (*Lespedeza cuneata*) was the most commonly encountered invasive herb on forested plots.

Table 15—Regionally recognized nonnative invasive plants identified on forest survey plots by common name, scientific name, number of plots, and the proportion of total sample (3,846 plots), Virginia, 2016

Common name	Scientific name	Survey plots			Proportion of total sample
		4.0[a]	6.0[b]	Total	
		- - - - number - - - -			percent
Trees					
Tree of heaven	*Ailanthus altissima*	74	21	95	2.47
Princesstree	*Paulownia tomentosa*	20	67	87	2.26
Silktree	*Albizia julibrissin*	4	47	51	1.33
Callery pear	*Pyrus calleryana*	—	16	16	0.42
Hardy orange	*Poncirus trifoliata*	—	5	5	0.13
Paper mulberry	*Broussonetia papyrifera*	—	1	1	0.03
Chinaberry	*Melia azedarach*	1	—	1	0.03
Shrubs					
Nonnative rose	*Rosa* spp.	121	575	696	18.10
Privet	*Ligustrum* spp.	73	294	367	9.54
Oleaster	*Elaeagnus* spp.	37	231	268	6.97
Japanese barberry	*Berberis thunbergii*	—	123	123	3.20
Honeysuckle	*Lonicera* spp.	14	78	92	2.39
Burningbush	*Euonymus alatus*	13	8	21	0.55
Japanese privet	*Ligustrum japonicum*	4	8	12	0.31
Silverthorn, thornyolive	*Elaeagnus pungens*	1	2	3	0.08
Beale's barberry	*Mahonia bealei*	—	2	2	0.05
Sacred bamboo	*Nandina* spp.	1	—	1	0.03
Vines					
Japanese honeysuckle	*Lonicera japonica*	273	1,192	1,465	38.09
Oriental bittersweet	*Celastrus orbiculatus*	13	129	142	3.69
Ivy	*Hedera* spp.	4	28	32	0.83
Periwinkle	*Vinca* spp.	3	9	12	0.31
Wisteria	*Wisteria* spp.	2	8	10	0.26
Winter creeper	*Euonymus fortunei*	4	5	9	0.23
Kudzu	*Pueraria montana* var. *lobata*	—	7	7	0.18
Yam	*Dioscorea* spp.	—	2	2	0.05
Grass					
Nepalese browntop	*Microstegium vimineum*	96	571	667	17.34
Tall fescue	*Schedonorus phoenix*	28	62	90	2.34
Crownvetch	*Securigera varia*	—	21	21	0.55
Chinese silvergrass	*Miscanthus sinensis*	2	4	6	0.16
Bamboo	*Bambusa* spp.	—	2	2	0.05
Herbs					
Chinese or sericea lespedeza	*Lespedeza cuneata*	23	117	140	3.64
Garlic mustard	*Alliaria petiolata*	6	134	140	3.64
Lespedeza	*Lespedeza* spp.	5	26	31	0.81
Japanese knotweed	*Polygonum cuspidatum*	—	7	7	0.18

— = no sample for the cell.

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

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

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GLOSSARY

Terms used in this report are defined in the Forest Inventory and Analysis (FIA) glossary available on the FIA Web site at https://www.fs.usda.gov/srsfia/states/state_information.shtml.

INVENTORY METHODS

The Virginia 2016 inventory was a three-phase, fixed-plot design conducted on an annual basis. Phase 1 (P1) provides the area estimates for the inventory. Phase 2 (P2) involves on-the-ground measurements of sample plots by field personnel. Phase 3 (P3) is a subset of the P2 plot system, where additional measurements are made by field personnel to aid in the assessment of forest health. The three phases of the sampling method are based on a hexagonal grid design, with successive phases being sampled with less intensity. There are 16 P2 hexagons for every P3 hexagon. P2 and P3 hexagons represent about 6,000 and 96,000 acres, respectively.

Under the annual inventory system, 20 percent (1 panel) of the total number of plots in a State are measured every year over a 5-year period (1 cycle). Each panel of plots is selected on a subgrid that is slightly offset from the previous panel so that each panel covers essentially the same sample area (both spatially and in intensity) as the prior panel. In the sixth year, the plots that were measured in the first panel are remeasured. This marks the beginning of the next cycle of data collection. After field measurements are completed, a cycle of data is available for the 5-year report.

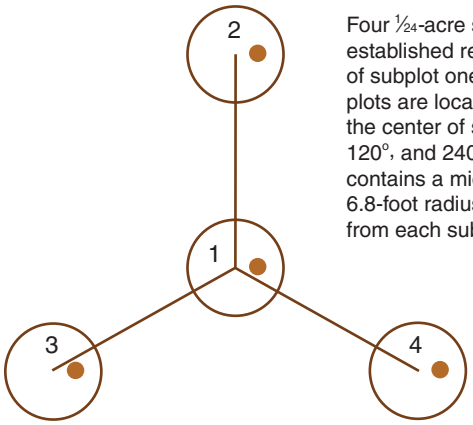
The Virginia 2016 estimates were made using data from a total of 4,804 points sampled over the course of 5 years. Of these sampled points, 3,289 were found to have forest and a forest inventory plot measured and 1,515 were not forested. Of the forested plots, 3,073 were pre-existing plots that were remeasured and used for the estimates of change. Forested plots were measured following 5 field data collections protocols, versions 4.01 (590 plots), 5.10 (48 plots), 6.00 (675 plots), 6.01 (679 plots), 6.11 (678 plots) and 7.00 (619 plots).

Phase 1

For the 2016 inventory of Virginia, the P1 forest area estimate was based on classifying National Land Cover Database points collected in 2011. Stratification of forest and nonforest was performed at the unit level. Area estimation of all lands and ownerships was based on the probability of selection of P2 plot locations. As a result, the known forest land area (for specific ownerships) does not always agree with area estimates based on probability of selection. For example, the acreage of national forests, published by the National Forest System, will not agree exactly with the statistical estimate of national forest land derived by Forest Inventory and Analysis. These numbers could differ substantially for very small areas.

Phase 2

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



Four 1/24-acre subplots are established relative to the center of subplot one. The 24-foot radius plots are located 120 feet from the center of subplot one at 0°, 120°, and 240°. Each subplot contains a microplot with a 6.8-foot radius, 12 feet (at 90°) from each subplot center.

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

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 (U.S. Department of Agriculture Forest Service 2014).

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

Phase 3

Data on forest health variables (P3) are collected on about $1/16^{th}$ of the P2 sample plots. P3 data are coarse descriptions and are meant to be used as general indicators of overall forest health over large geographic areas. P3 data collection has included variables pertaining to tree crown health, down woody material, and foliar ozone injury in the past. In recent years, however, the forest health monitoring data collection has evolved with some of the protocols changing and others being put on hiatus pending renovation. Down woody materials data were collected for the past cycle of Virginia forest health monitoring. That data collection took place under a more simplified set of field protocols that can be implemented on a greater number of plots to improve the sample size. This and other forest health monitoring data collection will continue to evolve as these protocols are refined.

Summary

Users wishing to make rigorous comparisons of data between surveys should be aware of any changes in methodologies between measurements and the evolving nature of the FIA program. 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. Fortunately FIA data collection in Virginia has followed the national annualized inventory protocols for 4 full cycles [2001 (Rose 2007), 2007 (Rose 2009) and 2011 (Rose 2013) and now 2016] allowing us to track change over time with a high degree of confidence.

DATA RELIABILITY

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

Measurement Error

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

Each variable collected by FIA is assigned a measurement quality objective (MQO) and a measurement tolerance level. The MQOs are documented in the FIA National Field Manual (U.S. Department of Agriculture Forest Service 2014). In some instances, the MQOs are a "best guess" of what experienced field crews should be able to consistently achieve. Tolerances are somewhat arbitrary and are based on the crews' ability to make repeatable measurements or observations within the assigned MQO.

Evaluation of field crew performance is accomplished by calculating the differences between data collected by the field crew and data collected by the QA crew on blind-check plots. Results of these calculations are compared to the established MQOs. In the analysis of blind-check data, an observation is within tolerance when the difference between the field crew observation and the QA crew observation does not exceed the assigned tolerance for that variable. For many categorical variables, the tolerance is "no error" allowed, so only observations that are identical are within the tolerance level. Tables B.1–B.5 show the results of various blind checks for Virginia data collection from 2012 to 2016.

Table B.1—Results of plot, subplot, and boundary-level blind checks for Virginia, 2016

Variable	Number of observations	Number within tolerance	Percent within tolerance
Plot variables			
Plot nonsampled reason	0	—	—
Distance to road	67	41	61.2
Water on plot	67	62	92.5
Latitude longitude	8	8	100.0
Plot in correct county	76	76	100.0
Corrected county	0	—	—
Plot accessibility	76	61	80.3
Subplot variables			
Subplot nonsampled reason	0	—	—
Subplot center condition	304	298	98.0
Microplot center condition	295	295	100.0
Subplot slope	136	132	97.1
Subplot aspect	136	87	64.0
Snow/water depth	136	134	98.5
Boundary variables			
Existance of change	21	12	57.1
Boundary change	8	6	75.0
Contrasting condition	21	18	85.7
Left azimuth	8	5	62.5
Right azimuth	8	3	37.5
Existance of corner	8	8	100.0
Corner azimuth	1	1	100.0
Corner distance	1	1	100.0

—= no sample for the cell.

Table B.2—Results of condition-level blind checks for Virginia, 2016

Variable	Number of observations	Number within tolerance	Percent within tolerance
Condition variables			
Condition status	107	107	100
Condition nonsampled reason	0	—	—
Reserved status	82	82	100
Owner group	82	82	100
Field forest type	81	61	75
Field forest type group	81	73	90
Stand size class	82	73	89
Regeneration Status	82	80	98
Tree density	82	81	99
Artificial regeneration species	7	7	100
Owner class	82	80	98
Stand age	81	59	73
Disturbance 1	82	75	91
Disturbance year 1	3	2	67
Disturbance 2	3	3	100
Disturbance year 2	0	—	—
Disturbance 3	0	—	—
Disturbance year 3	0	—	—
Treatment 1	82	81	98.78
Treatment year 1	7	6	86
Treatment 2	7	5	71
Treatment year 2	2	2	100
Treatment 3	2	2	100
Treatment year 3	0	—	—
Physiographic class	82	63	77
Present land use	82	82	100
Total acres	63	59	94
Percent forest	63	53	84
Stand structure	82	80	98
Operability	82	63	77
Site class	0	—	—
Afforestation	0	—	—
Chaining	105	105	100
Harvest type 1	82	80	98
Harvest type 2	6	6	100
Harvest type 3	0	—	—
Live canopy	99	86	86.87
Live and missing canopy	99	88	89
Number of stems	0	—	—
Secondary land use	0	—	—
Land cover class	107	94	87.9
Forested land cover class	0	—	—
Nonforested land cover class	0	—	—

— = no sample for the cell.

Table B.3—Results of tree and seedling blind checks for Virginia, 2016

Variable	Number of observations	Number within tolerance	Percent within tolerance
Tree variables			
Condition number	1,300	1,258	97
Azimuth	1,259	1,172	93
Horizontal distance	1,162	1,146	99
Present tree status	1,293	1,283	99
Reconcile	166	158	95
Standing dead	158	156	99
Species	1,300	1,282	99
Genus	1,300	1,298	100
Live d.b.h.	1,088	811	75
Live d.b.h.: both diameter checks = 0	980	775	79
Live d.b.h.: both diameter checks >0	42	22	52
Live d.b.h.: mixed diameter checks	66	14	21
Sound dead d.b.h.	20	11	55
Decayed dead d.b.h.	35	35	100
Live rotten/missing cull	84	73	87
Dead rotten/missing cull	52	26	50
Number of d.r.c. stems	0	—	—
Diameter root collar	0	—	—
Total length	1,088	816	75
Live tree actual length	10	9	90
Dead tree actual length	42	30	71
Crown class	1,088	912	84
Compacted crown ratio	1,088	885	81
Uncompacted crown ratio	50	0	0
Cause of death	0	—	—
Mortality year	0	—	—
Decay class	158	156	98.7
Tree class	850	764	90
Tree grade	253	166	66
Board foot cull	253	190	75
Dieback incidence	1,031	1,026	100
Dieback severity	37	37	100
Utilization class	1,088	1,079	99
Abnormal termination	439	429	98
Seedling variables			
Species	287	264	92
Genus	287	279	97.2
Count	287	205	71.4

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

Table B.4—Results of missing species, extra trees and seedlings, and missing invasive species blind checks for Virginia, 2016

Variable	Observations found by both	Observations found by just cruiser	Observations found by just QA
Missing/extra tree/seedling			
Trees	1,300	5	30
Seedlings	287	0	64
Invasive species			
Invasive species	66	23	38

QA = quality assurance.

Table B.5—Results of invasive species cover and down woody materials blind checks for Virginia, 2016

Variable	Number of observations	Number within tolerance	Percent within tolerance
Invasive species variable			
Invasive cover	66	66	100
Down woody materials variables			
Transect segments			
Existence of transect subsegments	72	72	100
Transect break point	1	—	—
Down woody materials duff/litter			
Duff/litter method	67	67	100
Litter depth	67	26	39
Duff depth	67	28	42
Fine woody debris			
Segment matches	36	33	92
Small count	33	6	18
Medium count	33	7	21
Large count	33	13	39
Coarse woody debris			
Found by both crews	45	31	69
Condition	31	31	100
Horizontal distance	31	22	71
Decay class	31	31	100
Transect diameter	31	24	77
Length >3 feet	31	30	97
Hollow diameter	31	30	97

— = no sample for the cell.

Sampling Error

Sampling error is associated with the natural and expected deviation of the sample from the true population mean. This deviation is susceptible to a mathematical evaluation of the probability of error. Sampling errors for State totals are based on one standard deviation. That is, there is a 68.27 percent probability that the confidence interval given for each sample estimate will cover the true population mean (table B.6).

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

Table B.6—Statistical reliability of forest land area, all-live volume, and growth, removals and mortality estimates for Virginia, 2016

Item	Sample estimate and 68.27-percent confidence interval		Sampling error
			percent
Forest land	*thousand acres*		
State	16,069.1	98.0	0.61
Coastal Plain	3,727.1	52.2	1.40
Southern Piedmont	3,836.9	48.0	1.25
Northern Piedmont	2,513.4	45.0	1.79
Northern Mountains	2,879.4	47.2	1.64
Southern Mountains	3,112.3	48.9	1.57
All-live volume on forest land	*million cubic feet*		
State	39,399.5	464.9	1.18
Softwoods	9,761.3	294.8	3.02
Hardwoods	29,638.2	435.7	1.47
Growth, removals and mortality	*million cubic feet*		
Net annual growth	1,312.8	26.1	1.99
Softwoods	548.0	21.2	3.86
Hardwoods	778.5	18.4	2.36
Annual removals	505.5	34.2	6.76
Softwoods	233.2	21.7	9.29
Hardwoods	272.3	23.6	8.67
Annual mortality	31.0	0.9	3.03
Softwoods	9.3	0.6	6.49
Hardwoods	21.7	0.7	3.29

For specific post-defined strata, the sampling error can be calculated using the following formula. Sampling errors obtained by this method are only approximations of reliability, because this process assumes constant variance across all subdivisions of totals.

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

where

SE_s = sampling error for subdivision of survey unit or State total

SE_t = sampling error for survey unit or State total

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

X_t = total area or volume for survey unit or State

For example, the estimate of sampling error for softwood live-tree volume in the Southern Piedmont survey unit is computed as:

$$SE_s = 2.61 \left[\frac{\sqrt{8{,}563{,}609{,}414}}{\sqrt{2{,}812{,}350{,}308}} \right] = 4.55$$

There are 8,563,609,414 cubic feet of softwood volume in the Southern Piedmont survey unit with a sampling error of 2.61 percent and 2,812,350,308 cubic feet of softwood volume in the Southern Piedmont. Thus, the estimated sampling error for softwood volume in the Southern Piedmont is 4.55 percent, and the resulting 68.27 percent confidence interval for the Southern Piedmont softwood volume is 2,812,350,308 cubic feet ± 128,086,583 cubic feet.

