



Forests of Minnesota, 2014

Overview

This resource update provides an overview of forest resources in Minnesota based on an inventory conducted by the U.S. Forest Service, Forest Inventory and Analysis (FIA) program at the Northern Research Station in cooperation with the Minnesota Department of Natural Resources. Estimates are based on field data collected during measurement years 2009-2014 with comparisons made to field data collected in 2005-2009. The 2009-2014 sample data consist of 6,226 field measured plots on forest land, with from 14 to 20 percent collected per year. Data used in this publication were accessed from the FIA database in April 2015 based on methods described in Bechtold and Patterson (2005) and O’Connell et al. (2014).

The area of forest land in Minnesota increased by 294,000 acres (1.7 percent) from 2009 to 2014 (Table 1). Just over 34 percent of Minnesota’s land area is classified as forest land. The number of live trees on Minnesota’s forest land in 2014 was estimated at 14.5 billion trees, an increase of 8.3 percent from 2009. Live tree aboveground biomass and net volume increased on both forest land and timberland. Annual mortality of live trees on forest land continues to remain high at approximately 1.9 percent of the 2014 forest land live tree volume. The 2013 harvest removal rate is significantly below the 2009 harvest removal rate. Harvest removals were 1.6 percent of timberland growing-stock volume in the 2009 report but are now just 1.1 percent of the timberland growing-stock volume.

Table 1.—Minnesota forest statistics, 2014 and 2009. Sampling errors and error bars shown in tables and figures represent 68-percent confidence intervals.

	2014 Estimate	Sampling error (percent)	2009 Estimate	Sampling error (percent)	Change since 2009 (percent)
Forest Land					
Area (thousand acres)	17,477.3	0.5	17183.2	0.5	1.7
Number of live trees ≥1 in diameter (million trees)	14,464.4	1.1	13,355.1	1.2	8.3
Aboveground biomass of live trees ≥1 in (thousand oven-dry tons)	494,559.4	0.9	465,496.2	1.0	6.2
Net volume of live trees ≥ 5 in diameter (million ft ³)	19,491.3	1.1	18,326.1	1.2	6.4
Annual net growth live trees ≥ 5 in (thousand ft ³ /yr)	402,226.9	3.4	441,127.5	3.3	-8.8
Annual mortality of live trees ≥ 5 in (thousand ft ³ /yr)	361,718.7	2.8	335,079.3	2.6	8.0
Annual harvest removals of live trees ≥5 in (thousand ft ³ /yr)	210,998.6	6.6	252,448.4	6.0	-16.4
Annual other removals of live trees ≥5 in (thousand ft ³ /yr)	8,489.9	28.1	8,410.4	26.0	0.9
Timberland					
Area (thousand acres)	15,741.3	0.6	15,461.1	0.6	1.8
Number of live trees ≥1 in diameter (million trees)	12,993.9	1.2	12,118.2	1.2	7.2
Aboveground biomass of live trees ≥1 in (thousand oven-dry tons)	451,637.5	1.0	425,008.1	1.1	6.3
Net volume of live trees ≥5 in diameter (million ft ³)	17,720.2	1.1	16,651.4	1.2	6.4
Net volume of growing stock trees (million ft ³)	15,396.7	1.2	14,141.6	1.3	8.9
Annual net growth of growing stock trees (thousand ft ³ /yr)	390,618.4	2.5	380,240.4	3.0	2.7
Annual mortality of growing stock trees (thousand ft ³ /yr)	229,025.6	2.8	237,932.9	2.6	-3.7
Annual harvest removals of growing stock trees (thousand ft ³ /yr)	173,072.1	6.8	230,224.0	6.0	-24.8
Annual other removals of growing stock trees (thousand ft ³ /yr)	10,234.9	22.9	18,686.5	18.9	-45.2



Forest Area

Minnesota’s presettlement area of forest land was estimated to be 31.5 million acres (Marschner 1930). By 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). For the most part, the area of forest land declined over the next 70 years. Over the past 11 years (from 2003 to 2014), the area of forest land has increased by 1.25 million acres. Some of the increase in estimated forest land area is due to improved digital imagery and remote sensing techniques (Miles and VanderSchaaf 2012) rather than actual reversion to forest land.

