



# Forests of South Dakota, 2017

This publication provides an overview of forest resources in South Dakota based on an inventory conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program at the Northern Research Station (NRS) in cooperation with the South Dakota Department of Agriculture, Resource Conservation and Forestry Division. Estimates are based on field data collected using the FIA annualized sample design and are updated yearly. Information about the national and regional FIA program is available at <http://fia.fs.fed.us>. For the 2017 inventory, the statewide base sample was augmented by a double intensification of plots within the Black Hills National Forest, thus increasing the sample size compared to previous inventories. The double intensification was initiated in 2017 and will continue in the 2018 inventory. Estimates for current variables such as area, volume, and biomass are based on 8,391 samples (484 forested) collected from 2011–2017.

Change variables, such as net growth, removals, and mortality, are based on 8,262 samples (391 forested) collected in 2006–2011 and resampled in 2011–2017. Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005), O’Connell et al. (2014), and Gormanson et al. (2018) for definitions and technical details. A complete set of inventory tables is available at <https://doi.org/10.2737/FS-RU-158>.

## Overview

South Dakota is home to 1.95 million acres of forest land. Forest area has increased since 2012 (Table 1). The number of live trees on South Dakota’s forest land in 2017 was estimated at 596 million, an increase from 2012. However, estimates of both net volume of live trees and aboveground biomass of live trees decreased. Estimates of net growth and harvest removals of live trees decreased, while annual mortality of live trees increased in 2017.

**Table 1.—South Dakota forest estimates and changes between 2012 and 2017. Sampling errors represent 68 percent confidence intervals.**

	2017	Sampling error (%)	2012 Estimate	Sampling error (%)	Percent change since 2012
<b>Forest Land</b>					
Area (thousand acres)	1,954	2.7	1,902	2.8	2.7
Number of live trees ≥1 inch diameter (million trees)	596	5.7	558	6.3	6.7
Net volume live trees ≥ 5 inches diameter (million ft <sup>3</sup> /yr)	2,128	4.3	2,228	4.5	-4.5
Live tree ≥1 inch diameter aboveground biomass (thousand oven-dry tons)	43,101	4.3	44,662	4.5	-3.5
Net growth live trees ≥5 inches (thousand ft <sup>3</sup> /yr)	2,922	285.1	31,360	24.2	-90.7
Annual mortality of live trees ≥5 inches (thousand ft <sup>3</sup> /yr)	57,073	13.8	37,499	16.0	52.2
Harvest removals of live trees ≥5 inches (thousand ft <sup>3</sup> /yr)	27,933	23.4	38,297	20.1	-27.1
<b>Timberland</b>					
Area (thousand acres)	1,816	2.9	1,775	3.0	2.3
Number of live trees ≥1 inch diameter (million trees)	564	6.0	530	6.5	6.3
Net volume live trees ≥5 inches diameter (million ft <sup>3</sup> /yr)	2,032	4.5	2,135	4.7	-4.8
Live tree aboveground biomass (thousand oven-dry tons)	40,736	4.5	42,375	4.7	-3.9
Net growth of growing-stock trees ≥5 inches (thousand ft <sup>3</sup> /yr)	900	799.4	26,395	22.8	-96.6
Annual mortality of growing-stock trees ≥5 inches (thousand ft <sup>3</sup> /yr)	43,181	15.8	26,511	18.1	62.9
Harvest removals of growing-stock trees ≥5 inches (thousand ft <sup>3</sup> /yr)	26,364	24.2	36,199	20.9	-27.2



# Forest Area

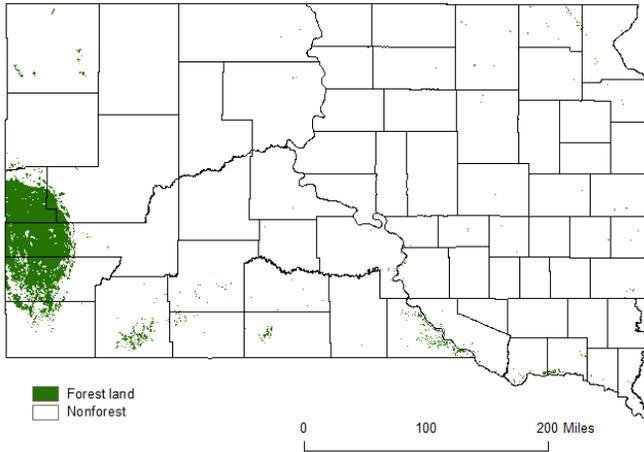


Figure 1.—Area of forest land, South Dakota.