Table C.1—Area by survey unit and land status, Virginia, 2016

Unit	Total area	All forest	Unreserved			Reserved			Nonforest land	Census water
			Total	Timber-land	Unpro-ductive	Total	Produc-tive	Unpro-ductive		
	thousand acres									
Coastal Plain	8,159.5	3,727.1	3,593.0	3,587.3	5.7	134.1	134.1	0.0	2,619.4	1,813.0
Southern Piedmont	5,674.8	3,836.9	3,817.7	3,817.7	0.0	19.2	19.2	0.0	1,751.5	86.4
Northern Piedmont	4,429.3	2,513.4	2,336.5	2,332.6	3.9	177.0	177.0	0.0	1,852.1	63.8
Northern Mountains	4,352.4	2,879.4	2,732.6	2,641.7	90.9	146.8	146.8	0.0	1,456.2	16.8
Southern Mountains	4,759.9	3,112.3	3,019.9	3,007.1	12.8	92.3	86.2	6.1	1,631.3	16.3
All survey units	27,375.9	16,069.1	15,499.7	15,386.4	113.3	569.4	563.4	6.1	9,310.5	1,996.3

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.2—Area of forest land by ownership class and land status, Virginia, 2016

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timber-land	Unpro-ductive	Total	Produc-tive	Unpro-ductive
	thousand acres						
U.S. Forest Service							
National forest	1,675.0	1,572.4	1,486.9	85.5	102.6	96.5	6.1
Total	1,675.0	1,572.4	1,486.9	85.5	102.6	96.5	6.1
Other Federal							
National Park Service	218.8	0.0	0.0	0.0	218.8	218.8	0.0
U.S. Fish and Wildlife Service	83.1	0.0	0.0	0.0	83.1	83.1	0.0
Dept. of Defense/Dept. of Energy	198.9	198.9	198.9	0.0	0.0	0.0	0.0
Other Federal	23.2	23.2	23.2	0.0	0.0	0.0	0.0
Total	524.1	222.2	222.2	0.0	301.9	301.9	0.0
State and local government							
State	347.3	275.8	269.4	6.3	71.5	71.5	0.0
Local	269.0	175.5	175.5	0.0	93.5	93.5	0.0
Total	616.2	451.3	445.0	6.3	165.0	165.0	0.0
Forest industry							
Corporate	145.9	145.9	145.9	0.0	0.0	0.0	0.0
Individual	37.5	37.5	37.5	0.0	0.0	0.0	0.0
Total	183.4	183.4	183.4	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	3,111.9	3,111.9	3,099.2	12.6	0.0	0.0	0.0
Conservation/natural resources organization	93.8	93.8	88.1	5.7	0.0	0.0	0.0
Unincorporated local partnership/association/club	108.4	108.4	108.4	0.0	0.0	0.0	0.0
Individual	9,756.3	9,756.3	9,753.3	3.1	0.0	0.0	0.0
Total	13,070.4	13,070.4	13,048.9	21.5	0.0	0.0	0.0
All classes	16,069.1	15,499.7	15,386.4	113.3	569.4	563.4	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 ownership group, Virginia, 2016

Forest-type group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	thousand acres					
Softwood types						
White-red-jack pine	174.0	31.7	2.7	6.3	7.8	125.5
Spruce-fir	7.7	0.0	0.0	6.1	0.0	1.5
Longleaf-slash pine	4.5	0.0	0.0	0.0	0.0	4.5
Loblolly-shortleaf pine	3,086.7	61.2	84.0	64.3	48.3	2,828.8
Other eastern softwoods	85.5	0.0	0.0	1.5	0.0	84.0
Exotic softwoods	2.8	0.0	0.0	0.0	0.0	2.8
Total softwoods	3,361.2	92.9	86.7	78.3	56.1	3,047.1
Hardwood types						
Oak-pine	1,682.7	150.2	54.1	69.2	22.6	1,386.6
Oak-hickory	9,703.4	1,361.9	312.5	383.6	92.1	7,553.2
Oak-gum-cypress	345.2	2.9	51.8	22.1	0.0	268.5
Elm-ash-cottonwood	437.2	0.0	7.1	41.5	5.2	383.3
Maple-beech-birch	345.8	62.4	0.0	21.5	1.5	260.5
Aspen-birch	1.5	0.0	0.0	0.0	0.0	1.5
Other hardwoods	57.7	3.9	5.9	0.0	0.0	48.0
Exotic hardwoods	26.5	0.8	0.0	0.0	0.0	25.7
Total hardwoods	12,600.0	1,582.1	431.4	537.9	121.4	9,927.2
Nonstocked	107.8	0.0	5.9	0.0	5.9	96.0
All groups	16,069.1	1,675.0	524.1	616.2	183.4	13,070.4

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

Table C.4—Area of forest land by forest-type group and stand-size class, Virginia, 2016

Forest-type group	All classes	Stand-size class			
		Large diameter	Medium diameter	Small diameter	Nonstocked
	thousand acres				
Softwood types					
White-red-jack pine	174.0	142.5	15.2	16.3	0.0
Spruce-fir	7.7	7.7	0.0	0.0	0.0
Longleaf-slash pine	4.5	0.0	0.0	4.5	0.0
Loblolly-shortleaf pine	3,086.7	1,564.2	1,052.5	470.0	0.0
Other eastern softwoods	85.5	19.9	36.5	29.1	0.0
Exotic softwoods	2.8	0.0	2.8	0.0	0.0
Total softwoods	3,361.2	1,734.3	1,107.0	519.9	0.0
Hardwood types					
Oak-pine	1,682.7	959.8	369.7	353.2	0.0
Oak-hickory	9,703.4	7,186.5	1,679.7	837.2	0.0
Oak-gum-cypress	345.2	256.5	70.5	18.2	0.0
Elm-ash-cottonwood	437.2	291.7	68.5	76.9	0.0
Maple-beech-birch	345.8	300.7	31.5	13.7	0.0
Aspen-birch	1.5	1.5	0.0	0.0	0.0
Other hardwoods	57.7	23.0	25.1	9.6	0.0
Exotic hardwoods	26.5	0.0	17.8	8.8	0.0
Total hardwoods	12,600.0	9,019.7	2,262.8	1,317.5	0.0
Nonstocked	107.8	0.0	0.0	0.0	107.8
All groups	16,069.1	10,754.0	3,369.8	1,837.4	107.8

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.5—Area of forest land by forest-type group and stand origin, Virginia, 2016

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	thousand acres		
Softwood types			
White-red-jack pine	174.0	122.1	51.9
Spruce-fir	7.7	6.1	1.5
Longleaf-slash pine	4.5	0.0	4.5
Loblolly-shortleaf pine	3,086.7	927.7	2,159.0
Other eastern softwoods	85.5	85.5	0.0
Exotic softwoods	2.8	0.0	2.8
Total softwoods	3,361.2	1,141.5	2,219.7
Hardwood types			
Oak-pine	1,682.7	1,414.4	268.4
Oak-hickory	9,703.4	9,564.6	138.8
Oak-gum-cypress	345.2	340.9	4.3
Elm-ash-cottonwood	437.2	424.3	12.9
Maple-beech-birch	345.8	342.6	3.2
Aspen-birch	1.5	1.5	0.0
Other hardwoods	57.7	57.7	0.0
Exotic hardwoods	26.5	25.1	1.4
Total hardwoods	12,600.0	12,171.0	429.0
Nonstocked	107.8	95.2	12.7
All groups	16,069.1	13,407.7	2,661.4

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

Table C.6—Area of forest land disturbed annually by forest-type group and disturbance class, Virginia, 2012–16

Forest-type group[b]	Disturbance class[a]							
	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	Human	Other natural
	thousand acres							
Softwood types								
White-red-jack pine	0.0	0.0	1.5	0.3	0.0	0.0	1.5	0.0
Spruce-fir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	3.7	1.1	6.2	1.9	2.9	1.4	3.8	3.6
Other eastern softwoods	0.0	0.0	0.0	0.0	0.9	0.0	1.5	0.0
Total softwoods	3.7	1.1	7.6	2.2	3.8	1.4	6.8	3.6
Hardwood types								
Oak-pine	4.4	1.0	4.0	3.2	3.0	1.1	8.2	1.1
Oak-hickory	10.7	1.0	26.5	20.7	27.5	4.2	10.8	10.3
Oak-gum-cypress	1.7	0.0	2.8	0.0	0.0	4.3	0.7	0.0
Elm-ash-cottonwood	0.0	0.0	1.4	0.0	1.5	3.6	0.3	0.0
Maple-beech-birch	4.6	0.0	1.0	0.0	0.7	0.0	0.7	3.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other hardwoods	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0
Exotic hardwoods	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total hardwoods	21.5	2.0	35.7	24.0	34.1	13.2	20.8	14.5
Nonstocked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All groups	25.2	3.0	43.3	26.2	37.9	14.6	27.6	18.1

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

Table C.7—Area of forest land treated annually by forest-type group and treatment class (cutting), Virginia, 2012–16

Forest-type group[b]	Total treated	Treatment class: Cutting[a]					
		Final harvest	Partial harvest	Seed-tree/ shelterwood harvest	Commercial thinning	Timber stand improvement	Salvage cutting
	thousand acres						
Softwood types							
White-red-jack pine	1.3	1.3	0.0	0.0	0.0	0.0	0.0
Spruce-fir	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	115.0	45.2	4.3	1.5	57.1	7.0	0.0
Other eastern softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total softwoods	116.2	46.5	4.3	1.5	57.1	7.0	0.0
Hardwood types							
Oak-pine	21.0	14.3	5.0	0.0	1.6	0.1	0.0
Oak-hickory	82.6	34.7	36.0	4.4	4.2	3.4	0.0
Oak-gum-cypress	2.0	2.0	0.0	0.0	0.0	0.0	0.0
Elm-ash-cottonwood	1.5	1.2	0.0	0.3	0.0	0.0	0.0
Maple-beech-birch	1.0	1.0	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
Other hardwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic hardwoods	1.2	0.2	1.0	0.0	0.0	0.0	0.0
Total hardwoods	109.4	53.4	42.1	4.7	5.8	3.5	0.0
Nonstocked	0.6	0.0	0.6	0.0	0.0	0.0	0.0
All groups	226.2	99.9	46.9	6.1	62.9	10.4	0.0

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

Table C.8—Number of live trees on forest land by species group and diameter class, Virginia, 2016

Species group	All classes	Diameter class (*inches*)														
		1.0–2.9	3.0–4.9	5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
		million trees														
Softwood																
Longleaf and slash pines	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly and shortleaf pines	1,265.3	432.3	240.9	209.9	169.3	99.9	57.9	29.8	13.5	6.4	2.8	2.1	0.6	0.1	0.0	0.0
Other yellow pines	469.8	217.2	106.2	52.2	35.6	28.1	17.5	8.0	3.6	1.0	0.3	0.1	0.0	0.0	0.0	0.0
Eastern white and red pines	179.6	91.1	28.2	17.3	13.2	10.2	7.0	4.0	2.9	2.1	1.4	1.5	0.5	0.2	0.0	0.0
Spruce and balsam fir	3.6	0.9	1.0	0.2	0.3	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Eastern hemlock	40.2	18.0	8.2	5.5	2.9	1.8	1.4	1.1	0.4	0.4	0.2	0.3	0.1	0.0	0.0	0.0
Cypress	4.3	2.2	0.4	0.6	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.0	0.0
Other eastern softwoods	270.0	180.8	48.3	20.0	11.0	5.6	2.2	1.5	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Total softwoods	2,234.6	944.3	433.2	305.8	232.6	145.8	86.1	44.7	20.9	10.3	5.1	4.3	1.2	0.4	0.0	0.1
Hardwood																
Select white oaks	415.9	202.5	60.6	36.4	27.1	22.8	17.5	15.9	11.1	9.6	4.8	5.4	1.4	0.5	0.2	0.1
Select red oaks	151.0	69.4	16.4	11.8	10.0	8.9	7.8	5.6	5.6	4.7	3.4	4.6	1.7	0.6	0.4	0.2
Other white oaks	353.4	86.1	53.2	47.1	43.1	37.3	28.4	19.6	15.4	9.3	6.3	5.3	1.5	0.6	0.3	0.0
Other red oaks	494.9	258.2	79.9	40.0	29.2	25.3	18.7	14.7	10.6	7.1	4.6	4.2	1.8	0.6	0.1	0.1
Hickory	415.9	242.2	60.2	35.4	25.9	17.6	12.9	8.5	6.2	3.5	1.9	1.0	0.4	0.1	0.0	0.0
Yellow birch	8.0	3.6	2.2	0.8	0.4	0.5	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	170.5	108.3	28.5	12.1	7.4	4.8	3.6	2.3	1.4	1.3	0.2	0.6	0.1	0.1	0.0	0.0
Soft maple	1,411.3	925.7	248.2	97.3	56.7	32.6	21.2	12.3	7.3	4.6	2.4	1.8	0.8	0.2	0.1	0.0
Beech	275.0	182.2	45.9	17.1	9.6	6.7	4.2	2.5	2.5	1.4	1.1	1.3	0.3	0.2	0.0	0.0
Sweetgum	793.5	547.9	138.9	47.1	23.6	13.4	8.7	5.5	3.9	2.3	1.1	0.8	0.2	0.0	0.0	0.0
Tupelo and blackgum	667.1	479.5	112.5	35.7	16.0	8.9	5.8	3.8	2.0	1.3	0.8	0.5	0.2	0.1	0.0	0.0
Ash	189.6	117.6	28.0	14.2	9.6	7.0	4.7	3.4	2.1	1.2	1.1	0.5	0.1	0.1	0.0	0.0
Cottonwood and aspen	10.0	6.1	1.8	0.9	0.6	0.3	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Basswood	26.9	12.1	2.9	2.9	2.4	2.4	1.0	0.8	0.9	0.4	0.5	0.4	0.2	0.0	0.0	0.0
Yellow-poplar	894.4	494.5	139.1	70.1	50.2	35.7	27.0	22.8	18.7	13.1	9.8	8.5	3.3	0.9	0.4	0.2
Black walnut	26.5	8.5	4.0	3.7	3.1	2.2	1.5	1.2	0.9	0.6	0.4	0.2	0.1	0.0	0.0	0.0
Other eastern soft hardwoods	663.7	437.7	106.9	49.5	28.0	15.2	10.5	5.9	4.1	2.6	1.6	1.1	0.3	0.1	0.1	0.1
Other eastern hard hardwoods	979.1	730.5	165.2	39.7	19.5	10.5	6.2	4.2	1.6	0.9	0.5	0.3	0.0	0.0	0.0	0.0
Eastern noncommercial hardwoods	1,202.5	902.5	203.2	57.8	24.0	8.6	3.2	1.7	1.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Total hardwoods	9,149.0	5,815.2	1,497.7	619.6	386.4	260.7	183.2	130.9	95.5	64.3	40.5	36.3	12.3	4.2	1.5	0.8
All species	11,383.6	6,759.4	1,931.0	925.4	619.0	406.5	269.3	175.6	116.4	74.5	45.5	40.6	13.4	4.6	1.5	0.9

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

Table C.9—Net[a] volume of live trees on forest land by ownership class and land status, Virginia, 2016

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Unproductive	Total	Productive	Unproductive
	million cubic feet						
U.S. Forest Service							
National forest	4,287.2	4,009.9	3,869.7	140.2	277.3	268.1	9.2
Total	4,287.2	4,009.9	3,869.7	140.2	277.3	268.1	9.2
Other Federal							
National Park Service	596.0	0.0	0.0	0.0	596.0	596.0	0.0
U.S. Fish and Wildlife Service	222.4	0.0	0.0	0.0	222.4	222.4	0.0
Dept. of Defense/Dept. of Energy	728.1	728.1	728.1	0.0	0.0	0.0	0.0
Other Federal	80.6	80.6	80.6	0.0	0.0	0.0	0.0
Total	1,627.1	808.7	808.7	0.0	818.4	818.4	0.0
State and local government							
State	1,013.4	776.8	771.8	5.0	236.6	236.6	0.0
Local	731.2	422.5	422.5	0.0	308.6	308.6	0.0
Total	1,744.5	1,199.3	1,194.3	5.0	545.2	545.2	0.0
Forest industry							
Corporate	309.5	309.5	309.5	0.0	0.0	0.0	0.0
Individual	83.5	83.5	83.5	0.0	0.0	0.0	0.0
Total	393.1	393.1	393.1	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	6,726.6	6,726.6	6,713.3	13.4	0.0	0.0	0.0
Conservation/natural resources organization	221.6	221.6	218.4	3.2	0.0	0.0	0.0
Unincorporated local partnership/association/club	329.5	329.5	329.5	0.0	0.0	0.0	0.0
Individual	24,069.9	24,069.9	24,067.0	2.9	0.0	0.0	0.0
Total	31,347.6	31,347.6	31,328.2	19.4	0.0	0.0	0.0
All classes	39,399.5	37,758.6	37,594.0	164.6	1,640.9	1,631.7	9.2

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

Table C.10—Net[a] volume of live trees on forest land by forest-type group and stand-size class, Virginia, 2016