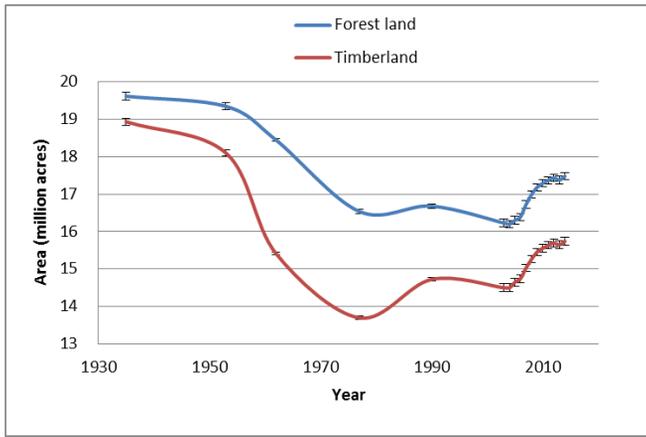


Figure 1.—Area of forest land and timberland by year, Minnesota 1935-2014.

Most of the forest land in Minnesota is in the northern and eastern parts of the State (Fig. 2). The western and southern parts of Minnesota were primarily in prairie and oak savannah in presettlement times.

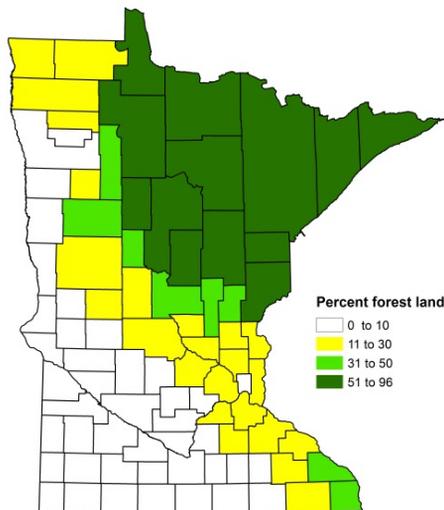


Figure 2.—Percent forest land by county, Minnesota 2014.

The aspen/birch and spruce/fir forest-type groups occupy the largest proportion of forest land in Minnesota at 6.5 and 4.1 million acres respectively (Fig. 3). Approximately 43 percent of the aspen/birch forest-type group is currently in the small diameter stand-size ensuring continued growth in the aspen/birch type. Conversely only 8 percent of the oak/hickory forest-type group is in the small diameter stand-size raising concerns about the adequacy of oak regeneration.

Large areas of the spruce/fir forest-type group are in the small diameter stand-size class but this is generally because of poor site conditions. Only 20 percent of the spruce/fir forest-type group acreage is capable of producing 50 cubic feet/acre/year as compared to 58 percent for the other type groups. Most of the small diameter spruce/fir acreage (74 percent) has a stand age of over 40 years and 15 percent of the small diameter spruce/fir forest-type group has a stand-age of over 100 years.

