



# Forests of Minnesota, 2017

This resource update provides an overview of forest resources in Minnesota based on an inventory conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station in cooperation with the Minnesota Department of Natural Resources. Estimates are based on field data collected from 2013–2017 with comparisons made to field data collected in 2008–2012. The 2013–2017 sample data was collected from 6,290 field measured plots on forest land, with 20 percent collected per year. Data used in this publication were accessed from the FIA database in March 2017; data collection and analysis are described in Bechtold and Patterson (2005) and O’Connell et al. (2016). Forest land refers to land with minimum 10 percent crown cover for live trees of any size, while timber land refers to lands that could support commercial forestry operations and not withdrawn from utilization by statute or regulation. Inventory tables is available at <https://doi.org/10.2737/FS-RU-154>.

## Overview

The Minnesota forest land area increased by 1 percent, or 168,000 acres, from 2012 to 2017 (Table 1). Of the 54 million total acres in Minnesota, 17.6 million acres are forest land, or approximately 34 percent of the land in Minnesota. Generally the forest in Minnesota is growing. Annual mortality was reduced by 2.7 percent in 2017 compared to 2012. The number of live trees increased from 14 billion in 2012 to 14.7 billion in 2017, a 5.1 percent increase. Aboveground biomass continued to increase on both forest and timber land. Biomass on forest land increased by 6.6 percent from 2012 and on timberlands by 6.6 percent over 2012 estimates. Harvest removals increased by 3 percent over 2012 on forest land but stayed relatively unchanged on timberland. Net volume of growing stock trees on timberland increased by 1.2 billion cubic feet from 2012, or 8.2 percent.

**Table 1.—Minnesota forest statistics, 2017 and 2012. Volumes are for trees 5.0 inches and larger in diameter. Number of trees and biomass are for trees 1.0 inch and larger in diameter. Sampling errors and error bars shown in tables and figures in this report represent 68 percent confidence intervals.**

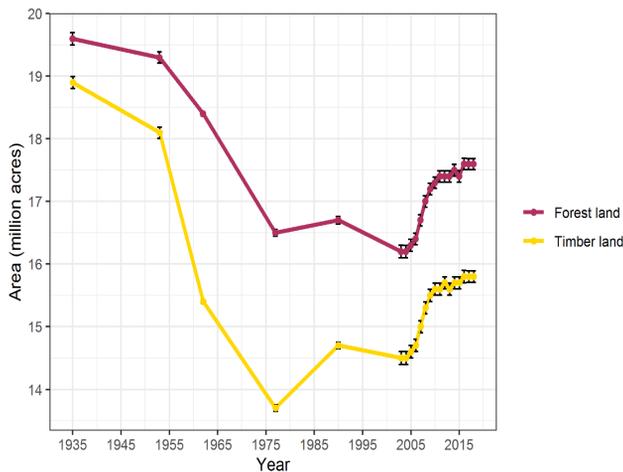
	2017 Estimate	Sampling error (percent)	2012 Estimate	Sampling error (percent)	Change since 2012 (percent)
<b>Forest Land</b>					
Area (thousand acres)	17,601	0.5	17,433	0.5	1.0
Number of live trees (million trees, ≥1 inch diameter)	14,766	1.1	14,008	1.2	5.4
Aboveground biomass of live trees (thousand oven-dry tons)	510,597	0.9	478,970	1.0	6.6
Net volume of live trees (million ft <sup>3</sup> )	20,136	1.1	18,809	1.2	7.1
Annual net growth of live trees (thousand ft <sup>3</sup> /yr)	453,915	3.0	392,070	3.5	15.8
Annual mortality of trees (thousand ft <sup>3</sup> /yr)	355,653	2.8	365,371	2.7	-2.7
Annual harvest removals of live trees (thousand ft <sup>3</sup> /yr)	219,859	6.6	213,496	6.5	3.0
<b>Timberland</b>					
Area (thousand acres)	15,784	0.6	15,652	0.6	0.8
Number of live trees (million trees)	13,171	1.2	12,589	1.2	4.6
Aboveground biomass of live trees (thousand oven-dry tons)	464,575	1.0	435,961	1.1	6.6
Net volume of live trees (million ft <sup>3</sup> )	18,246	1.1	17,034	1.2	7.1
Net volume of growing stock trees (million ft <sup>3</sup> )	15,810	1.2	14,607	1.3	8.2
Annual net growth of growing stock trees (thousand ft <sup>3</sup> /yr)	403,672	2.4	361,794	2.8	11.6
Annual mortality of growing stock trees (thousand ft <sup>3</sup> /yr)	229,645	2.9	245,028	2.7	-6.3
Annual harvest removals of growing stock trees (thousand ft <sup>3</sup> /yr)	184,394	6.8	184,479	6.6	0.0