Forest-type group	All classes	Stand-size class			Nonstocked
		Large diameter	Medium diameter	Small diameter	
	million cubic feet				
Softwood types					
White-red-jack pine	482.3	420.3	55.1	6.9	0.0
Spruce-fir	31.4	31.4	0.0	0.0	0.0
Longleaf-slash pine	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	7,297.6	5,501.0	1,720.1	76.4	0.0
Other eastern softwoods	71.5	32.1	34.4	5.0	0.0
Exotic softwoods	0.8	0.0	0.8	0.0	0.0
Total softwoods	7,883.5	5,984.8	1,810.4	88.3	0.0
Hardwood types					
Oak-pine	3,558.2	2,944.0	546.1	68.1	0.0
Oak-hickory	25,044.2	22,260.6	2,578.2	205.4	0.0
Oak-gum-cypress	995.8	886.5	98.6	10.7	0.0
Elm-ash-cottonwood	902.5	798.7	94.0	9.7	0.0
Maple-beech-birch	880.5	831.9	45.2	3.4	0.0
Aspen-birch	5.9	5.9	0.0	0.0	0.0
Other hardwoods	105.8	56.2	45.1	4.5	0.0
Exotic hardwoods	17.5	0.0	14.3	3.2	0.0
Total hardwoods	31,510.4	27,783.7	3,421.7	305.0	0.0
Nonstocked	5.6	0.0	0.0	0.0	5.6
All groups	39,399.5	33,768.5	5,232.1	393.3	5.6

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

Table C.11—Net[a] volume of live trees on forest land by species group and ownership group, Virginia, 2016

Species group	All ownerships	Ownership group				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet					
Softwood						
Longleaf and slash pines	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly and shortleaf pines	6,560.8	12.5	246.6	189.6	85.8	6,026.3
Other yellow pines	1,658.3	231.2	78.0	71.9	15.8	1,261.5
Eastern white and red pines	1,010.1	249.5	29.3	8.3	28.6	694.4
Spruce and balsam fir	40.2	10.5	0.0	16.3	0.0	13.3
Eastern hemlock	174.9	33.9	1.2	7.5	0.3	132.0
Cypress	73.3	0.0	4.4	0.2	0.0	68.7
Other eastern softwoods	243.8	1.0	2.7	18.2	0.6	221.3
Total softwoods	9,761.3	538.6	362.2	311.8	131.1	8,417.6
Hardwood						
Select white oaks	3,478.0	271.8	92.6	141.4	20.5	2,951.7
Select red oaks	1,973.4	548.8	157.4	108.9	11.4	1,146.8
Other white oaks	3,664.9	1,294.4	121.7	141.6	20.8	2,086.5
Other red oaks	3,067.3	408.8	117.9	126.7	12.0	2,401.8
Hickory	1,724.8	128.9	61.7	70.7	10.4	1,453.0
Yellow birch	24.8	10.3	0.0	2.5	2.7	9.2
Hard maple	472.7	84.0	4.8	31.3	4.3	348.2
Soft maple	2,519.3	286.3	161.1	125.0	17.8	1,929.2
Beech	696.8	10.5	18.8	54.5	5.9	607.0
Sweetgum	1,310.9	0.0	113.4	45.7	15.1	1,136.7
Tupelo and blackgum	685.0	78.0	51.2	49.1	0.9	505.9
Ash	649.8	27.7	35.7	35.3	2.7	548.4
Cottonwood and aspen	25.6	0.0	0.7	0.7	0.0	24.1
Basswood	260.2	76.0	22.0	27.8	3.5	130.8
Yellow-poplar	6,429.8	296.7	220.2	318.2	104.0	5,490.7
Black walnut	198.1	2.9	0.1	10.5	0.0	184.7
Other eastern soft hardwoods	1,310.0	87.1	42.4	77.1	22.6	1,080.8
Other eastern hard hardwoods	661.6	93.5	31.9	31.4	4.2	500.6
Eastern noncommercial hardwoods	485.3	42.9	11.2	34.2	3.1	394.0
Total hardwoods	29,638.2	3,748.6	1,264.9	1,432.7	262.0	22,930.0
All species	39,399.5	4,287.2	1,627.1	1,744.5	393.1	31,347.6

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

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

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

Table C.12—Net[a] volume of live trees on forest land by species group and diameter class, Virginia, 2016

Species group	All classes	Diameter class (*inches*) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–24.9	25.0–28.9	29.0–32.9	33.0–36.9	37.0+
							million cubic feet							
Softwood														
Longleaf and slash pines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly and shortleaf pines	6,560.8	510.0	1,074.6	1,262.8	1,226.4	943.7	605.9	388.2	222.3	224.4	86.3	16.1	0.0	0.0
Other yellow pines	1,658.3	175.6	281.8	381.0	367.6	232.4	141.1	50.4	20.8	7.7	0.0	0.0	0.0	0.0
Eastern white and red pines	1,010.1	48.7	81.6	111.6	115.8	105.5	104.5	105.9	91.7	132.7	60.3	37.8	7.0	6.9
Spruce and balsam fir	40.2	0.5	2.3	2.0	4.1	8.2	6.4	6.3	2.8	7.7	0.0	0.0	0.0	0.0
Eastern hemlock	174.9	10.8	14.0	15.9	20.0	25.8	11.2	17.2	16.3	21.6	16.5	5.7	0.0	0.0
Cypress	73.3	1.5	1.4	2.2	1.3	1.7	1.0	6.2	10.7	17.8	0.0	13.4	0.0	16.1
Other eastern softwoods	243.8	46.9	57.7	51.8	30.1	33.3	11.0	7.2	4.0	1.6	0.0	0.0	0.0	0.0
Total softwoods	9,761.3	794.0	1,513.3	1,827.3	1,765.3	1,350.6	881.2	581.5	368.5	413.5	163.1	73.0	7.0	23.0
Hardwood														
Select white oaks	3,478.0	103.8	184.0	282.3	351.1	463.6	444.5	514.2	316.3	488.0	176.2	75.2	36.8	42.0
Select red oaks	1,973.4	36.1	65.8	105.9	144.8	149.2	203.9	226.2	210.5	383.7	205.2	96.8	87.8	57.6
Other white oaks	3,664.9	122.1	252.0	391.2	476.4	472.4	515.3	402.3	357.1	375.0	150.8	83.6	44.8	22.1
Other red oaks	3,067.3	112.0	180.5	284.3	342.3	390.3	392.8	350.1	297.3	357.6	227.3	95.6	25.7	11.5
Hickory	1,724.8	91.7	163.9	208.2	249.8	250.0	257.6	187.4	133.6	93.5	55.8	28.1	0.0	5.3
Yellow birch	24.8	3.0	3.0	6.1	3.3	4.4	2.1	2.1	0.7	0.0	0.0	0.0	0.0	0.0
Hard maple	472.7	39.4	52.9	60.6	68.6	61.9	52.7	63.5	7.9	49.8	3.0	12.4	0.0	0.0
Soft maple	2,519.3	293.6	362.3	363.2	368.0	304.4	251.1	202.6	137.0	117.0	80.7	33.0	6.3	0.0
Beech	696.8	49.4	61.2	81.9	76.1	64.5	85.5	61.1	66.9	92.5	34.5	23.2	0.0	0.0
Sweetgum	1,310.9	119.8	156.6	176.7	182.5	176.1	172.8	133.1	78.9	79.9	29.2	5.3	0.0	0.0
Tupelo and blackgum	685.0	89.8	88.6	97.6	97.5	92.9	66.4	59.2	38.6	33.8	14.0	6.8	0.0	0.0
Ash	649.8	41.6	59.1	81.1	89.1	89.7	84.9	59.0	72.4	46.5	8.4	18.1	0.0	0.0
Cottonwood and aspen	25.6	2.8	5.2	4.2	2.3	2.5	0.0	3.9	4.7	0.0	0.0	0.0	0.0	0.0
Basswood	260.2	10.3	16.1	29.1	18.5	26.4	38.7	22.8	34.5	35.1	22.3	0.0	6.3	0.0
Yellow-poplar	6,429.8	220.4	363.2	486.9	584.9	719.1	829.0	768.0	748.0	870.4	478.5	171.2	94.9	95.1
Black walnut	198.1	9.7	16.9	22.1	24.2	30.5	28.3	25.9	19.2	11.2	10.0	0.0	0.0	0.0
Other eastern soft hardwoods	1,310.0	134.5	163.7	162.9	182.5	148.0	140.6	115.4	91.3	80.5	30.2	11.8	23.1	25.5
Other eastern hard hardwoods	661.6	111.5	116.1	107.2	99.5	99.8	47.5	33.8	23.7	13.7	2.2	1.7	0.0	4.9
Eastern noncommercial hardwoods	485.3	133.1	124.1	80.1	46.0	36.8	31.0	8.3	9.9	6.1	0.0	0.0	0.0	9.8
Total hardwoods	29,638.2	1,724.5	2,435.1	3,031.8	3,407.2	3,582.4	3,644.5	3,239.1	2,648.7	3,134.3	1,528.4	662.8	325.6	273.7
All species	39,399.5	2,518.5	3,948.4	4,859.1	5,172.5	4,933.0	4,525.7	3,820.6	3,017.2	3,547.7	1,691.5	735.8	332.6	296.7

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

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

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

Table C.13—Net[a] volume of live trees on forest land by forest-type group and stand origin, Virginia, 2016

Forest-type group	Total	Stand origin	
		Natural stands	Artificial regeneration
	million cubic feet		
Softwood types			
White-red-jack pine	482.3	344.3	137.9
Spruce-fir	31.4	18.0	13.3
Longleaf-slash pine	0.0	0.0	0.0
Loblolly-shortleaf pine	7,297.6	2,476.2	4,821.4
Other eastern softwoods	71.5	71.5	0.0
Exotic softwoods	0.8	0.0	0.8
Total softwoods	7,883.5	2,910.1	4,973.5
Hardwood types			
Oak-pine	3,558.2	3,316.2	242.0
Oak-hickory	25,044.2	24,967.3	76.8
Oak-gum-cypress	995.8	986.4	9.4
Elm-ash-cottonwood	902.5	898.6	3.8
Maple-beech-birch	880.5	880.5	0.0
Aspen-birch	5.9	5.9	0.0
Other hardwoods	105.8	105.8	0.0
Exotic hardwoods	17.5	15.1	2.4
Total hardwoods	31,510.4	31,176.0	334.5
Nonstocked	5.6	5.0	0.5
All groups	39,399.5	34,091.0	5,308.5

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

Table C.14—Aboveground dry weight[a] of live trees on forest land by ownership class and land status, Virginia, 2016

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Unproductive	Total	Productive	Unproductive
	thousand tons						
U.S. Forest Service							
National forest	115,765.5	108,077.7	104,180.8	3,896.8	7,687.8	7,441.6	246.2
Total	115,765.5	108,077.7	104,180.8	3,896.8	7,687.8	7,441.6	246.2
Other Federal							
National Park Service	15,678.5	0.0	0.0	0.0	15,678.5	15,678.5	0.0
U.S. Fish and Wildlife Service	5,911.8	0.0	0.0	0.0	5,911.8	5,911.8	0.0
Dept. of Defense/Dept. of Energy	18,615.5	18,615.5	18,615.5	0.0	0.0	0.0	0.0
Other Federal	1,955.2	1,955.2	1,955.2	0.0	0.0	0.0	0.0
Total	42,160.9	20,570.7	20,570.7	0.0	21,590.3	21,590.3	0.0
State and local government							
State	26,562.7	20,397.1	20,170.9	226.2	6,165.5	6,165.5	0.0
Local	19,220.9	11,230.6	11,230.6	0.0	7,990.2	7,990.2	0.0
Total	45,783.5	31,627.7	31,401.5	226.2	14,155.8	14,155.8	0.0
Forest industry							
Corporate	8,002.8	8,002.8	8,002.8	0.0	0.0	0.0	0.0
Individual	2,080.4	2,080.4	2,080.4	0.0	0.0	0.0	0.0
Total	10,083.2	10,083.2	10,083.2	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	178,585.7	178,585.7	178,196.1	389.7	0.0	0.0	0.0
Conservation/natural resources organization	5,799.5	5,799.5	5,695.7	103.7	0.0	0.0	0.0
Unincorporated local partnership/association/club	8,238.6	8,238.6	8,238.6	0.0	0.0	0.0	0.0
Individual	635,485.5	635,485.5	635,393.8	91.7	0.0	0.0	0.0
Total	828,109.3	828,109.3	827,524.2	585.1	0.0	0.0	0.0
All classes	1,041,902.5	998,468.6	993,760.5	4,708.1	43,433.9	43,187.6	246.2

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

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

[a] Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT.

Table C.15—Total carbon[a] of live trees on forest land by ownership class and land status, Virginia, 2016

Ownership class	All forest land	Unreserved			Reserved		
		Total	Timberland	Unproductive	Total	Productive	Unproductive
	thousand tons						
U.S. Forest Service							
National forest	57,882.7	54,038.8	52,090.4	1,948.4	3,843.9	3,720.8	123.1
Total	57,882.7	54,038.8	52,090.4	1,948.4	3,843.9	3,720.8	123.1
Other Federal							
National Park Service	7,839.2	0.0	0.0	0.0	7,839.2	7,839.2	0.0
U.S. Fish and Wildlife Service	2,955.9	0.0	0.0	0.0	2,955.9	2,955.9	0.0
Dept. of Defense/Dept. of Energy	9,307.7	9,307.7	9,307.7	0.0	0.0	0.0	0.0
Other Federal	977.6	977.6	977.6	0.0	0.0	0.0	0.0
Total	21,080.5	10,285.3	10,285.3	0.0	10,795.1	10,795.1	0.0
State and local government							
State	13,281.3	10,198.6	10,085.5	113.1	3,082.8	3,082.8	0.0
Local	9,610.4	5,615.3	5,615.3	0.0	3,995.1	3,995.1	0.0
Total	22,891.8	15,813.9	15,700.8	113.1	7,077.9	7,077.9	0.0
Forest industry							
Corporate	4,001.4	4,001.4	4,001.4	0.0	0.0	0.0	0.0
Individual	1,040.2	1,040.2	1,040.2	0.0	0.0	0.0	0.0
Total	5,041.6	5,041.6	5,041.6	0.0	0.0	0.0	0.0
Nonindustrial private							
Corporate	89,292.9	89,292.9	89,098.0	194.8	0.0	0.0	0.0
Conservation/natural resources organization	2,899.7	2,899.7	2,847.9	51.9	0.0	0.0	0.0
Unincorporated local partnership/association/club	4,119.3	4,119.3	4,119.3	0.0	0.0	0.0	0.0
Individual	317,742.8	317,742.8	317,696.9	45.9	0.0	0.0	0.0
Total	414,054.7	414,054.7	413,762.1	292.5	0.0	0.0	0.0
All classes	520,951.2	499,234.3	496,880.2	2,354.1	21,716.9	21,593.8	123.1

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. Calculations based on TREE_REGIONAL_BIOMASS.REGIONAL_DRYBIOT.