South Dakota’s forest land area is 1.95 million acres, roughly 4 percent of total land area in the State. Most forest land is found in the Black Hills, which are located in the western part of the state (Fig. 1). Forest land, as well as timberland, has been increasing over the last two decades (Fig. 2).

The Forest Service is the largest forest land owner in South Dakota with just over 1 million acres, or 51 percent of total forest land area (Fig. 3). Forty-one percent of forest land is privately owned. The remaining forest land is owned by state and local governments (5 percent) and other federal agencies (3 percent).

Ponderosa pine (*Pinus ponderosa*) forest type accounts for over half of forest land in South Dakota with 1 million acres, as well as over 70 percent of large diameter stands. Bur oak (*Quercus macrocarpa*) and sugarberry/hackberry/elm/green ash are the largest hardwood forest types with 101,000 and 99,000 acres respectively (Fig. 4).

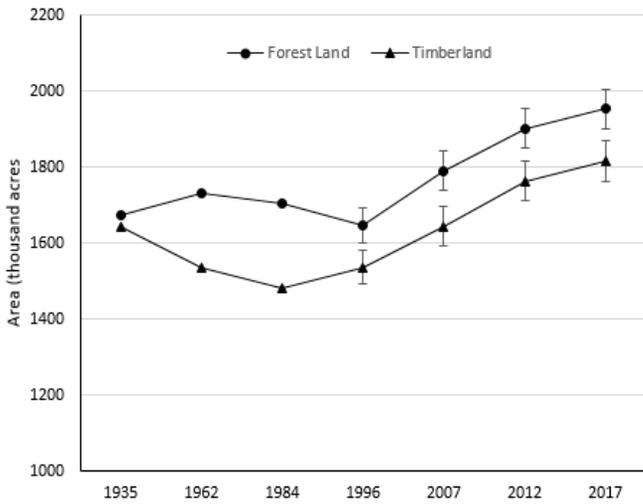


Figure 2.—Area of forest land and timberland by year, South Dakota. Error bars represent 68 percent confidence intervals.

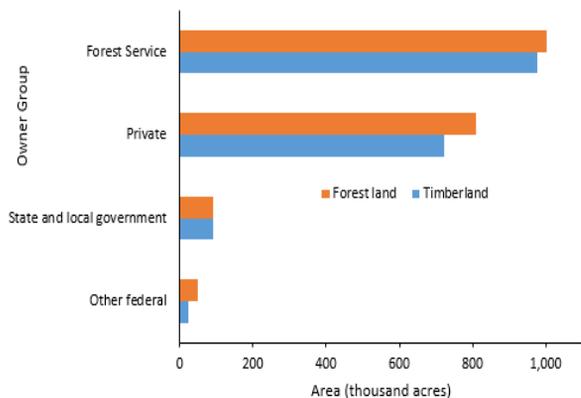


Figure 3.—Area of forest land and timberland by owner group, South Dakota, 2017.

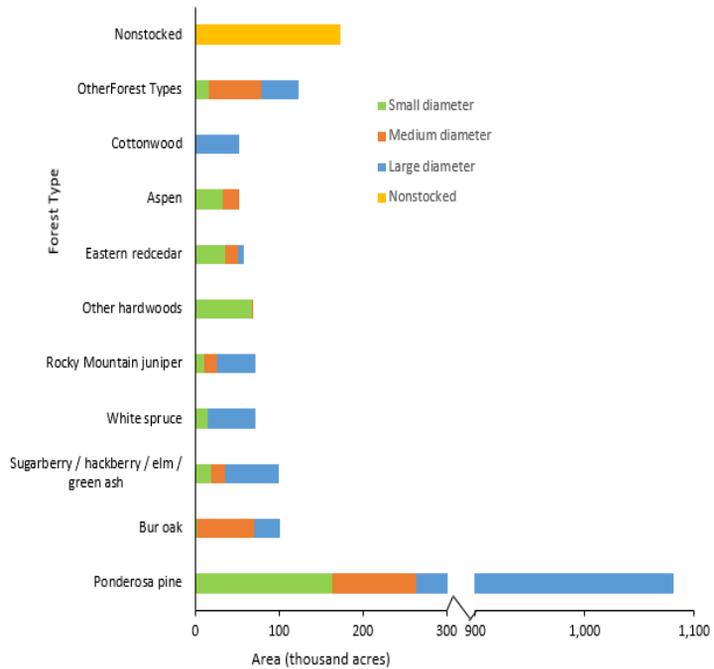


Figure 4.—Area of forest land by forest type and stand size class, South Dakota, 2017. Note: Large diameter trees are at least 11.0 inches diameter for hardwoods and at least 9.0 inches diameter for softwoods. Medium diameter trees are at least 5.0 inches diameter but not as large as large diameter trees. Small diameter trees are less than 5.0 inches diameter.