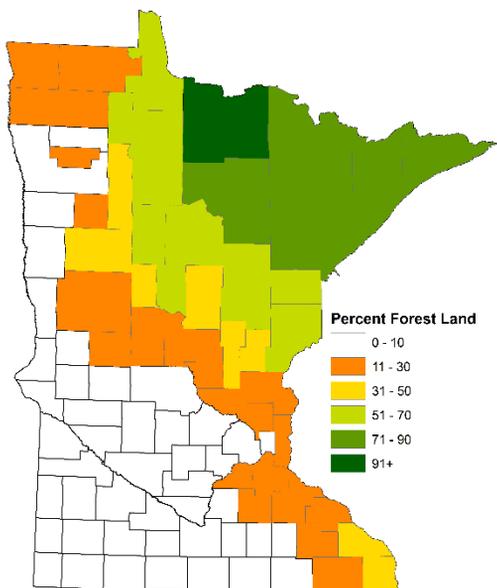
# Forest Area

Minnesota’s presettlement area of forest land was estimated to be 31.5 million acres (Marchner 1930). At the time of the first forest inventory in the mid 1930s, the area of forest land had declined to 19.6 million acres (Fig. 1). The area of forest land declined over the following decades until the 1970s, when the area of forest began trending upward. Over the past 14 years, 2003–2017, the forest land area has increased by 1.5 million acres. Some of this increase is attributable to improved digital imagery and remote sensing techniques (Miles and Vanderschaff 2012), rather than a reversion to forest land.

Minnesota’s forests are mainly found in the northern and eastern portions of the state (Fig. 2) with most of the forest found in the northeastern section. The counties with the highest percentage of forest are Koochiching, Lake, and Cook Counties. The western and southern portions of the state were primarily oak savannah and prairie in presettlement times.



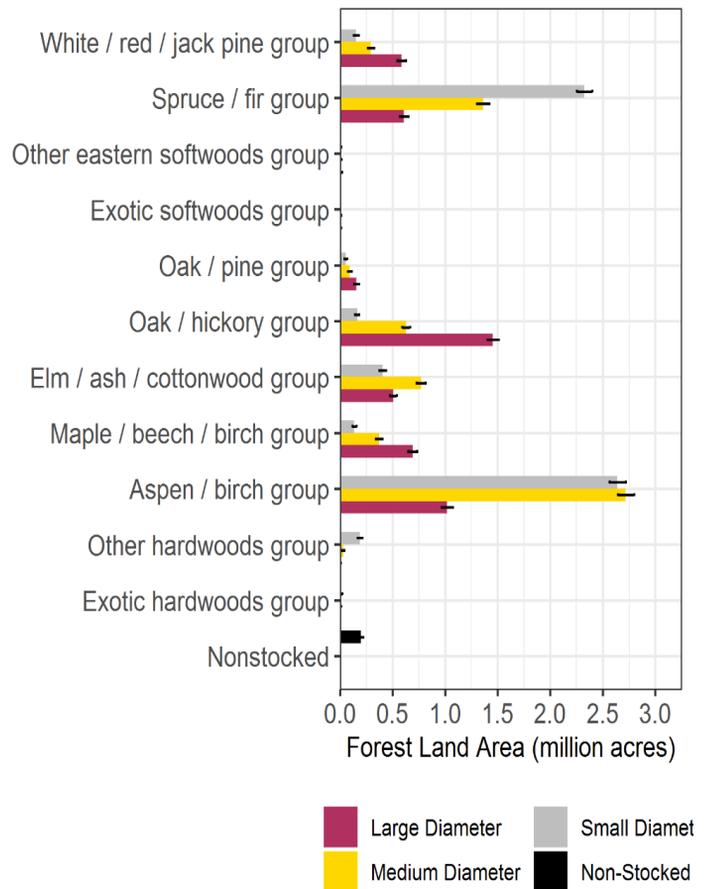
**Figure 1.—Forest land and timberland by year, Minnesota 1935-2017.**