Table C.16—Average annual net growth of live trees by ownership class and land status, Virginia, 2016 (2008–11 to 2012–16)

Ownership class[a]	Land status	
	Timberland	Forest land
	million cubic feet per year	
U.S. Forest Service		
Other Forest Service	77.2	81.8
Total	77.2	81.8
Other Federal		
National Park Service	0.0	9.2
U.S. Fish and Wildlife Service	0.0	3.0
Dept. of Defense/Dept. of Energy	16.7	16.7
Other Federal	2.0	2.0
Total	18.7	30.8
State and local government		
State	21.0	25.8
Local	15.9	20.8
Total	36.9	46.5
Forest industry		
Corporate	15.8	15.8
Individual	4.4	4.4
Total	20.2	20.2
Nonindustrial private		
Corporate	283.7	283.8
Conservation/natural resources organization	6.5	4.7
Unincorporated partnership/association/club	9.8	9.8
Individual	837.2	835.2
Total	1,137.2	1,133.5
All classes	1,290.2	1,312.8

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

Table C.17—Average annual net growth of live trees on forest land by forest-type group and stand-size class, Virginia, 2016 (2008–11 to 2012–16)

Forest-type group[a]	All classes	Stand-size class[a]			
		Large diameter	Medium diameter	Small diameter	Nonstocked
	million cubic feet per year				
Softwood types					
White-red-jack pine	17.8	11.3	6.0	0.5	0.0
Spruce-fir	0.3	0.3	0.0	0.0	0.0
Loblolly-shortleaf pine	464.7	170.8	209.6	84.3	0.0
Other eastern softwoods	3.8	1.3	1.1	1.4	0.0
Total softwoods	486.6	183.7	216.7	86.1	0.0
Hardwood types					
Oak-pine	128.2	58.0	39.3	30.9	0.0
Oak-hickory	637.1	463.8	126.1	47.3	0.0
Oak-gum-cypress	10.6	4.9	3.5	2.2	0.0
Elm-ash-cottonwood	23.4	16.2	4.8	2.5	0.0
Maple-beech-birch	19.4	16.3	2.3	0.8	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0
Other hardwoods	2.4	0.7	1.1	0.7	0.0
Exotic hardwoods	2.3	0.0	1.4	0.9	0.0
Total hardwoods	823.4	559.9	178.4	85.1	0.0
Nonstocked	2.8	0.0	0.0	0.0	2.8
All groups	1,312.8	743.6	395.2	171.3	2.8

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

Table C.18—Average annual net growth of live trees on forest land by species group and ownership group, Virginia, 2016 (2008–11 to 2012–16)

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet per year					
Softwood						
Longleaf and slash pines	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly and shortleaf pines	472.0	0.1	7.9	11.6	9.1	443.4
Other yellow pines	23.7	2.6	-0.6	1.2	1.0	19.4
Eastern white and red pines	37.8	6.4	0.7	-0.9	1.9	29.7
Spruce and balsam fir	0.8	0.5	0.0	0.3	0.0	0.0
Eastern hemlock	1.6	-0.1	0.0	0.1	-0.2	1.8
Cypress	1.3	0.0	0.0	0.0	0.0	1.3
Other eastern softwoods	8.4	0.0	-0.2	0.4	0.0	8.1
Total softwoods	545.5	9.5	7.9	12.6	11.9	503.6
Hardwood						
Select white oaks	82.2	4.6	1.7	2.3	0.8	72.9
Select red oaks	40.1	10.5	2.8	3.5	0.2	23.1
Other white oaks	73.9	21.5	0.6	3.5	0.3	47.9
Other red oaks	67.0	9.3	1.7	3.4	0.5	52.2
Hickory	34.3	1.7	1.5	0.7	-0.2	30.7
Yellow birch	0.2	-0.1	0.0	0.1	0.1	0.2
Hard maple	14.1	1.8	0.2	1.0	0.0	11.1
Soft maple	55.4	7.1	0.9	2.7	0.9	43.7
Beech	16.7	0.0	0.7	1.1	-0.1	15.0
Sweetgum	37.8	0.0	2.0	1.1	0.7	34.0
Tupelo and blackgum	9.3	2.4	0.6	-0.1	0.0	6.4
Ash	14.5	0.7	0.8	0.1	0.1	12.9
Cottonwood and aspen	0.3	0.0	0.1	0.1	0.0	0.1
Basswood	6.9	2.2	0.5	0.3	-0.1	3.9
Yellow-poplar	237.4	6.2	5.9	9.6	3.3	212.4
Black walnut	9.0	0.1	0.0	0.7	0.2	8.0
Other eastern soft hardwoods	44.6	1.8	1.5	1.6	1.7	38.0
Other eastern hard hardwoods	8.8	1.3	1.0	1.3	0.1	5.1
Eastern noncommercial hardwoods	14.7	1.3	0.3	1.0	0.0	12.1
Total hardwoods	767.3	72.2	22.9	33.9	8.4	629.9
All species	1,312.8	81.8	30.8	46.5	20.2	1,133.5

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.

[a] Based on current conditions.

Table C.19—Average annual mortality of live trees by ownership class and land status, Virginia, 2016 (2008–11 to 2012–16)

Ownership class[a]	Land status	
	Timberland	Forest land
	million cubic feet per year	
U.S. Forest Service		
National forest	33.8	35.9
Total	33.8	35.9
Other Federal		
National Park Service	0.0	6.6
U.S. Fish and Wildlife Service	0.0	1.5
Dept. of Defense/Dept. of Energy	5.1	5.1
Other Federal	0.5	0.5
Total	5.6	13.7
State and local government		
State	5.3	7.8
Local	2.6	4.3
Total	7.9	12.1
Forest industry		
Corporate	3.1	3.1
Individual	0.7	0.7
Total	3.8	3.8
Nonindustrial private		
Corporate	49.4	49.4
Conservation/natural resources organization	1.8	2.1
Unincorporated partnership/association/club	4.7	4.7
Individual	177.5	177.7
Total	233.3	233.9
All classes	284.4	299.5

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

Table C.20—Average annual mortality of live trees on forest land by forest-type group and stand-size class, Virginia, 2016 (2008–11 to 2012–16)

Forest-type group[a]	All classes	Stand-size class[a]			
		Large diameter	Medium diameter	Small diameter	Nonstocked
	million cubic feet per year				
Softwood types					
White-red-jack pine	4.7	4.6	0.2	0.0	0.0
Spruce-fir	0.6	0.6	0.0	0.0	0.0
Loblolly-shortleaf pine	42.0	28.5	12.5	1.0	0.0
Other eastern softwoods	0.8	0.5	0.2	0.0	0.0
Total softwoods	48.1	34.2	12.9	1.0	0.0
Hardwood types					
Oak-pine	36.2	30.0	5.5	0.7	0.0
Oak-hickory	185.7	163.8	19.4	2.5	0.0
Oak-gum-cypress	9.2	8.9	0.2	0.1	0.0
Elm-ash-cottonwood	12.1	10.5	1.5	0.1	0.0
Maple-beech-birch	7.1	6.7	0.4	0.0	0.0
Aspen-birch	0.4	0.0	0.4	0.0	0.0
Other hardwoods	0.5	0.5	0.1	0.0	0.0
Exotic hardwoods	0.1	0.0	0.0	0.1	0.0
Total hardwoods	251.3	220.4	27.4	3.5	0.0
Nonstocked	0.1	0.0	0.0	0.0	0.1
All groups	299.5	254.6	40.3	4.4	0.1

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

Table C.21—Average annual mortality of live trees on forest land by species group and ownership group, Virginia, 2016 (2008–11 to 2012–16)

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet per year					
Softwood						
Longleaf and slash pines	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly and shortleaf pines	26.6	0.0	1.1	0.7	0.6	24.2
Other yellow pines	40.4	2.3	2.6	1.3	0.2	33.9
Eastern white and red pines	8.7	3.4	0.0	1.2	0.0	4.1
Spruce and balsam fir	0.6	0.0	0.0	0.0	0.0	0.6
Eastern hemlock	4.0	0.9	0.0	0.0	0.2	2.9
Cypress	0.0	0.0	0.0	0.0	0.0	0.0
Other eastern softwoods	3.5	0.0	0.2	0.3	0.0	2.9
Total softwoods	83.7	6.6	4.0	3.6	1.0	68.5
Hardwood						
Select white oaks	17.2	2.7	0.1	1.1	0.0	13.3
Select red oaks	21.7	3.7	1.7	0.1	0.1	16.1
Other white oaks	21.9	10.2	1.6	0.5	0.3	9.3
Other red oaks	42.0	4.8	1.8	1.3	0.2	33.8
Hickory	14.3	1.3	0.2	1.2	0.7	10.9
Yellow birch	0.5	0.4	0.0	0.0	0.0	0.1
Hard maple	2.2	0.9	0.0	0.0	0.3	1.0
Soft maple	20.2	1.5	1.5	0.6	0.1	16.5
Beech	2.7	0.3	0.0	0.0	0.4	2.0
Sweetgum	7.3	0.0	0.4	0.1	0.0	6.7
Tupelo and blackgum	3.4	0.0	0.2	0.2	0.0	2.9
Ash	8.4	0.1	0.3	1.1	0.1	6.8
Cottonwood and aspen	1.0	0.0	0.0	0.0	0.0	1.0
Basswood	0.9	0.3	0.0	0.0	0.1	0.5
Yellow-poplar	15.9	1.0	0.8	0.7	0.1	13.3
Black walnut	0.7	0.0	0.0	0.0	0.0	0.6
Other eastern soft hardwoods	15.9	0.3	0.5	1.0	0.3	13.8
Other eastern hard hardwoods	11.9	1.0	0.2	0.3	0.0	10.4
Eastern noncommercial hardwoods	7.8	0.9	0.3	0.1	0.1	6.4
Total hardwoods	215.8	29.3	9.7	8.6	2.8	165.5
All species	299.5	35.9	13.7	12.1	3.8	233.9

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

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

[a] Based on current conditions.

Table C.22—Average annual net removals of live trees by ownership class and land status, Virginia, 2016 (2008–11 to 2012–16)

Ownership class[a]	Land status	
	Timberland	Forest land
	million cubic feet per year	
U.S. Forest Service		
National forest	14.0	1.5
Total	14.0	1.5
Other Federal		
National Park Service	0.0	0.6
Dept. of Defense/Dept. of Energy	2.8	2.8
Total	2.8	3.4
State and local government		
State	4.3	3.7
Local	2.3	2.3
Total	6.6	6.0
Forest industry		
Corporate	7.9	7.9
Total	7.9	7.9
Nonindustrial private		
Corporate	177.8	175.4
Conservation/natural resources organization	1.0	1.0
Unincorporated partnership/association/club	1.3	1.3
Individual	309.0	309.0
Total	489.1	486.7
All classes	520.4	505.5

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

Table C.23—Average annual removals of live trees on forest land by forest-type group and stand-size class, Virginia, 2016 (2008–11 to 2012–16)

Forest-type group[a]	All classes	Stand-size class[a]			
		Large diameter	Medium diameter	Small diameter	Nonstocked
	million cubic feet per year				
Softwood types					
White-red-jack pine	7.8	7.8	0.0	0.0	0.0
Spruce-fir	0.0	0.0	0.0	0.0	0.0
Loblolly-shortleaf pine	219.2	121.8	94.0	3.5	0.0
Other eastern softwoods	1.7	0.0	1.6	0.1	0.0
Total softwoods	228.8	129.6	95.6	3.5	0.0
Hardwood types					
Oak-pine	45.2	37.2	7.5	0.4	0.0
Oak-hickory	215.2	179.1	34.7	1.4	0.0
Oak-gum-cypress	4.8	4.0	0.8	0.0	0.0
Elm-ash-cottonwood	9.6	7.9	1.8	0.0	0.0
Maple-beech-birch	1.1	1.0	0.0	0.0	0.0
Aspen-birch	0.0	0.0	0.0	0.0	0.0
Other hardwoods	0.4	0.0	0.4	0.0	0.0
Exotic hardwoods	0.3	0.0	0.3	0.0	0.0
Total hardwoods	276.6	229.1	45.5	1.9	0.0
Nonstocked	0.1	0.0	0.0	0.0	0.1
All groups	505.5	358.8	141.2	5.4	0.1

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

Table C.24—Average annual removals of live trees on forest land by species group and ownership group, Virginia, 2016 (2008–11 to 2012–16)

Species group	All ownerships	Ownership group[a]				
		U.S. Forest Service	Other Federal	State and local government	Forest industry	Nonindustrial private
	million cubic feet per year					
Softwood						
Longleaf and slash pines	0.0	0.0	0.0	0.0	0.0	0.0
Loblolly and shortleaf pines	192.1	0.0	1.0	2.6	3.7	184.8
Other yellow pines	24.7	0.0	0.0	0.3	1.0	23.4
Eastern white and red pines	13.0	0.0	0.0	0.0	1.7	11.3
Spruce and balsam fir	0.0	0.0	0.0	0.0	0.0	0.0
Eastern hemlock	0.1	0.0	0.0	0.0	0.0	0.1
Cypress	0.6	0.0	0.0	0.0	0.0	0.6
Other eastern softwoods	2.7	0.0	0.1	0.0	0.0	2.7
Total softwoods	233.2	0.0	1.1	2.9	6.4	222.8
Hardwood						
Select white oaks	43.9	0.0	0.0	0.2	0.1	43.5
Select red oaks	10.0	0.0	1.0	0.0	0.0	9.0
Other white oaks	15.2	0.3	0.0	0.0	0.0	14.8
Other red oaks	33.5	0.1	0.0	0.3	0.3	32.9
Hickory	13.7	0.0	0.0	0.0	0.0	13.7
Yellow birch	0.0	0.0	0.0	0.0	0.0	0.0
Hard maple	0.9	0.0	0.0	0.0	0.0	0.9
Soft maple	23.6	1.1	0.1	0.4	0.2	21.8
Beech	4.2	0.0	0.0	0.0	0.0	4.2
Sweetgum	17.2	0.0	0.0	0.0	0.0	17.2
Tupelo and blackgum	1.7	0.0	0.1	0.0	0.0	1.6
Ash	5.5	0.0	0.0	0.0	0.0	5.5
Cottonwood and aspen	0.1	0.0	0.0	0.0	0.0	0.1
Basswood	0.2	0.0	0.0	0.0	0.0	0.2
Yellow-poplar	76.7	0.0	1.0	2.1	0.0	73.6
Black walnut	2.4	0.0	0.0	0.0	0.5	1.9
Other eastern soft hardwoods	15.5	0.0	0.0	0.0	0.2	15.3
Other eastern hard hardwoods	5.5	0.0	0.0	0.0	0.0	5.4
Eastern noncommercial hardwoods	2.5	0.0	0.0	0.0	0.1	2.4
Total hardwoods	272.3	1.5	2.3	3.1	1.5	263.9
All species	505.5	1.5	3.4	6.0	7.9	486.7

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

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

[a] Based on current conditions.

Table C.25—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Virginia, 2012–16

Common name	Scientific name	Number
Softwoods		
Loblolly pine	*Pinus taeda*	22,479
Virginia pine	*P. virginiana*	6,089
Eastern white pine	*P. strobus*	2,686
Eastern redcedar	*Juniperus virginiana*	2,107
Eastern hemlock	*Tsuga canadensis*	765
Pitch pine	*Pinus rigida*	745
Shortleaf pine	*P. echinata*	631
Table Mountain pine	*P. pungens*	543
Red spruce	*Picea rubens*	78
Baldcypress	*Taxodium distichum*	59
Pine spp.	*Pinus* spp.	35
Atlantic white-cedar	*Chamaecyparis thyoides*	16
Scotch pine	*Pinus sylvestris*	16
Fraser fir	*Abies fraseri*	12
Carolina hemlock	*Tsuga caroliniana*	8
Pond pine	*Pinus serotina*	8
Longleaf pine	*P. palustris*	4
Norway spruce	*Picea abies*	2
Northern white-cedar	*Thuja occidentalis*	1
Hardwoods		
Red maple	*Acer rubrum*	11,850
Yellow-poplar	*Liriodendron tulipifera*	10,368
Chestnut oak	*Quercus prinus*	8,755
White oak	*Q. alba*	5,844
Sweetgum	*Liquidambar styraciflua*	5,553
Blackgum	*Nyssa sylvatica*	3,698
Scarlet oak	*Quercus coccinea*	3,076
Northern red oak	*Q. rubra*	2,768
Sourwood	*Oxydendrum arboreum*	2,343
American holly	*Ilex opaca*	2,093
Pignut hickory	*Carya glabra*	2,021
Black oak	*Quercus velutina*	1,997
American beech	*Fagus grandifolia*	1,986
Mockernut hickory	*Carya alba*	1,983
Black cherry	*Prunus serotina*	1,832
Black locust	*Robinia pseudoacacia*	1,827
Sweet birch	*Betula lenta*	1,338
Sugar maple	*Acer saccharum*	1,332
Southern red oak	*Quercus falcata*	1,298
American hornbeam, musclewood	*Carpinus caroliniana*	1,163
White ash	*Fraxinus americana*	1,142

(Continued)

Table C.25 (continued)—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Virginia, 2012–16

Common name	Scientific name	Number
Hardwoods (continued)		
Sassafras	*Sassafras albidum*	977
Flowering dogwood	*Cornus florida*	807
Green ash	*Fraxinus pennsylvanica*	758
Ailanthus	*Ailanthus altissima*	727
Eastern redbud	*Cercis canadensis*	603
Willow oak	*Quercus phellos*	515
Black walnut	*Juglans nigra*	485
Swamp tupelo	*Nyssa biflora*	479
American elm	*Ulmus americana*	467
American sycamore	*Platanus occidentalis*	463
Serviceberry spp.	*Amelanchier* spp.	449
Striped maple	*Acer pensylvanicum*	422
American basswood	*Tilia americana*	419
Winged elm	*Ulmus alata*	359
River birch	*Betula nigra*	358
Cucumbertree	*Magnolia acuminata*	333
Shagbark hickory	*Carya ovata*	304
Water oak	*Quercus nigra*	301
Post oak	*Q. stellata*	294
Bitternut hickory	*Carya cordiformis*	279
Slippery elm	*Ulmus rubra*	243
Mountain or Fraser magnolia	*Magnolia fraseri*	229
Boxelder	*Acer negundo*	228
Eastern hophornbeam	*Ostrya virginiana*	212
Hackberry	*Celtis occidentalis*	176
Yellow buckeye	*Aesculus flava*	171
Common persimmon	*Diospyros virginiana*	166
Pawpaw	*Asimina triloba*	150
Swamp chestnut oak	*Quercus michauxii*	115
Yellow birch	*Betula alleghaniensis*	113
Sweetbay	*Magnolia virginiana*	113
Chinkapin oak	*Quercus muehlenbergii*	109
Hawthorn spp.	*Crataegus* spp.	101
Bigtooth aspen	*Populus grandidentata*	100
Paulownia, empress-tree	*Paulownia tomentosa*	99
Water tupelo	*Nyssa aquatica*	92
Redbay	*Persea borbonia*	76
Florida maple	*Acer barbatum*	74
American chestnut	*Castanea dentata*	70
Pin oak	*Quercus palustris*	65
Black willow	*Salix nigra*	61