# Volume, Biomass, and Trends

Twenty-one species (including unknown species of trees identified to the genus level) were recorded on South Dakota forest land in 2017. Ponderosa pine is the most numerous species. Bur oak has the largest number of stems for hardwood species (Table 2).

Ponderosa pine continues to rank first for live tree volume, as well as softwood volume on forest land in South Dakota (Table 2). Hardwood species accounted for 21 percent of live tree volume with bur oak and eastern cottonwood (*Populus tremuloides*) combining for over 50 percent of the hardwood volume in the State.

South Dakota has more than 43.1 million oven-dry tons of biomass on forest land which equates to 21.6 million

tons of carbon in South Dakota’s forests. Softwoods have 31.1 million oven-dry tons of biomass with over 75 percent on public lands. Conversely, hardwood biomass is over 84 percent on privately owned lands (Fig. 5).

In 2017, average annual net growth on forest land was 2,922 thousand cubic feet per year (Table 1). Harvest removals were 28 million cubic feet, for a net growth to removal ratio of 0.1. South Dakota’s removals are, on average, about 1.3 percent of the total standing volume per year. Mortality was 57 million cubic feet annually, a 52 percent increase since 2012 (Fig. 6). The species with the largest increase in mortality between 2017 and 2012 was ponderosa pine at 66 percent.

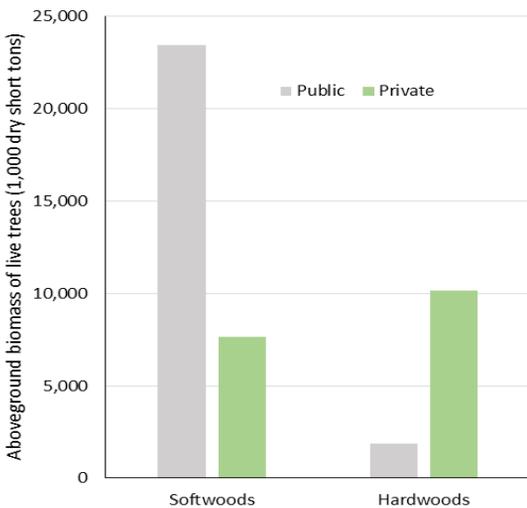


Figure 5.—Aboveground biomass of live trees in thousand dry short tons, on forest land by ownership class, and major species group, South Dakota, 2017.

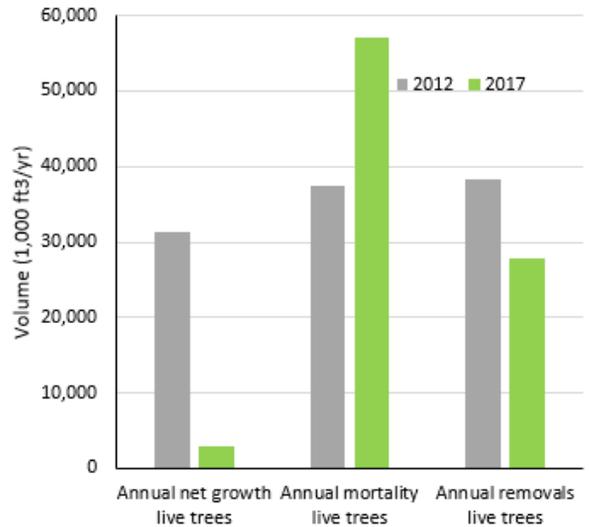


Figure 6.—Average annual net growth, mortality, and removals of live trees ≥5 inches diameter at breast height (d.b.h.) on forest land, South Dakota, 2012 and 2017.

Table 2.—Number, volume, biomass, growth, mortality, and removals of live trees on forest land by species of the top 10 tree species by net volume, South Dakota, 2017.