**Figure 2.—Percent forest land by county, Minnesota 2017.**

Minnesota’s forests are dominated by the aspen/ birch and spruce/fir forest-type group (Fig. 3). These groups occupy 6.4 and 4.3 million acres, respectively. Approximately 42 percent of the aspen/birch forest is medium diameter, with the same portion in the small diameter class. Contrast the aspen/birch forest type with oak/hickory, where 7 percent of the forest type is in the small diameter class. This indicates major differences in regeneration, with low percentages in oak/hickory raising concerns about the future composition of the forest.

While large portions of the spruce/fir forest type are also in the small diameter class, this may be more a reflection of poor growing conditions. Of the acreage occupied by spruce/fir, 20 percent is capable of producing 50 ft<sup>3</sup>/acre per year, compared to 58 percent for the other forest groups. While the diameter class may be small, 74 percent of the spruce/fir is at stand age 40, and another 15 percent is over stand age 100.



**Figure 3.—Forest land area by forest-type group and stand size class, Minnesota 2017.**

Note: Large-diameter stands: a plurality of stocking is in hardwoods 11 inches d.b.h and larger and softwoods 9 inches d.b.h and larger. Medium-diameter stands: a plurality of stocking is in softwood trees from 5 to 9 inches d.b.h and hardwood trees from 5 to 11 inches d.b.h Seedling-sapling stands: a plurality of stocking is in trees less than 5 inches.

# Volume, Biomass, and Trends

During the FIA inventory for 2017, field crews recorded 70 tree species on forest lands in Minnesota. Most of the volume on timberlands is represented by 10 species (Table 2). Quaking aspen (*Populus tremuloides*) has the most standing volume at 3.41 billion cubic feet. Followed by northern white-cedar (*Thuja occidentalis*) and red pine (*Pinus resinosa*). Some species have seen a decline in volume on timberlands, in particular paper birch (*Betula papyrifera*), which had a 5.5 percent decline since 2012, and northern red oak (*Quercus rubra*), with a decline of 4.0 percent since 2012. The net growth to harvest removals ratio (Fig. 4) shows that some species' growth is far exceeding harvest (Northern red cedar), while paper birch show that harvest is exceeding growth. Net growth (Fig. 5) has averaged 4 billion ft<sup>3</sup>/year over the last decade. Biomass from hardwoods (Fig. 6) exceeds that of softwoods, both of which have been steadily increasing since 2012.