(Continued)

Table C.25 (continued)—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Virginia, 2012–16

Common name	Scientific name	Number
Hardwoods (continued)		
Pin cherry	*Prunus pensylvanica*	54
Cherrybark oak	*Quercus pagoda*	53
Apple spp.	*Malus* spp.	44
Sweet cherry, domesticated	*Prunus avium*	41
Osage-orange	*Maclura pomifera*	40
Blackjack oak	*Quercus marilandica*	37
Red mulberry	*Morus rubra*	35
Umbrella magnolia	*Magnolia tripetala*	32
Butternut	*Juglans cinerea*	27
White willow	*Salix alba*	17
Honeylocust	*Gleditsia triacanthos*	16
Oak spp.	*Quercus* spp.	16
Other or unknown live tree	Tree unknown	16
Laurel oak	*Quercus laurifolia*	15
American mountain-ash	*Sorbus americana*	12
Blue ash	*Fraxinus quadrangulata*	10
Mimosa, silktree	*Albizia julibrissin*	10
Scrub oak	*Quercus ilicifolia*	10
Pecan	*Carya illinoinensis*	9
Eastern cottonwood	*Populus deltoides*	9
Overcup oak	*Quercus lyrata*	8
White mulberry	*Morus alba*	8
Southern crab apple	*Malus angustifolia*	8
Downy hawthorn	*Crataegus mollis*	7
Bigleaf magnolia	*Magnolia macrophylla*	7
European alder	*Alnus glutinosa*	6

(Continued)

Table C.25 (continued)—List of tree species ≥1.0 inch d.b.h. occurring in the FIA sample and number measured, Virginia, 2012–16

Common name	Scientific name	Number
Hardwoods (continued)		
Chinese chestnut	*Castanea mollissima*	6
Shingle oak	*Quercus imbricaria*	4
Allegheny chinkapin	*Castanea pumila*	4
Unknown dead hardwood	Tree broadleaf	4
Shumard oak	*Quercus shumardii*	3
Shellbark hickory	*Carya laciniosa*	3
Swamp white oak	*Quercus bicolor*	2
Hickory spp.	*Carya* spp.	2
Carolina ash	*Fraxinus caroliniana*	2
Weeping willow	*Salix sepulcralis*	2
Southern catalpa	*Catalpa bignonioides*	2
Turkey oak	*Quercus laevis*	2
Bur oak	*Q. macrocarpa*	1
Red hickory	*Carya ovalis*	1
Norway maple	*Acer platanoides*	1
Silver maple	*A. saccharinum*	1
Black ash	*Fraxinus nigra*	1
Pumpkin ash	*F. profunda*	1
Swamp cottonwood	*Populus heterophylla*	1
Northern catalpa	*Catalpa speciosa*	1
Southern magnolia	*Magnolia grandiflora*	1
Siberian elm	*Ulmus pumila*	1
Rock elm	*U. thomasii*	1
Persimmon spp.	*Diospyros* spp.	1
Cherry and plum spp.	*Prunus* spp.	1
American plum	*P. americana*	1

Table C.26a—Area of sampled land and water by county name, and land class, Virginia, 2016

County name	Total	Land class			
		Accessible forest	Nonforest	Noncensus water	Census water
			acres		
51001 Accomack	885,352	105,399	228,352	—	551,602
51003 Albemarle	495,445	300,560	191,113	3,772	—
51005 Alleghany	287,092	251,903	33,850	1,338	—
51007 Amelia	218,097	153,858	60,878	3,361	—
51009 Amherst	299,315	239,675	59,640	—	—
51011 Appomattox	215,807	127,870	85,731	2,206	—
51013 Arlington	13,026	—	13,026	—	—
51015 Augusta	630,981	346,895	284,086	—	—
51017 Bath	330,761	281,638	37,536	—	11,587
51019 Bedford	490,299	288,995	184,326	—	16,978
51021 Bland	220,923	160,920	60,003	—	—
51023 Botetourt	350,310	260,465	89,233	445	167
51025 Brunswick	364,415	264,228	93,204	6,982	—
51027 Buchanan	335,389	294,555	40,835	—	—
51029 Buckingham	377,647	324,185	52,774	689	—
51031 Campbell	352,949	225,882	125,387	1,680	—
51033 Caroline	327,499	248,299	76,257	2,944	—
51035 Carroll	325,709	191,480	129,102	1,687	3,439
51036 Charles City	139,584	93,587	37,579	—	8,418
51037 Charlotte	293,496	223,585	65,312	4,600	—
51041 Chesterfield	314,882	152,833	150,541	1,654	9,854
51043 Clarke	111,496	31,926	79,569	—	—
51045 Craig	206,375	161,658	44,717	—	—
51047 Culpeper	234,699	99,811	129,038	5,851	—
51049 Cumberland	189,439	115,323	64,361	—	9,754
51051 Dickenson	236,470	195,999	40,471	—	—
51053 Dinwiddie	305,633	236,694	67,504	—	1,436
51057 Essex	167,309	89,361	66,658	—	11,289
51059 Fairfax	277,948	78,827	199,087	34	—
51061 Fauquier	417,348	208,558	208,471	318	—
51063 Floyd	240,582	123,402	117,180	—	—
51065 Fluvanna	166,571	101,576	58,483	—	6,512
51067 Franklin	449,173	251,975	196,460	—	738
51069 Frederick	275,393	172,962	102,432	—	—
51071 Giles	254,106	201,724	48,943	—	3,439
51073 Gloucester	195,151	88,864	43,272	6,982	56,032
51075 Goochland	169,472	108,688	59,321	—	1,463
51077 Grayson	290,222	165,647	119,676	1,460	3,439
51079 Greene	110,198	77,794	31,096	1,309	—
51081 Greensville	172,160	126,694	39,299	6,167	—

(Continued)

Table C.26a (continued)—Area of sampled land and water by county name, and land class, Virginia, 2016

County name	Total	Land class			
		Accessible forest	Nonforest	Noncensus water	Census water
			acres		
51083 Halifax	544,299	383,753	150,791	—	9,754
51085 Hanover	287,185	188,151	97,598	—	1,436
51087 Henrico	183,199	63,747	116,037	1,436	1,980
51089 Henry	267,813	198,433	63,162	3,780	2,439
51091 Highland	299,309	231,255	68,054	—	—
51093 Isle Of Wight	226,130	112,145	107,002	—	6,982
51095 James City	130,211	60,335	55,911	—	13,965
51097 King And Queen	196,119	134,829	61,290	—	—
51099 King George	110,270	76,769	33,501	—	—
51101 King William	179,840	112,304	60,554	—	6,982
51103 Lancaster	133,465	45,564	49,625	3,365	34,912
51105 Lee	282,703	182,410	100,293	—	—
51107 Loudoun	337,524	108,086	227,281	2,158	—
51109 Louisa	329,273	199,794	109,142	2,925	17,412
51111 Lunenburg	283,300	245,503	37,797	—	—
51113 Madison	194,454	94,345	100,109	—	—
51115 Mathews	172,029	25,362	20,985	—	125,681
51117 Mecklenburg	435,381	301,432	118,412	—	15,536
51119 Middlesex	133,639	46,774	46,211	5,742	34,912
51121 Montgomery	257,067	163,402	93,665	—	—
51125 Nelson	311,926	258,928	50,072	2,925	—
51127 New Kent	123,189	81,654	27,880	8,418	5,237
51131 Northampton	570,135	25,736	140,840	—	403,560
51133 Northumberland	194,843	63,331	58,775	—	72,738
51135 Nottoway	199,401	145,044	54,356	—	—
51137 Orange	225,995	141,586	77,764	133	6,512
51139 Page	189,670	113,289	71,368	—	5,013
51141 Patrick	296,633	213,198	75,776	5,764	1,895
51143 Pittsylvania	657,683	391,421	256,507	—	9,754
51145 Powhatan	182,393	100,343	70,837	1,459	9,754
51147 Prince Edward	220,971	146,117	65,100	—	9,754
51149 Prince George	193,902	107,100	61,948	16,127	8,728
51153 Prince William	224,774	88,256	117,644	—	18,874
51155 Pulaski	207,028	124,560	79,888	—	2,580
51157 Rappahannock	193,026	135,888	57,138	—	—
51159 Richmond	148,794	79,014	48,833	—	20,947
51161 Roanoke	206,930	93,787	113,143	—	—
51163 Rockbridge	408,828	276,649	130,858	1,320	—
51165 Rockingham	578,653	378,658	199,196	798	—
51167 Russell	283,266	147,344	135,922	—	—

(Continued)

Table C.26a (continued)—Area of sampled land and water by county name, and land class, Virginia, 2016

County name	Total	Land class			
		Accessible forest	Nonforest	Noncensus water	Census water
			acres		
51169 Scott	341,588	254,826	76,392	8,910	1,460
51171 Shenandoah	333,219	197,822	134,089	1,308	—
51173 Smyth	273,903	183,909	89,994	—	—
51175 Southampton	363,253	249,912	106,359	—	6,982
51177 Spotsylvania	255,097	149,352	91,258	1,463	13,024
51179 Stafford	173,236	121,686	51,550	—	—
51181 Surry	200,186	145,268	29,070	4,902	20,947
51183 Sussex	310,678	256,302	54,376	—	—
51185 Tazewell	319,228	230,507	87,187	—	1,534
51187 Warren	143,337	80,499	62,839	—	—
51191 Washington	355,813	199,091	155,262	1,460	—
51193 Westmoreland	156,599	92,517	54,282	1,072	8,728
51195 Wise	251,386	169,531	81,438	—	417
51197 Wythe	284,478	122,949	155,691	5,838	—
51199 York	199,618	43,295	43,482	1,124	111,717
51550 Chesapeake city	301,861	94,994	159,230	—	47,636
51650 Hampton city	89,423	1,297	46,232	—	41,894
51700 Newport News city	73,754	5,742	40,082	—	27,929
51800 Suffolk city	276,002	176,290	84,239	—	15,473
51810 Virginia Beach city	333,221	32,722	145,452	—	155,046
Total	27,375,851	16,069,105	9,174,571	135,906	1,996,269

Table C.26b—Sampling error for area of sampled land and water by county name, and land class, Virginia, 2016

County name	Total	Land class			
		Accessible forest	Nonforest	Noncensus water	Census water
			percent		
51001 Accomack	7.29	22.54	15.14	—	8.79
51003 Albemarle	10.27	12.87	15.90	61.17	—
51005 Alleghany	12.43	12.71	35.75	125.00	—
51007 Amelia	16.29	18.85	29.15	94.71	—
51009 Amherst	13.14	14.11	27.41	—	—
51011 Appomattox	16.39	20.05	23.89	101.43	—
51013 Arlington	67.25	—	67.25	—	—
51015 Augusta	8.47	10.59	12.78	—	—
51017 Bath	11.21	11.90	35.16	—	53.79
51019 Bedford	10.54	13.06	16.36	—	58.71
51021 Bland	14.90	16.54	28.83	—	—
51023 Botetourt	11.97	13.36	24.15	125.00	97.83
51025 Brunswick	12.47	14.47	24.31	92.81	—
51027 Buchanan	12.62	13.11	30.25	—	—
51029 Buckingham	12.08	12.68	28.01	101.43	—
51031 Campbell	12.61	15.48	19.99	94.71	—
51033 Caroline	13.19	14.71	25.34	71.48	—
51035 Carroll	12.99	15.64	18.49	86.27	151.16
51036 Charles City	20.54	23.97	35.89	—	78.93
51037 Charlotte	13.96	15.49	26.95	94.71	—
51041 Chesterfield	13.45	18.24	18.57	89.76	69.06
51043 Clarke	22.86	41.21	26.51	—	—
51045 Craig	14.57	15.28	33.83	—	—
51047 Culpeper	15.41	23.35	20.23	100.49	—
51049 Cumberland	17.58	21.96	28.88	—	80.99
51051 Dickenson	15.11	16.15	32.27	—	—
51053 Dinwiddie	13.68	15.16	27.21	—	102.27
51057 Essex	18.73	24.83	28.76	—	69.41
51059 Fairfax	14.03	25.97	16.33	100.49	—
51061 Fauquier	11.32	15.67	15.47	95.47	—
51063 Floyd	15.25	20.72	21.16	—	—
51065 Fluvanna	18.57	22.34	28.32	—	99.83
51067 Franklin	11.10	14.22	15.78	—	94.71
51069 Frederick	14.16	17.42	22.75	—	—
51071 Giles	13.84	14.87	31.77	—	151.16
51073 Gloucester	17.33	24.74	34.37	92.81	32.28
51075 Goochland	18.35	22.21	29.56	—	100.49
51077 Grayson	13.65	17.01	20.16	100.78	151.16
51079 Greene	22.88	26.63	41.84	100.49	—
51081 Greensville	18.41	20.72	35.66	77.76	—

(Continued)

Table C.26b (continued)—Sampling error for area of sampled land and water by county name, and land class, Virginia, 2016

County name	Total	Land class			
		Accessible forest	Nonforest	Noncensus water	Census water
			percent		
51083 Halifax	10.02	11.59	17.75	—	80.99
51085 Hanover	14.13	16.64	22.48	—	102.27
51087 Henrico	17.78	28.23	21.81	102.27	102.27
51089 Henry	14.64	16.58	28.95	80.99	80.99
51091 Highland	12.85	14.24	28.85	—	—
51093 Isle Of Wight	16.05	21.76	22.22	—	92.81
51095 James City	21.31	30.28	31.33	—	65.50
51097 King And Queen	17.25	20.39	29.72	—	—
51099 King George	23.12	26.53	37.87	—	—
51101 King William	18.06	21.81	28.62	—	92.81
51103 Lancaster	21.08	32.85	32.24	102.27	41.19
51105 Lee	13.85	16.67	22.25	—	—
51107 Loudoun	12.54	21.67	14.77	75.36	—
51109 Louisa	12.92	15.93	21.28	100.49	55.51
51111 Lunenburg	14.19	15.03	35.81	—	—
51113 Madison	17.08	23.98	23.23	—	—
51115 Mathews	18.25	45.90	49.97	—	21.17
51117 Mecklenburg	11.33	13.08	19.91	—	59.04
51119 Middlesex	21.06	34.64	34.81	102.27	41.19
51121 Montgomery	14.46	17.58	23.53	—	—
51125 Nelson	13.07	14.11	33.00	70.98	—
51127 New Kent	21.88	25.51	41.56	78.93	92.81
51131 Northampton	9.33	46.53	19.86	—	10.87
51133 Northumberland	17.37	29.38	30.34	—	28.46
51135 Nottoway	17.07	19.40	30.09	—	—
51137 Orange	15.82	18.96	24.79	100.49	99.83
51139 Page	16.98	21.09	28.00	—	125.00
51141 Patrick	13.84	15.93	26.37	102.24	94.71
51143 Pittsylvania	8.98	11.30	13.39	—	80.99
51145 Powhatan	17.96	22.61	26.45	101.43	80.99
51147 Prince Edward	16.19	19.45	28.25	—	80.99
51149 Prince George	17.37	22.37	29.08	58.85	76.47
51153 Prince William	15.86	24.00	21.13	—	55.19
51155 Pulaski	16.24	19.49	24.38	—	151.16
51157 Rappahannock	17.11	20.17	31.22	—	—
51159 Richmond	19.92	26.79	33.53	—	53.38
51161 Roanoke	16.56	23.46	21.68	—	—
51163 Rockbridge	11.02	12.85	19.95	107.40	—
51165 Rockingham	8.97	10.65	15.63	125.00	—
51167 Russell	13.91	18.95	19.41	—	—

(Continued)

Table C.26b (continued)—Sampling error for area of sampled land and water by county name, and land class, Virginia, 2016

County name	Total	Land class			
		Accessible forest	Nonforest	Noncensus water	Census water
			percent		
51169 Scott	12.41	14.12	26.80	86.47	100.78
51171 Shenandoah	12.33	15.34	19.74	107.40	—
51173 Smyth	13.49	15.42	23.54	—	—
51175 Southampton	12.51	14.64	21.64	—	92.81
51177 Spotsylvania	14.83	18.67	23.71	100.49	66.03
51179 Stafford	18.09	20.62	29.85	—	—
51181 Surry	17.11	19.49	40.05	92.59	53.38
51183 Sussex	13.52	14.69	31.33	—	—
51185 Tazewell	13.02	14.85	24.10	—	98.09
51187 Warren	20.06	25.13	28.45	—	—
51191 Washington	12.23	15.85	18.25	100.78	—
51193 Westmoreland	19.38	23.88	30.60	102.27	76.47
51195 Wise	14.60	16.59	22.56	—	98.09
51197 Wythe	13.19	18.95	18.17	100.78	—
51199 York	17.01	34.81	35.27	102.27	22.54
51550 Chesapeake city	13.81	24.62	18.81	—	35.24
51650 Hampton city	25.73	102.27	35.56	—	37.53
51700 Newport News city	28.43	102.27	38.58	—	46.14
51800 Suffolk city	14.46	17.63	25.18	—	59.92
51810 Virginia Beach city	13.03	38.03	19.51	—	18.84