Common Name	Latin name	Number of trees <sup>a</sup> (millions)	Net volume <sup>b</sup> (million ft <sup>3</sup> )	Aboveground biomass <sup>a</sup> (thousand dry tons)	Average Annual net growth <sup>b</sup> (thousand ft <sup>3</sup> )	Average annual mortality <sup>b</sup> (thousand ft <sup>3</sup> )	Average annual harvest removals <sup>b</sup> (thousand ft <sup>3</sup> )
Ponderosa pine	<i>Pinus ponderosa</i>	350.9	1,522.2	28,282.9	-7,009.4	45,887.4	26,269.0
Bur oak	<i>Quercus macrocarpa</i>	32.5	120.1	3,698.8	1,483.2	622.6	--
Eastern cottonwood	<i>Populus deltoides</i>	1.8	109	1,977.5	1,341.2	1,459.8	--
Green ash	<i>Fraxinus pennsylvanica</i>	29.3	86.9	2,591.1	1,349.9	1,752.2	--
White spruce	<i>Picea glauca</i>	30.2	82.1	1,496.9	955.8	1,519.2	619.7
Rocky Mountain juniper	<i>Juniperus scopulorum</i>	26.7	38.2	607.4	583.6	817.5	--
Boxelder	<i>Acer negundo</i>	8.2	34.1	777.5	1,282.5	278.0	566.6
American elm	<i>Ulmus americana</i>	5.4	33.5	767.7	-106.1	2,251.8	193.3
Eastern redcedar	<i>Juniperus virginiana</i>	19.1	26.5	608.4	1,556.3	--	--
Siberian elm	<i>Ulmus pumila</i>	2.9	23.8	598.0	1,240.2	157.1	173.7

<sup>a</sup> Trees ≥1 inch diameter      <sup>b</sup> Trees ≥5 inches diameter

Note: Table cells without observation are indicated by --. A value of 0.0 is due to rounding of a small value.

# Ponderosa Pine Resource Update

Ponderosa pine is an important commercial tree species in South Dakota, particularly in the western part of the state. Increased insect activity, climate-related events, such as drought, and wildfire are interrelated factors that have affected the ponderosa pine resource. To better understand the impact these factors have had on ponderosa pine, an increased sampling effort was implemented in the Black Hills National Forest. In effect, the number of plot samples was doubled; half of which were measured in 2017. The remaining half will be measured in 2018. The additional plots provide a larger sample size and reduced sampling error. Here we examine the current status and trends in growth and mortality over the past 10 years at the state level and for the South Dakota portion of the Black Hills National Forest (BHNF).

The current estimate of net live-tree volume ( $\geq 5.0$  inches d.b.h.) on timberland in South Dakota is 2.03 billion cubic feet. Ponderosa pine makes up 74 percent (1.5 billion cubic

feet) of the total volume and most (1.05 billion cubic feet) is found on the BHNF. More than half of the ponderosa pine volume is contained in the 9- to 15-inch diameter classes (Fig. 7). Net growth of trees at least 5.0 inches d.b.h. is determined by deducting losses in volume due to mortality or damage, rot, etc. from gross growth. The current estimate of net growth is negative at the state level as well as on the BHNF (Fig. 8). The increase in mortality since 2010 and slight declines in gross growth have resulted in current estimates of negative net growth (Fig. 9). However, this trend will likely reverse as mountain pine beetle activity decreases, resulting in decreased mortality.

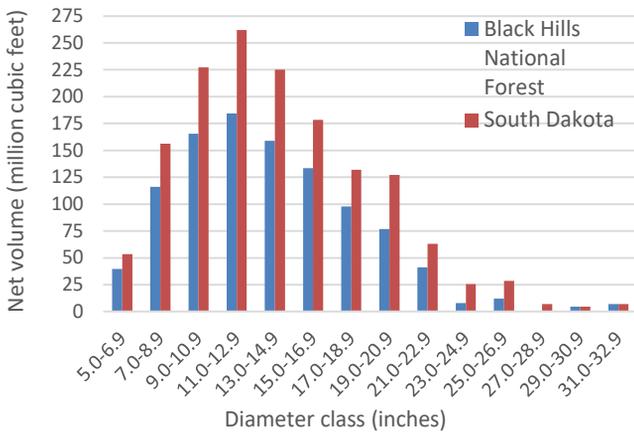


Figure 7.—Net volume of live ponderosa pine (at least 5-inches d.b.h.) on timberland, South Dakota, 2017