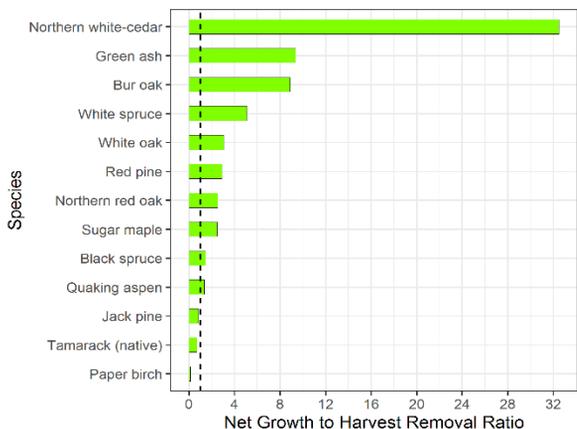


Figure 4.—Net growth-to-harvest removal ratio on timberland by species, Minnesota, 2017. Dashed line shows where net growth is equal to harvest removals.

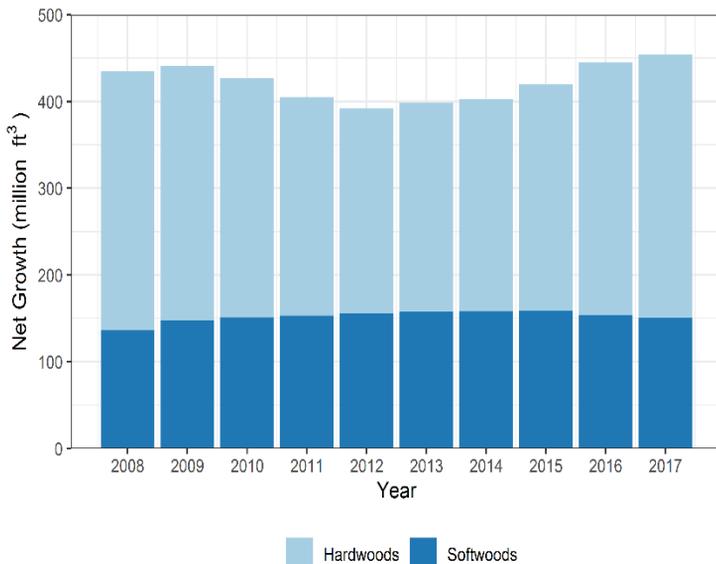


Figure 5.—Trend in net growth on forest land by major species group.

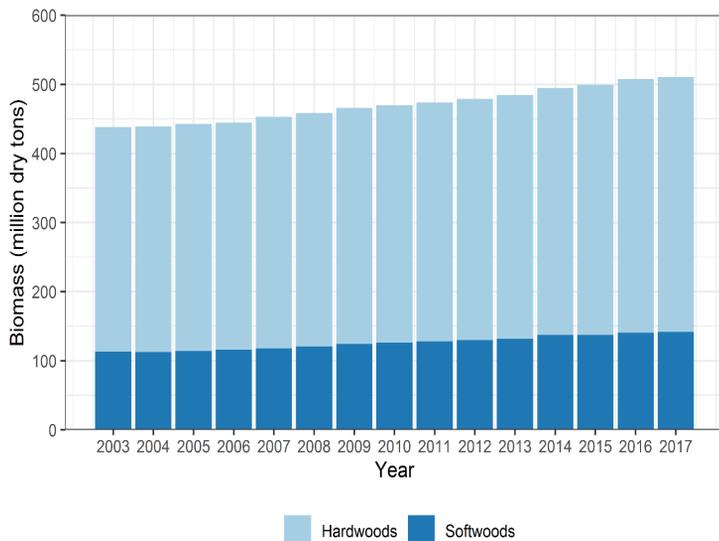
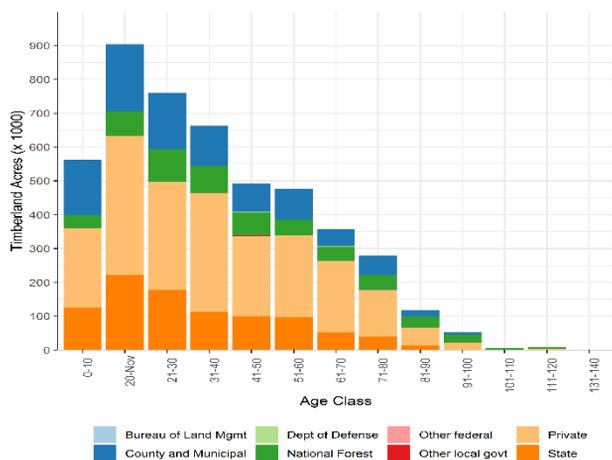


Figure 6.—Aboveground biomass (dry tons) trends on forest land by major species group.