Table C.27a—Area of timberland by county and major ownership group, Virginia, 2016

County name	Total	Major ownership group	
		Public	Private
		acres	
51001 Accomack	102,687	—	102,687
51003 Albemarle	288,196	13,164	275,032
51005 Alleghany	235,319	123,209	112,111
51007 Amelia	153,858	—	153,858
51009 Amherst	233,882	57,126	176,756
51011 Appomattox	127,870	14,955	112,915
51015 Augusta	320,120	183,592	136,528
51017 Bath	267,553	156,527	111,026
51019 Bedford	285,814	10,209	275,605
51021 Bland	148,923	61,206	87,717
51023 Botetourt	236,349	68,448	167,900
51025 Brunswick	264,228	20,727	243,502
51027 Buchanan	294,555	6,138	288,417
51029 Buckingham	324,185	17,506	306,679
51031 Campbell	225,882	—	225,882
51033 Caroline	248,299	55,279	193,019
51035 Carroll	181,824	9,077	172,748
51036 Charles City	93,587	2,871	90,715
51037 Charlotte	223,585	—	223,585
51041 Chesterfield	144,219	10,049	134,170
51043 Clarke	31,926	—	31,926
51045 Craig	124,421	82,464	41,957
51047 Culpeper	99,811	5,851	93,960
51049 Cumberland	115,323	17,506	97,817
51051 Dickenson	195,999	17,261	178,738
51053 Dinwiddie	236,694	1,722	234,972
51057 Essex	89,361	1,436	87,926
51059 Fairfax	44,601	—	44,601
51061 Fauquier	208,558	17,552	191,006
51063 Floyd	123,402	—	123,402
51065 Fluvanna	101,576	—	101,576
51067 Franklin	247,599	—	247,599
51069 Frederick	169,099	3,862	165,237
51071 Giles	182,413	78,977	103,435
51073 Gloucester	83,296	—	83,296
51075 Goochland	108,688	—	108,688
51077 Grayson	151,747	20,297	131,450
51079 Greene	60,242	—	60,242
51081 Greensville	126,694	—	126,694

(Continued)

Table C.27a (continued)—Area of timberland by county and major ownership group, Virginia, 2016

County name	Total	Major ownership group	
		Public	Private
		acres	
51083 Halifax	383,753	17,368	366,385
51085 Hanover	188,151	—	188,151
51087 Henrico	55,133	—	55,133
51089 Henry	192,598	—	192,598
51091 Highland	231,255	109,693	121,562
51093 Isle Of Wight	112,145	—	112,145
51095 James City	60,335	11,485	48,850
51097 King And Queen	134,829	11,485	123,344
51099 King George	76,769	5,742	71,026
51101 King William	112,304	4,547	107,757
51103 Lancaster	45,564	1,392	44,172
51105 Lee	170,135	12,290	157,845
51107 Loudoun	102,235	5,172	97,063
51109 Louisa	199,794	—	199,794
51111 Lunenburg	245,503	—	245,503
51113 Madison	66,022	—	66,022
51115 Mathews	25,362	—	25,362
51117 Mecklenburg	301,432	54,917	246,515
51119 Middlesex	46,774	5,742	41,031
51121 Montgomery	154,965	20,112	134,853
51125 Nelson	252,127	18,946	233,181
51127 New Kent	81,654	4,352	77,302
51131 Northampton	25,736	—	25,736
51133 Northumberland	63,331	—	63,331
51135 Nottoway	145,044	5,835	139,209
51137 Orange	141,586	5,851	135,736
51139 Page	87,994	31,692	56,302
51141 Patrick	207,362	15,987	191,376
51143 Pittsylvania	391,421	9,481	381,940
51145 Powhatan	100,343	2,530	97,814
51147 Prince Edward	146,117	15,935	130,182
51149 Prince George	107,100	1,508	105,591
51153 Prince William	72,465	23,403	49,062
51155 Pulaski	121,491	20,772	100,719
51157 Rappahannock	94,933	—	94,933
51159 Richmond	73,272	—	73,272
51161 Roanoke	91,078	23,352	67,726
51163 Rockbridge	253,772	60,808	192,964
51165 Rockingham	340,716	164,228	176,488
51167 Russell	147,344	11,360	135,984

(Continued)

Table C.27a (continued)—Area of timberland by county and major ownership group, Virginia, 2016

County name	Total	Major ownership group	
		Public	Private
		acres	
51169 Scott	254,826	35,622	219,204
51171 Shenandoah	194,642	71,360	123,282
51173 Smyth	174,591	77,408	97,183
51175 Southampton	249,912	—	249,912
51177 Spotsylvania	142,039	8,746	133,293
51179 Stafford	115,835	29,253	86,582
51181 Surry	145,268	5,742	139,525
51183 Sussex	256,302	—	256,302
51185 Tazewell	224,629	2,939	221,690
51187 Warren	57,463	10,186	47,277
51191 Washington	194,619	42,766	151,853
51193 Westmoreland	86,774	—	86,774
51195 Wise	169,531	24,309	145,222
51197 Wythe	116,148	73,463	42,684
51199 York	33,278	21,793	11,485
51550 Chesapeake city	43,312	8,857	34,455
51650 Hampton city	1,297	—	1,297
51800 Suffolk city	141,835	—	141,835
51810 Virginia Beach city	31,762	8,614	23,148
Total	15,386,392	2,154,054	13,232,338

Table C.27b—Sampling error for area of timberland by county and major ownership group, Virginia, 2016

County name	Total	Major ownership group	
		Public	Private
		percent	
51001 Accomack	22.98	—	22.98
51003 Albemarle	13.13	60.01	13.53
51005 Alleghany	13.31	15.84	21.84
51007 Amelia	18.85	—	18.85
51009 Amherst	14.34	26.59	17.04
51011 Appomattox	20.05	60.01	21.34
51015 Augusta	11.02	13.25	18.77
51017 Bath	12.31	14.11	21.85
51019 Bedford	13.15	55.49	13.46
51021 Bland	17.44	23.65	24.63
51023 Botetourt	14.19	21.73	17.92
51025 Brunswick	14.47	50.48	15.09
51027 Buchanan	13.11	98.09	13.26
51029 Buckingham	12.68	58.45	13.06
51031 Campbell	15.48	—	15.48
51033 Caroline	14.71	31.35	16.75
51035 Carroll	16.05	74.91	16.48
51036 Charles City	23.97	102.27	24.53
51037 Charlotte	15.49	—	15.49
51041 Chesterfield	18.83	73.00	19.54
51043 Clarke	41.21	—	41.21
51045 Craig	17.94	20.26	35.42
51047 Culpeper	23.35	100.49	24.06
51049 Cumberland	21.96	58.45	23.81
51051 Dickenson	16.15	48.60	16.99
51053 Dinwiddie	15.16	99.94	15.25
51057 Essex	24.83	102.27	25.19
51059 Fairfax	33.94	—	33.94
51061 Fauquier	15.67	57.89	16.37
51063 Floyd	20.72	—	20.72
51065 Fluvanna	22.34	—	22.34
51067 Franklin	14.38	—	14.38
51069 Frederick	17.69	93.64	17.97
51071 Giles	15.93	21.68	22.82
51073 Gloucester	25.54	—	25.54
51075 Goochland	22.21	—	22.21
51077 Grayson	17.83	38.78	19.69
51079 Greene	30.17	—	30.17
51081 Greensville	20.72	—	20.72

(Continued)

Table C.27b (continued)—Sampling error for area of timberland by county and major ownership group, Virginia, 2016

County name	Total	Major ownership group	
		Public	Private
		percent	
51083 Halifax	11.59	57.30	11.88
51085 Hanover	16.64	—	16.64
51087 Henrico	30.46	—	30.46
51089 Henry	16.83	—	16.83
51091 Highland	14.24	18.30	21.45
51093 Isle Of Wight	21.76	—	21.76
51095 James City	30.28	72.27	33.42
51097 King And Queen	20.39	72.27	21.31
51099 King George	26.53	102.27	27.50
51101 King William	21.81	102.27	22.34
51103 Lancaster	32.85	104.03	33.72
51105 Lee	17.23	52.00	18.12
51107 Loudoun	22.23	100.49	22.84
51109 Louisa	15.93	—	15.93
51111 Lunenburg	15.03	—	15.03
51113 Madison	28.67	—	28.67
51115 Mathews	45.90	—	45.90
51117 Mecklenburg	13.08	30.35	14.63
51119 Middlesex	34.64	102.27	36.87
51121 Montgomery	18.26	43.68	19.99
51125 Nelson	14.37	50.88	15.04
51127 New Kent	25.51	102.27	26.36
51131 Northampton	46.53	—	46.53
51133 Northumberland	29.38	—	29.38
51135 Nottoway	19.40	101.43	19.79
51137 Orange	18.96	100.49	19.34
51139 Page	23.59	32.57	31.99
51141 Patrick	16.15	57.66	16.90
51143 Pittsylvania	11.30	61.72	11.40
51145 Powhatan	22.61	94.71	23.08
51147 Prince Edward	19.45	59.18	20.67
51149 Prince George	22.37	99.94	22.65
51153 Prince William	26.47	50.08	31.28
51155 Pulaski	19.53	39.32	22.12
51157 Rappahannock	24.23	—	24.23
51159 Richmond	27.79	—	27.79
51161 Roanoke	24.02	48.12	27.84
51163 Rockbridge	13.60	24.96	16.19
51165 Rockingham	11.15	13.60	17.22
51167 Russell	18.95	69.49	19.78

(Continued)

Table C.27b (continued)—Sampling error for area of timberland by county and major ownership group, Virginia, 2016

County name	Total	Major ownership group	
		Public	Private
		percent	
51169 Scott	14.12	30.42	15.55
51171 Shenandoah	15.50	21.90	21.00
51173 Smyth	15.79	20.48	23.15
51175 Southampton	14.64	—	14.64
51177 Spotsylvania	19.05	74.94	19.64
51179 Stafford	21.11	44.75	24.12
51181 Surry	19.49	102.27	19.88
51183 Sussex	14.69	—	14.69
51185 Tazewell	15.11	107.55	15.24
51187 Warren	29.27	70.35	32.31
51191 Washington	15.97	33.33	18.36
51193 Westmoreland	24.58	—	24.58
51195 Wise	16.59	38.29	18.29
51197 Wythe	19.67	23.63	35.07
51199 York	39.80	47.51	72.27
51550 Chesapeake city	36.28	73.48	41.60
51650 Hampton city	102.27	—	102.27
51800 Suffolk city	19.61	—	19.61
51810 Virginia Beach city	39.07	72.27	46.47

Table C.28a—Volume of live trees on timberland by county and major species group, Virginia, 2016

County name	Total	Major species group	
		Softwood	Hardwood
	million cubic feet		
51001 Accomack	409.1	279.7	129.4
51003 Albemarle	738.8	99.7	639.1
51005 Alleghany	497.6	89.0	408.6
51007 Amelia	348.2	148.2	200.0
51009 Amherst	550.2	129.2	420.9
51011 Appomattox	267.6	53.1	214.5
51015 Augusta	678.3	110.6	567.7
51017 Bath	684.4	80.5	603.9
51019 Bedford	779.6	78.7	700.9
51021 Bland	384.1	68.6	315.5
51023 Botetourt	540.4	92.4	448.0
51025 Brunswick	614.1	351.6	262.6
51027 Buchanan	689.6	25.7	663.9
51029 Buckingham	593.6	221.5	372.1
51031 Campbell	435.7	113.4	322.3
51033 Caroline	755.5	256.3	499.2
51035 Carroll	421.1	135.0	286.1
51036 Charles City	259.5	94.8	164.7
51037 Charlotte	439.3	173.0	266.3
51041 Chesterfield	429.4	146.1	283.3
51043 Clarke	91.6	—	91.6
51045 Craig	263.9	54.5	209.4
51047 Culpeper	267.3	38.5	228.8
51049 Cumberland	295.5	149.1	146.4
51051 Dickenson	461.1	20.1	441.0
51053 Dinwiddie	455.3	221.2	234.0
51057 Essex	178.0	83.8	94.1
51059 Fairfax	144.0	4.1	139.9
51061 Fauquier	532.3	57.3	475.0
51063 Floyd	369.6	88.8	280.8
51065 Fluvanna	242.1	72.0	170.2
51067 Franklin	566.3	80.3	486.0
51069 Frederick	363.3	70.4	292.9
51071 Giles	508.1	13.3	494.7
51073 Gloucester	330.5	106.4	224.2
51075 Goochland	288.6	90.5	198.1
51077 Grayson	416.2	90.1	326.1
51079 Greene	183.1	2.4	180.6
51081 Greensville	342.2	156.4	185.8

(Continued)

Table C.28a (continued)—Volume of live trees on timberland by county and major species group, Virginia, 2016

County name	Total	Major species group	
		Softwood	Hardwood
	million cubic feet		
51083 Halifax	775.1	393.1	382.0
51085 Hanover	536.6	176.7	359.9
51087 Henrico	93.2	23.9	69.3
51089 Henry	440.3	167.8	272.6
51091 Highland	647.7	99.5	548.2
51093 Isle Of Wight	290.8	142.5	148.3
51095 James City	170.1	52.4	117.7
51097 King And Queen	327.2	129.8	197.4
51099 King George	248.6	26.1	222.4
51101 King William	219.6	83.5	136.0
51103 Lancaster	124.3	48.7	75.6
51105 Lee	426.8	17.6	409.2
51107 Loudoun	276.3	15.7	260.6
51109 Louisa	510.7	164.7	346.0
51111 Lunenburg	444.9	221.4	223.4
51113 Madison	219.1	48.4	170.7
51115 Mathews	70.2	34.0	36.3
51117 Mecklenburg	797.0	281.6	515.5
51119 Middlesex	102.3	44.1	58.1
51121 Montgomery	311.7	54.7	257.0
51125 Nelson	639.7	85.0	554.8
51127 New Kent	218.4	87.2	131.2
51131 Northampton	97.1	74.7	22.3
51133 Northumberland	175.3	47.0	128.2
51135 Nottoway	315.6	163.5	152.1
51137 Orange	406.3	50.4	356.0
51139 Page	175.7	15.7	160.0
51141 Patrick	599.8	58.1	541.7
51143 Pittsylvania	818.0	261.9	556.0
51145 Powhatan	289.1	101.6	187.5
51147 Prince Edward	292.5	145.0	147.6
51149 Prince George	235.1	127.6	107.5
51153 Prince William	245.3	30.1	215.2
51155 Pulaski	277.8	45.2	232.6
51157 Rappahannock	279.5	17.9	261.6
51159 Richmond	160.9	60.1	100.8
51161 Roanoke	200.0	31.1	168.9
51163 Rockbridge	621.0	72.5	548.5
51165 Rockingham	757.0	88.1	668.9
51167 Russell	389.0	28.0	361.0

(Continued)

Table C.28a (continued)—Volume of live trees on timberland by county and major species group, Virginia, 2016

County name	Total	Major species group	
		Softwood	Hardwood
	million cubic feet		
51169 Scott	682.5	39.4	643.1
51171 Shenandoah	422.6	31.8	390.9
51173 Smyth	465.9	35.3	430.6
51175 Southampton	586.3	280.4	305.9
51177 Spotsylvania	460.8	178.5	282.3
51179 Stafford	353.6	19.6	334.0
51181 Surry	285.8	132.2	153.6
51183 Sussex	488.7	335.3	153.4
51185 Tazewell	543.1	3.8	539.3
51187 Warren	158.5	8.1	150.4
51191 Washington	653.8	41.4	612.4
51193 Westmoreland	225.8	58.3	167.4
51195 Wise	302.3	26.3	276.0
51197 Wythe	236.3	51.0	185.3
51199 York	131.0	35.6	95.3
51550 Chesapeake city	141.4	77.5	63.9
51650 Hampton city	12.8	6.5	6.3
51800 Suffolk city	293.6	166.1	127.5
51810 Virginia Beach city	108.3	72.6	35.7
Total	37,594.0	9,563 .0	28,031.0

Table C.28b—Sampling error for volume of live trees on timberland by county and major species group, Virginia, 2016