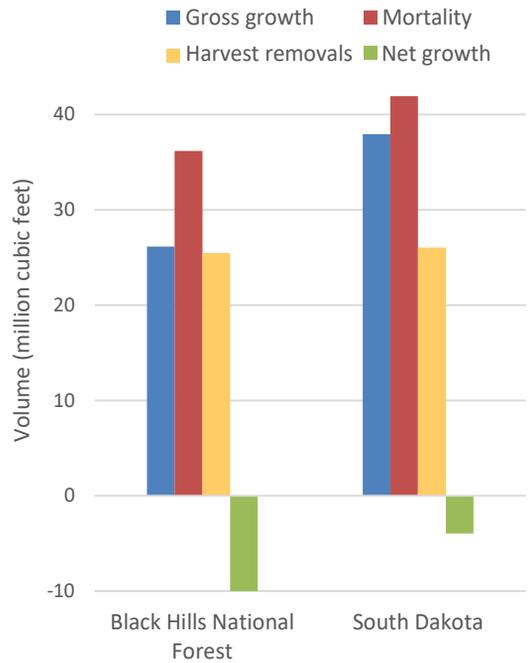


Figure 8.—Gross growth, mortality, harvest removals, and net growth volume of ponderosa pine (at least 5-inches d.b.h.) on timberland, South Dakota, 2017

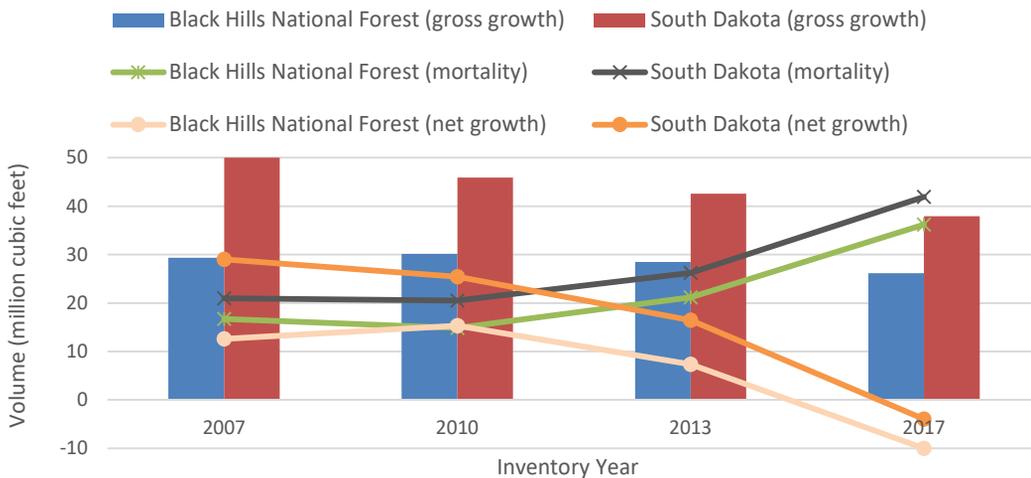


Figure 9.—Gross growth, mortality, and net growth volume of ponderosa pine (at least 5-inches d.b.h.) on timberland, South Dakota, 2007-2017

## Definitions

**Average annual mortality**—The average cubic foot volume of sound wood in growing-stock trees that died in 1 year.

**Average annual removals**—The average net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues and the volume of other removals.

**Biomass**—The aboveground weight of wood and bark in live trees 1.0 inch (2.5 cm) d.b.h. and larger from the ground to the tip of the tree, excluding all foliage. The weight of wood and bark in lateral limbs, secondary limbs, and twigs under 0.5 inch (1.3 cm) in diameter at the point of occurrence on sampling-size trees is included but is excluded on poletimber and sawtimber-size trees. Biomass is typically expressed as green or oven-dry weight and the units are tons.

**Forest land**—Land that has at least 10 percent canopy cover of live trees of any size or formerly having had such tree cover and is not currently developed for nonforest uses. The area with trees must be at least 1 acre in size and at least 120 feet wide.

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

**Net annual growth**—The average annual net increase in the volume of trees during the period between inventories. Components include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that died during the year, and minus the net volume of trees that became cull trees during the year.

**Net volume in cubic feet**—The gross volume in cubic feet less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

**Reserved forest land**—Land permanently reserved from wood products utilization through statute or administrative designation. Examples include national forest wilderness areas and national parks and monuments.

**Timberland**—Forest land that is producing or is capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands and is not withdrawn from timber utilization by statute or administrative regulation.

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