Table 2.—Top 10 species by statewide volume estimates on timberland, Minnesota 2017

Species	Rank	Net volume (million ft <sup>3</sup> )	Sampling error (%)	Saw timber (million board feet)	Sampling error (%)	Net volume change since 2012 (%)
Quaking aspen	1	3,416.4	2.5	6,562.7	4.0	6.7
Northern white cedar	2	1,243.6	6.0	3,403.3	7.5	12.8
Red pine	3	1,227.8	6.7	5,182.0	7.2	8.8
Bur oak	4	1,120.4	4.7	2,516.5	6.4	11.9
Black ash	5	1,004.6	4.6	1,646.2	6.6	4.3
American basswood	6	952.7	4.9	1,214.3	6.0	3.0
Paper birch	7	934.7	3.5	2,710.5	6.3	-5.5
Black spruce	8	836.5	5.1	910.8	7.8	4.8
Northern red oak	9	832.5	5.7	2,855.8	6.5	-4.0
Balsam fir	10	703.8	3.4	1,175.7	5.4	7.4

# Aspen in Minnesota



**Figure 7.—Age class distribution for aspen forest type distribution by FIA owner class. Minnesota, 2017. Updated 04/06/20**

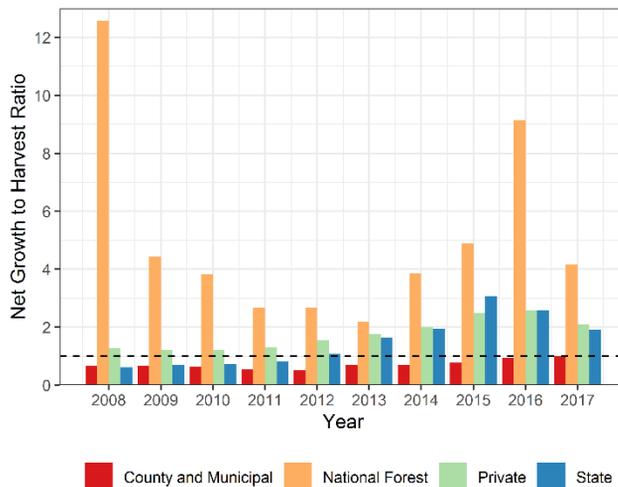
Aspen is an ecologically and economically important species and forest type in Minnesota. Aspen forest type comprises the majority of volume and forest acres in the state. Annually, most of the pulpwood harvested in the Lake States comes from aspen forest type. Typically in Minnesota, aspen is harvested between age 40-60 years (Domke 2008). Age class distributions for aspen indicate that much of the forest is younger than 60 years (Fig. 7). The aspen forest is aging, however, with private and national forest ownership contributing the most acres to aspen older than 60 years (Table 3). The aspen harvest ratio (Fig. 8) shows net growth to harvest on private, state, county, and national forest. A harvest ratio below 1 indicates that harvest is exceeding growth. (Rudis 2003).

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**Figure 8.—Net growth to harvest ratio by owner class for major contributors to annual harvest. Minnesota, 2017. Updated 04/06/20**

**Table 3.—Aspen forest type acres on timberland over age 60 by owner class. Updated 04/06/20**

Owner Class	Acres Over Age 60	Percentage of acres over 60 years
National Forest	155,752	28 %
Private	425,465	19 %
State	105,575	11 %
County and Municipal	130,752	14%

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