County name	Total	Major species group	
		Softwood	Hardwood
		percent	
51001 Accomack	25.61	28.98	28.88
51003 Albemarle	14.73	28.28	15.84
51005 Alleghany	15.37	22.18	16.68
51007 Amelia	24.23	35.47	27.57
51009 Amherst	15.97	27.09	17.30
51011 Appomattox	22.56	33.36	25.42
51015 Augusta	12.22	20.39	12.92
51017 Bath	13.97	24.83	14.72
51019 Bedford	15.06	28.47	15.77
51021 Bland	19.45	33.73	19.62
51023 Botetourt	15.99	29.60	17.02
51025 Brunswick	19.17	23.58	24.04
51027 Buchanan	15.78	41.34	15.89
51029 Buckingham	15.72	24.86	18.91
51031 Campbell	20.13	27.45	23.45
51033 Caroline	17.12	23.59	20.64
51035 Carroll	17.98	28.18	18.35
51036 Charles City	28.81	43.45	31.87
51037 Charlotte	21.05	26.49	27.52
51041 Chesterfield	21.23	33.33	23.95
51043 Clarke	49.74	—	49.74
51045 Craig	19.15	26.20	20.21
51047 Culpeper	25.36	45.04	27.18
51049 Cumberland	25.45	35.61	29.13
51051 Dickenson	18.06	43.61	18.51
51053 Dinwiddie	18.81	23.12	22.79
51057 Essex	27.62	35.28	32.30
51059 Fairfax	38.65	66.37	38.95
51061 Fauquier	18.00	41.67	18.87
51063 Floyd	23.49	35.02	24.46
51065 Fluvanna	22.69	37.42	24.53
51067 Franklin	16.82	25.81	17.49
51069 Frederick	19.01	31.79	19.61
51071 Giles	18.05	40.59	18.18
51073 Gloucester	27.97	37.85	29.58
51075 Goochland	25.55	36.06	29.47
51077 Grayson	20.36	30.37	22.77
51079 Greene	35.49	97.68	35.74
51081 Greensville	25.24	34.18	27.67

(Continued)

Table C.28b (continued)—Sampling error for volume of live trees on timberland by county and major species group, Virginia, 2016

County name	Total	Major species group	
		Softwood	Hardwood
		percent	
51083 Halifax	14.35	18.93	18.02
51085 Hanover	18.48	21.56	22.04
51087 Henrico	35.00	44.45	34.56
51089 Henry	20.24	28.57	22.53
51091 Highland	14.92	29.29	15.54
51093 Isle Of Wight	25.85	31.40	30.38
51095 James City	33.01	43.48	34.82
51097 King And Queen	22.03	29.26	27.71
51099 King George	28.62	48.72	29.57
51101 King William	25.85	36.16	32.27
51103 Lancaster	34.42	46.34	36.53
51105 Lee	21.27	46.99	21.74
51107 Loudoun	23.29	51.85	23.72
51109 Louisa	18.10	28.73	20.34
51111 Lunenburg	19.85	26.49	23.27
51113 Madison	34.50	59.34	35.20
51115 Mathews	52.85	60.70	71.40
51117 Mecklenburg	16.18	22.30	19.99
51119 Middlesex	43.77	61.29	47.35
51121 Montgomery	20.12	34.66	21.28
51125 Nelson	15.99	32.19	17.10
51127 New Kent	26.65	35.44	32.00
51131 Northampton	58.06	62.28	66.93
51133 Northumberland	30.20	43.93	31.13
51135 Nottoway	23.14	30.13	26.99
51137 Orange	22.09	34.16	23.53
51139 Page	28.54	47.61	27.79
51141 Patrick	17.82	34.70	18.11
51143 Pittsylvania	15.24	25.45	17.12
51145 Powhatan	24.43	37.83	27.78
51147 Prince Edward	23.92	31.93	29.57
51149 Prince George	25.03	32.94	27.39
51153 Prince William	29.11	53.02	29.28
51155 Pulaski	21.32	27.07	22.03
51157 Rappahannock	26.20	64.30	27.06
51159 Richmond	34.83	57.01	36.48
51161 Roanoke	26.58	35.63	29.08
51163 Rockbridge	15.61	27.05	16.37
51165 Rockingham	12.56	24.43	12.90
51167 Russell	20.96	60.66	21.37

(Continued)

Table C.28b (continued)—Sampling error for volume of live trees on timberland by county and major species group, Virginia, 2016

County name	Total	Major species group	
		Softwood	Hardwood
	percent		
51169 Scott	16.45	38.65	16.84
51171 Shenandoah	17.47	30.91	17.63
51173 Smyth	17.56	47.64	17.78
51175 Southampton	19.42	24.11	23.77
51177 Spotsylvania	21.89	30.45	25.60
51179 Stafford	22.24	52.80	22.62
51181 Surry	24.08	30.08	31.20
51183 Sussex	19.75	22.91	25.67
51185 Tazewell	17.60	45.75	17.63
51187 Warren	31.84	82.53	31.93
51191 Washington	17.84	36.64	18.20
51193 Westmoreland	30.99	41.17	32.78
51195 Wise	20.77	38.00	21.22
51197 Wythe	21.80	29.70	22.96
51199 York	44.61	44.71	45.84
51550 Chesapeake city	41.43	45.51	47.73
51650 Hampton city	102.27	102.27	102.27
51800 Suffolk city	26.41	29.56	31.69
51810 Virginia Beach city	43.83	53.18	47.67

Table C.29a—Area of forest land by county and forest-type group, Virginia, 2016

County name	Total	Forest-type group					
		White-red-jack pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Other eastern softwoods	Exotic softwoods
		acres					
51001 Accomack	105,399	—	—	—	74,500	—	—
51003 Albemarle	300,560	4,238	—	—	41,257	4,149	—
51005 Alleghany	251,903	5,102	—	—	18,971	—	—
51007 Amelia	153,858	—	—	—	54,686	—	—
51009 Amherst	239,675	7,313	—	—	43,653	—	—
51011 Appomattox	127,870	—	—	—	25,691	—	—
51015 Augusta	346,895	10,205	—	—	11,008	6,913	—
51017 Bath	281,638	7,289	—	—	25,025	—	—
51019 Bedford	288,995	—	—	—	23,019	—	—
51021 Bland	160,920	6,138	—	—	2,204	—	—
51023 Botetourt	260,465	3,862	—	—	23,225	—	—
51025 Brunswick	264,228	—	—	—	145,584	—	—
51027 Buchanan	294,555	1,368	—	—	—	—	—
51029 Buckingham	324,185	—	—	—	87,427	—	—
51031 Campbell	225,882	—	—	—	47,770	—	—
51033 Caroline	248,299	—	—	—	75,393	—	—
51035 Carroll	191,480	28,179	—	—	10,305	—	—
51036 Charles City	93,587	—	—	—	35,716	—	—
51037 Charlotte	223,585	—	—	—	71,995	—	—
51041 Chesterfield	152,833	—	—	—	38,740	—	—
51043 Clarke	31,926	—	—	—	—	—	—
51045 Craig	161,658	4,643	—	—	13,443	2,584	—
51047 Culpeper	99,811	—	—	—	17,313	1,659	—
51049 Cumberland	115,323	—	—	—	34,304	—	—
51051 Dickenson	195,999	3,619	—	—	—	—	—
51053 Dinwiddie	236,694	—	—	—	129,010	—	—
51057 Essex	89,361	—	—	—	52,060	—	—
51059 Fairfax	78,827	—	—	—	4,719	2,881	—
51061 Fauquier	208,558	1,463	—	—	14,627	1,405	—
51063 Floyd	123,402	9,077	—	—	2,687	—	—
51065 Fluvanna	101,576	—	—	—	22,251	—	—
51067 Franklin	251,975	1,680	—	—	29,926	—	—
51069 Frederick	172,962	—	—	—	11,462	—	—
51071 Giles	201,724	—	—	—	—	—	—
51073 Gloucester	88,864	—	—	—	27,602	—	—
51075 Goochland	108,688	—	—	—	21,940	—	—
51077 Grayson	165,647	16,027	1,534	—	—	—	—
51079 Greene	77,794	—	—	—	1,463	—	—
51081 Greensville	126,694	—	—	—	48,097	—	—

Table C.29a (continued)—Area of forest land by county and forest-type group, Virginia, 2016

Forest-type group (continued)								
Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Other hardwoods	Exotic hardwoods	Nonstocked
acres								
10,688	15,527	4,684	—	—	—	—	—	—
39,214	199,689	—	12,013	—	—	—	—	—
39,078	170,071	—	6,034	12,648	—	—	—	—
31,396	54,413	—	13,363	—	—	—	—	—
27,238	156,904	2,939	1,628	—	—	—	—	—
15,439	80,306	—	6,434	—	—	—	—	—
48,559	257,075	—	—	6,718	—	—	—	6,418
18,218	231,106	—	—	—	—	—	—	—
27,137	234,462	—	—	—	—	1,459	2,918	—
12,275	129,227	—	—	11,075	—	—	—	—
26,126	195,206	—	9,703	—	—	—	795	1,548
28,296	67,561	11,011	11,776	—	—	—	—	—
4,103	238,078	—	2,735	43,729	—	4,541	—	—
46,857	173,854	—	5,835	—	—	—	—	10,212
65,826	105,563	—	6,722	—	—	—	—	—
25,597	123,184	5,742	13,857	—	—	4,525	—	—
32,047	100,479	—	3,069	6,063	—	9,401	—	1,936
14,333	26,013	10,273	7,251	—	—	—	—	—
42,922	90,149	—	9,491	—	—	—	4,475	4,553
11,485	78,381	21,745	2,482	—	—	—	—	—
—	21,352	—	—	6,324	—	—	—	4,251
17,512	123,477	—	—	—	—	—	—	—
1,338	66,171	—	13,330	—	—	—	—	—
19,187	61,832	—	—	—	—	—	—	—
11,671	159,302	—	1,460	19,948	—	—	—	—
14,642	63,135	11,204	18,703	—	—	—	—	—
—	27,063	8,802	1,436	—	—	—	—	—
—	56,253	—	11,667	—	—	3,307	—	—
10,190	169,579	—	5,851	—	—	—	—	5,444
18,429	87,071	—	—	—	—	6,138	—	—
13,495	54,065	1,527	10,239	—	—	—	—	—
34,717	166,373	2,918	6,978	—	—	1,441	1,441	6,500
14,829	146,672	—	—	—	—	—	—	—
—	173,280	—	—	28,443	—	—	—	—
5,742	52,649	—	2,871	—	—	—	—	—
24,065	55,580	—	7,103	—	—	—	—	—
17,200	112,309	—	1,850	12,370	—	2,897	—	1,460
—	74,869	—	1,463	—	—	—	—	—
21,838	14,766	17,809	24,184	—	—	—	—	—

(Continued)

Table C.29a (continued)—Area of forest land by county and forest-type group, Virginia, 2016

County name	Total	Forest-type group					
		White-red-jack pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Other eastern softwoods	Exotic softwoods
		acres					
51083 Halifax	383,753	—	—	—	170,599	5,699	—
51085 Hanover	188,151	—	—	—	54,626	—	—
51087 Henrico	63,747	—	—	—	5,568	—	—
51089 Henry	198,433	—	—	—	62,371	—	—
51091 Highland	231,255	17,347	—	—	—	—	—
51093 Isle Of Wight	112,145	—	—	—	47,627	—	—
51095 James City	60,335	—	—	—	12,921	—	—
51097 King And Queen	134,829	—	—	—	58,295	—	—
51099 King George	76,769	—	—	—	2,508	—	—
51101 King William	112,304	—	—	—	30,228	—	—
51103 Lancaster	45,564	—	—	—	14,760	—	—
51105 Lee	182,410	1,460	—	—	3,069	13,414	—
51107 Loudoun	108,086	—	—	—	—	—	—
51109 Louisa	199,794	—	—	—	45,175	—	—
51111 Lunenburg	245,503	—	—	—	103,469	—	—
51113 Madison	94,345	2,925	—	—	5,851	—	—
51115 Mathews	25,362	—	—	—	14,822	—	—
51117 Mecklenburg	301,432	—	—	—	103,421	—	—
51119 Middlesex	46,774	—	—	—	17,604	—	—
51121 Montgomery	163,402	9,057	—	—	8,467	4,603	—
51125 Nelson	258,928	—	—	—	27,404	—	—
51127 New Kent	81,654	—	—	—	21,844	—	—
51131 Northampton	25,736	—	—	—	17,122	—	—
51133 Northumberland	63,331	—	—	—	17,162	—	—
51135 Nottoway	145,044	—	—	—	60,620	—	—
51137 Orange	141,586	—	—	—	9,869	1,463	—
51139 Page	113,289	—	—	—	—	—	—
51141 Patrick	213,198	—	—	—	12,286	—	—
51143 Pittsylvania	391,421	—	—	—	102,395	—	—
51145 Powhatan	100,343	—	—	—	32,504	—	—
51147 Prince Edward	146,117	—	—	—	54,458	—	—
51149 Prince George	107,100	—	—	—	43,957	—	—
51153 Prince William	88,256	—	—	—	7,313	—	—
51155 Pulaski	124,560	1,460	—	—	3,180	2,991	—
51157 Rappahannock	135,888	5,038	—	—	—	—	—
51159 Richmond	79,014	—	—	—	28,896	—	—
51161 Roanoke	93,787	—	—	—	10,966	—	—
51163 Rockbridge	276,649	1,590	—	—	3,591	12,994	—
51165 Rockingham	378,658	3,862	—	—	4,127	18,133	2,799
51167 Russell	147,344	—	6,138	—	—	—	—

Table C.29a (continued)—Area of forest land by county and forest-type group, Virginia, 2016

Forest-type group (continued)								
Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Other hardwoods	Exotic hardwoods	Nonstocked
acres								
51,351	137,710	5,835	12,557	—	—	—	—	—
28,712	96,611	3,895	4,307	—	—	—	—	—
4,206	37,659	5,742	8,614	—	—	—	—	1,957
27,718	98,167	—	4,341	—	—	—	—	5,835
13,560	164,299	—	—	36,049	—	—	—	—
6,005	33,005	18,490	5,582	—	—	—	—	1,436
17,310	25,798	4,307	—	—	—	—	—	—
18,470	42,272	4,307	11,485	—	—	—	—	—
9,595	63,230	—	—	—	—	—	—	1,436
17,258	62,441	—	296	—	—	—	—	2,082
—	25,291	4,078	—	—	—	—	—	1,436
—	153,727	—	4,603	6,138	—	—	—	—
10,725	92,973	—	4,388	—	—	—	—	—
5,674	132,855	—	16,089	—	—	—	—	—
41,065	93,837	—	7,132	—	—	—	—	—
6,107	74,656	—	—	—	—	2,925	1,880	—
5,742	—	4,798	—	—	—	—	—	—
41,438	143,249	—	11,270	—	—	—	—	2,055
4,491	17,123	7,555	—	—	—	—	—	—
18,649	108,891	—	7,597	6,138	—	—	—	—
28,052	193,234	—	2,925	—	—	—	1,463	5,851
11,720	48,090	—	—	—	—	—	—	—
5,742	2,871	—	—	—	—	—	—	—
9,798	33,118	2,871	382	—	—	—	—	—
22,025	49,297	—	9,674	—	—	1,969	—	1,459
14,896	97,484	5,851	7,181	—	—	—	—	4,844
—	106,966	—	—	6,324	—	—	—	—
24,783	176,129	—	—	—	—	—	—	—
67,898	189,652	2,918	22,723	—	—	—	—	5,835
7,785	54,188	1,490	4,377	—	—	—	—	—
26,441	57,924	—	7,294	—	—	—	—	—
15,792	29,194	12,415	—	—	—	—	—	5,742
5,851	73,629	—	—	—	1,463	—	—	—
9,876	103,615	—	—	3,437	—	—	—	—
—	119,148	—	—	—	—	5,851	5,851	—
1,436	40,068	4,307	—	—	—	—	—	4,307
16,101	60,396	—	—	—	—	—	6,324	—
17,005	236,096	—	2,732	2,641	—	—	—	—
20,349	305,274	1,253	2,962	12,467	—	—	—	7,431
—	118,190	—	—	23,016	—	—	—	—

(Continued)

Table C.29a (continued)—Area of forest land by county and forest-type group, Virginia, 2016

County name	Total	Forest-type group					
		White-red-jack pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Other eastern softwoods	Exotic softwoods
				acres			
51169 Scott	254,826	1,534	—	—	—	—	—
51171 Shenandoah	197,822	—	—	—	7,771	5,282	—
51173 Smyth	183,909	4,078	—	—	733	1,368	—
51175 Southampton	249,912	—	—	—	122,042	—	—
51177 Spotsylvania	149,352	—	—	—	51,796	—	—
51179 Stafford	121,686	—	—	—	12,352	—	—
51181 Surry	145,268	—	—	—	72,525	—	—
51183 Sussex	256,302	—	—	4,525	150,805	—	—
51185 Tazewell	230,507	—	—	—	—	—	—
51187 Warren	80,499	—	—	—	—	—	—
51191 Washington	199,091	1,534	—	—	—	—	—
51193 Westmoreland	92,517	—	—	—	13,104	—	—
51195 Wise	169,531	6,246	—	—	—	—	—
51197 Wythe	122,949	7,672	—	—	2,330	—	—
51199 York	43,295	—	—	—	11,743	—	—
51550 Chesapeake city	94,994	—	—	—	35,197	—	—
51650 Hampton city	1,297	—	—	—	—	—	—
51700 Newport News city	5,742	—	—	—	5,742	—	—
51800 Suffolk city	176,290	—	—	—	76,483	—	—
51810 Virginia Beach city	32,722	—	—	—	17,913	—	—
Total	16,069,105	174,006	7,672	4,525	3,086,681	85,538	2,799

Table C.29a (continued)—Area of forest land by county and forest-type group, Virginia, 2016

Forest-type group (continued)								
Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Other hardwoods	Exotic hardwoods	Nonstocked
acres								
7,672	212,677	—	11,309	12,428	—	6,138	—	3,069
7,914	173,236	—	2,654	—	—	966	—	—
5,878	167,213	—	—	4,640	—	—	—	—
38,955	43,563	34,509	7,178	—	—	—	—	3,665
23,379	62,476	5,851	4,388	—	—	—	—	1,463
—	106,078	—	3,256	—	—	—	—	—
24,101	28,645	19,997	—	—	—	—	—	—
23,712	47,478	21,965	7,816	—	—	—	—	—
—	169,287	—	—	59,800	—	—	—	1,420
1,632	71,356	—	7,510	—	—	—	—	—
2,998	184,094	—	—	10,465	—	—	—	—
18,633	59,388	—	—	—	—	—	1,392	—
10,354	121,452	—	8,910	12,237	—	6,138	—	4,195
28,209	77,400	—	4,603	2,735	—	—	—	—
5,742	25,809	—	—	—	—	—	—	—
23,907	12,921	22,970	—	—	—	—	—	—
1,297	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
27,758	28,908	41,633	1,508	—	—	—	—	—
5,267	—	9,542	—	—	—	—	—	—
1,682,722	9,703,388	345,233	437,173	345,832	1,463	57,695	26,539	107,839

Table C.29b—Sampling error for area of forest land by county and forest-type group, Virginia, 2016

County name	Total	Forest-type group					
		White-red-jack pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Other eastern softwoods	Exotic softwoods
				percent			
51001 Accomack	22.54	—	—	—	26.96	—	—
51003 Albemarle	12.87	100.49	—	—	35.90	100.49	—
51005 Alleghany	12.71	65.01	—	—	45.69	—	—
51007 Amelia	18.85	—	—	—	31.47	—	—
51009 Amherst	14.11	82.82	—	—	34.16	—	—
51011 Appomattox	20.05	—	—	—	40.56	—	—
51015 Augusta	10.59	56.71	—	—	50.55	82.55	—
51017 Bath	11.90	85.77	—	—	40.29	—	—
51019 Bedford	13.06	—	—	—	41.83	—	—
51021 Bland	16.54	98.09	—	—	107.55	—	—
51023 Botetourt	13.36	93.64	—	—	44.30	—	—
51025 Brunswick	14.47	—	—	—	18.98	—	—
51027 Buchanan	13.11	103.93	—	—	—	—	—
51029 Buckingham	12.68	—	—	—	24.50	—	—
51031 Campbell	15.48	—	—	—	31.92	—	—
51033 Caroline	14.71	—	—	—	26.44	—	—
51035 Carroll	15.64	38.51	—	—	69.66	—	—
51036 Charles City	23.97	—	—	—	40.29	—	—
51037 Charlotte	15.49	—	—	—	25.63	—	—
51041 Chesterfield	18.24	—	—	—	36.47	—	—
51043 Clarke	41.21	—	—	—	—	—	—
51045 Craig	15.28	99.45	—	—	65.22	99.45	—
51047 Culpeper	23.35	—	—	—	57.90	95.47	—
51049 Cumberland	21.96	—	—	—	36.87	—	—
51051 Dickenson	16.15	100.78	—	—	—	—	—
51053 Dinwiddie	15.16	—	—	—	20.55	—	—
51057 Essex	24.83	—	—	—	31.61	—	—
51059 Fairfax	25.97	—	—	—	72.87	95.47	—
51061 Fauquier	15.67	100.49	—	—	60.18	100.49	—
51063 Floyd	20.72	63.28	—	—	98.09	—	—
51065 Fluvanna	22.34	—	—	—	41.30	—	—
51067 Franklin	14.22	94.71	—	—	37.56	—	—
51069 Frederick	17.42	—	—	—	61.55	—	—
51071 Giles	14.87	—	—	—	—	—	—
51073 Gloucester	24.74	—	—	—	45.75	—	—
51075 Goochland	22.21	—	—	—	48.60	—	—
51077 Grayson	17.01	50.16	98.09	—	—	—	—
51079 Greene	26.63	—	—	—	100.49	—	—
51081 Greensville	20.72	—	—	—	30.43	—	—

Table C.29b (continued)—Sampling error for area of forest land by county and forest-type group, Virginia, 2016

Forest-type group (continued)								
Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Other hardwoods	Exotic hardwoods	Nonstocked
percent								
68.90	50.51	102.27	—	—	—	—	—	—
35.12	16.02	—	62.33	—	—	—	—	—
34.12	14.73	—	77.86	69.02	—	—	—	—
37.45	30.83	—	60.21	—	—	—	—	—
38.58	17.30	107.55	95.47	—	—	—	—	—
54.65	24.90	—	72.24	—	—	—	—	—
29.58	12.41	—	—	63.36	—	—	—	84.45
45.71	13.13	—	—	—	—	—	—	—
42.75	14.27	—	—	—	—	101.43	101.43	—
69.26	18.00	—	—	69.67	—	—	—	—
40.83	15.31	—	68.81	—	—	—	103.51	99.45
42.20	27.18	64.15	64.62	—	—	—	—	—
103.93	14.60	—	103.93	34.54	—	100.78	—	—
33.43	17.09	—	80.14	—	—	—	—	66.32
28.70	22.13	—	94.71	—	—	—	—	—
45.81	20.86	102.27	62.37	—	—	99.94	—	—
39.17	21.32	—	98.09	78.32	—	66.54	—	100.78
53.92	43.24	72.19	83.62	—	—	—	—	—
34.90	23.37	—	66.64	—	—	—	94.71	101.43
72.27	25.29	45.67	72.79	—	—	—	—	—
—	50.29	—	—	97.83	—	—	—	107.40
49.01	16.86	—	—	—	—	—	—	—
100.49	28.85	—	63.39	—	—	—	—	—
53.97	28.53	—	—	—	—	—	—	—
63.66	17.72	—	100.78	46.91	—	—	—	—
58.73	28.18	72.29	52.61	—	—	—	—	—
—	41.32	75.56	102.27	—	—	—	—	—
—	30.49	—	70.98	—	—	100.49	—	—
57.17	17.40	—	100.49	—	—	—	—	104.49
48.79	24.98	—	—	—	—	98.09	—	—
55.67	28.95	95.47	71.70	—	—	—	—	—
40.87	17.22	101.43	66.12	—	—	102.24	102.24	76.90
57.49	18.72	—	—	—	—	—	—	—
—	15.84	—	—	43.53	—	—	—	—
102.27	31.22	—	102.27	—	—	—	—	—
47.18	30.65	—	72.93	—	—	—	—	—
49.78	21.38	—	103.93	51.31	—	93.64	—	100.78
—	26.87	—	100.49	—	—	—	—	—
46.28	51.65	54.96	45.62	—	—	—	—	—

(Continued)

Table C.29b (continued)—Sampling error for area of forest land by county and forest-type group, Virginia, 2016

County name	Total	Forest-type group					
		White-red-jack pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Other eastern softwoods	Exotic softwoods
				percent			
51083 Halifax	11.59	—	—	—	17.07	76.28	—
51085 Hanover	16.64	—	—	—	28.71	—	—
51087 Henrico	28.23	—	—	—	104.03	—	—
51089 Henry	16.58	—	—	—	28.12	—	—
51091 Highland	14.24	53.98	—	—	—	—	—
51093 Isle Of Wight	21.76	—	—	—	32.07	—	—
51095 James City	30.28	—	—	—	65.21	—	—
51097 King And Queen	20.39	—	—	—	30.78	—	—
51099 King George	26.53	—	—	—	102.27	—	—
51101 King William	21.81	—	—	—	40.71	—	—
51103 Lancaster	32.85	—	—	—	58.00	—	—
51105 Lee	16.67	100.78	—	—	98.09	55.45	—
51107 Loudoun	21.67	—	—	—	—	—	—
51109 Louisa	15.93	—	—	—	32.55	—	—
51111 Lunenburg	15.03	—	—	—	22.74	—	—
51113 Madison	23.98	100.49	—	—	100.49	—	—
51115 Mathews	45.90	—	—	—	59.39	—	—
51117 Mecklenburg	13.08	—	—	—	21.95	—	—
51119 Middlesex	34.64	—	—	—	53.05	—	—
51121 Montgomery	17.58	73.98	—	—	73.88	73.03	—
51125 Nelson	14.11	—	—	—	41.45	—	—
51127 New Kent	25.51	—	—	—	45.09	—	—
51131 Northampton	46.53	—	—	—	58.59	—	—
51133 Northumberland	29.38	—	—	—	54.03	—	—
51135 Nottoway	19.40	—	—	—	29.84	—	—
51137 Orange	18.96	—	—	—	58.48	100.49	—
51139 Page	21.09	—	—	—	—	—	—
51141 Patrick	15.93	—	—	—	57.41	—	—
51143 Pittsylvania	11.30	—	—	—	22.30	—	—
51145 Powhatan	22.61	—	—	—	39.72	—	—
51147 Prince Edward	19.45	—	—	—	29.60	—	—
51149 Prince George	22.37	—	—	—	35.19	—	—
51153 Prince William	24.00	—	—	—	82.82	—	—
51155 Pulaski	19.49	100.78	—	—	103.51	103.93	—
51157 Rappahannock	20.17	100.49	—	—	—	—	—
51159 Richmond	26.79	—	—	—	43.51	—	—
51161 Roanoke	23.46	—	—	—	61.29	—	—
51163 Rockbridge	12.85	103.51	—	—	75.80	67.24	—
51165 Rockingham	10.65	93.64	—	—	57.23	52.37	107.40
51167 Russell	18.95	—	98.09	—	—	—	—

Table C.29b (continued)—Sampling error for area of forest land by county and forest-type group, Virginia, 2016

Forest-type group (continued)								
Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Other hardwoods	Exotic hardwoods	Nonstocked
percent								
31.21	18.40	101.43	54.65	—	—	—	—	—
42.64	23.01	102.27	102.27	—	—	—	—	—
102.27	36.32	102.27	72.27	—	—	—	—	102.27
45.44	23.08	—	75.96	—	—	—	—	101.43
48.46	16.91	—	—	35.83	—	—	—	—
60.46	37.29	47.81	84.20	—	—	—	—	102.27
51.54	46.11	102.27	—	—	—	—	—	—
51.49	36.02	102.27	72.27	—	—	—	—	—
73.66	29.41	—	—	—	—	—	—	102.27
52.20	28.89	—	104.03	—	—	—	—	102.27
—	43.47	99.94	—	—	—	—	—	102.27
—	18.05	—	98.09	98.09	—	—	—	—
67.25	23.44	—	100.49	—	—	—	—	—
100.49	19.39	—	55.43	—	—	—	—	—
34.97	23.52	—	61.69	—	—	—	—	—
96.36	27.09	—	—	—	—	100.49	95.47	—
102.27	—	102.27	—	—	—	—	—	—
35.49	18.65	—	58.94	—	—	—	—	94.71
72.57	53.18	61.74	—	—	—	—	—	—
50.69	21.24	—	81.57	98.09	—	—	—	—
43.04	16.29	—	100.49	—	—	—	100.49	100.49
65.04	33.42	—	—	—	—	—	—	—
102.27	102.27	—	—	—	—	—	—	—
73.33	39.20	102.27	99.94	—	—	—	—	—
48.47	29.22	—	73.17	—	—	101.43	—	101.43
58.64	22.52	100.49	83.93	—	—	—	—	100.49
—	21.65	—	—	97.83	—	—	—	—
48.00	17.53	—	—	—	—	—	—	—
26.88	16.15	71.65	50.00	—	—	—	—	80.14
79.14	30.39	101.43	101.43	—	—	—	—	—
42.25	28.77	—	83.61	—	—	—	—	—
59.45	39.29	62.52	—	—	—	—	—	102.27
100.49	26.02	—	—	—	100.49	—	—	—
59.90	21.35	—	—	98.09	—	—	—	—
—	21.65	—	—	—	—	100.49	100.49	—
102.27	36.24	102.27	—	—	—	—	—	102.27
50.96	28.86	—	—	—	—	—	97.83	—
51.17	13.95	—	97.83	107.40	—	—	—	—
48.98	11.61	125.00	125.00	55.31	—	—	—	67.29
—	20.97	—	—	49.17	—	—	—	—

(Continued)

Table C.29b (continued)—Sampling error for area of forest land by county and forest-type group, Virginia, 2016

County name	Total	Forest-type group					
		White-red-jack pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Other eastern softwoods	Exotic softwoods
		percent					
51169 Scott	14.12	98.09	—	—	—	—	—
51171 Shenandoah	15.34	—	—	—	81.68	107.40	—
51173 Smyth	15.42	98.09	—	—	98.09	103.93	—
51175 Southampton	14.64	—	—	—	21.03	—	—
51177 Spotsylvania	18.67	—	—	—	29.64	—	—
51179 Stafford	20.62	—	—	—	50.29	—	—
51181 Surry	19.49	—	—	—	27.70	—	—
51183 Sussex	14.69	—	—	99.94	18.63	—	—
51185 Tazewell	14.85	—	—	—	—	—	—
51187 Warren	25.13	—	—	—	—	—	—
51191 Washington	15.85	98.09	—	—	—	—	—
51193 Westmoreland	23.88	—	—	—	61.07	—	—
51195 Wise	16.59	63.05	—	—	—	—	—
51197 Wythe	18.95	80.83	—	—	73.64	—	—
51199 York	34.81	—	—	—	59.80	—	—
51550 Chesapeake city	24.62	—	—	—	39.48	—	—
51650 Hampton city	102.27	—	—	—	—	—	—
51700 Newport News city	102.27	—	—	—	102.27	—	—
51800 Suffolk city	17.63	—	—	—	27.21	—	—
51810 Virginia Beach city	38.03	—	—	—	51.82	—	—
Total	0.61	15.05	80.83	99.94	3.44	22.25	107.40

Table C.29b (continued)—Sampling error for area of forest land by county and forest-type group, Virginia, 2016

Forest-type group (continued)								
Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Other hardwoods	Exotic hardwoods	Nonstocked
percent								
80.83	15.28	—	72.35	59.69	—	98.09	—	98.09
80.89	16.17	—	107.40	—	—	93.64	—	—
75.77	16.05	—	—	77.71	—	—	—	—
36.62	31.23	37.46	84.31	—	—	—	—	72.90
45.56	27.93	100.49	100.49	—	—	—	—	100.49
—	21.81	—	95.47	—	—	—	—	—
48.26	42.26	51.48	—	—	—	—	—	—
48.39	32.44	46.17	79.85	—	—	—	—	—
—	17.45	—	—	29.03	—	—	—	101.96
99.45	26.88	—	84.12	—	—	—	—	—
105.46	16.65	—	—	60.31	—	—	—	—
54.97	29.21	—	—	—	—	—	104.03	—
71.92	19.40	—	71.71	61.01	—	98.09	—	76.30
40.29	22.69	—	98.09	103.93	—	—	—	—
102.27	44.99	—	—	—	—	—	—	—
49.18	61.12	51.02	—	—	—	—	—	—
102.27	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
45.24	40.65	36.64	99.94	—	—	—	—	—
85.59	—	62.89	—	—	—	—	—	—
5.13	1.40	11.50	10.07	11.38	100.49	27.86	39.49	19.13

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Notable in this current resource bulletin is relative stability of forest land and timberland acreage and increasing maturity of the trees and stands that comprise it. Virginia's total land area is 27.4 million acres, 16.1 million (58.7 percent) of which are forested according to the results of the latest forest inventory completed in 2016. This current estimate confirms that Virginia's forest land area has remained stable for at least the past two decades. The previous three, 5-year cycles of FIA data collection under the annualized forest inventory have estimates of forest land acreage in the State at 15.9 million in 2001, 15.8 million in 2006, and 15.9 million in 2011. Net volume on both forest land and timberland has been increasing as forest stands are more typically comprised of fewer, larger trees. Net tree growth and mortality in terms of their volume has increased while removals from both harvesting and land clearing to nonforest land uses has shown fluctuations probably related to varying economic conditions like the recent recession. Virginia's forests face some notable forest health challenges that could significantly affect the resource in the coming years, specifically emerald ash borer, hemlock wooly adelgid, and the prevalence of nonnative invasive plant species.

Keywords: Disturbance, carbon, FIA, forest health monitoring, forest inventory, forest trends, timber volume, Virginia.

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Forests cover more than half of Virginia's total land area. (photo courtesy of John Pemberton, Virginia Department of Forestry)

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