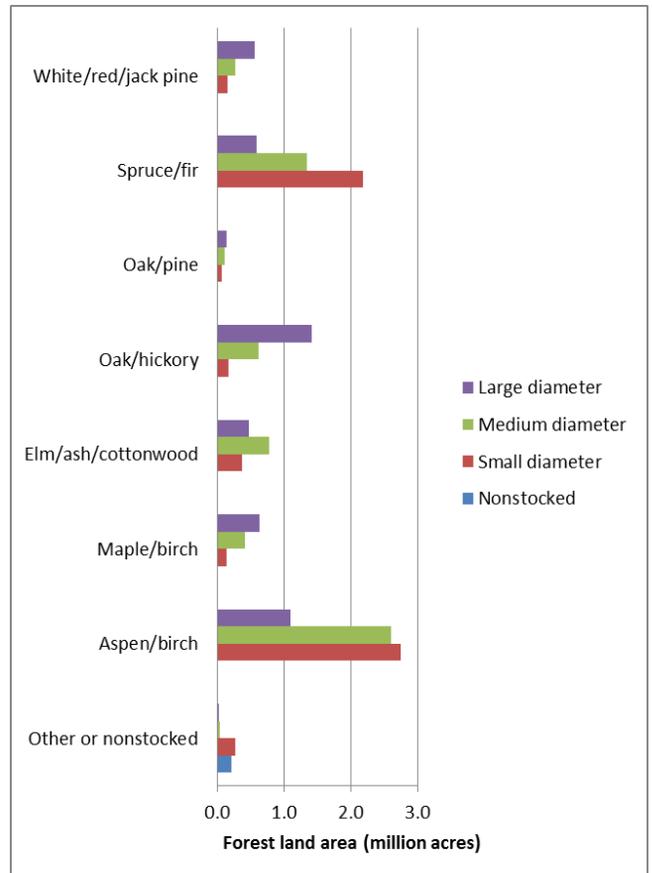


Figure 3.—Area of forest land by forest-type group and stand-size class, Minnesota, 2014.

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 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

FIA field crews recorded trees of 71 species on Minnesota forest land during the 2014 inventory. Two-thirds of Minnesota’s 19.5 billion cubic feet of live tree volume on forest land is represented by just 10 species (Table 2). Quaking aspen (*Populus tremuloides*) has a plurality of the volume in Minnesota followed by red pine (*Pinus resinosa*) and northern white-cedar (*Thuja occidentalis*). The growing-stock volume of paper birch (*Betula papyrifera*) decreased by 8.8 percent from 2009 to 2014 while the volume of red pine increased by 18.2 percent over the same period. Paper birch is a short-lived species while red pine has a much longer life span, so these volume changes are plausible, especially given the high rate of paper birch mortality and the large amount of red pine planting in the 1970s and 1980s.

The aboveground live tree biomass on forest land increased from 465.5 million short tons in 2009 to 494.6 million short tons in 2014. Most aboveground tree biomass is in the bole (64 percent), followed by saplings (16 percent), tops and limbs (16 percent), and stumps (4 percent).

Annual net growth is equivalent to annual gross growth less annual mortality. Therefore, because annual net growth of growing-stock on timberland exceeds annual removals of growing-stock on timberland, we expect that the volume of growing-stock on timberland would have increased over the remeasurement period; and that is indeed the case. Growing-stock volume on timberland increased from 14.1 billion cubic feet in 2009 to 15.4 billion cubic feet in 2014.

Table 3.— Average annual net growth, annual mortality, and annual removals of growing-stock on timberland as a percent of current growing-stock volume on timberland, Minnesota, 2014.

Major species group	Average annual net growth	Annual mortality	Annual removals
Pines	3.4	0.5	1.3
Other softwoods	2.4	1.6	1.0
Soft hardwoods	2.5	2.0	1.6
Hard hardwoods	2.3	0.6	0.4
Total	2.5	1.5	1.2

Annual net growth of growing-stock on timberland exceeds removals of growing-stock on timberland for all four major species groups in Minnesota. Growth, removals, and mortality are often expressed as a percent of current volume to facilitate comparisons (Table 3). Higher mortality rates in the soft hardwoods major species group are partially due to the short-lived nature of pioneer species such as aspen and paper birch.

Harvest removal rates, as a percent of growing-stock volume on timberland, vary by ownership. Rates are highest (1.9 percent) on State and county lands, followed by 0.8 percent on private ownerships. Harvest removals are lowest on National Forest and other Federal timberland (0.4 percent).

Mortality rates as a percent of growing-stock volume are nearly identical for all three ownership groups at 1.5 percent. Mortality rates for hardwoods (1.65 percent) are slightly higher than softwoods (1.25 percent).

Table 2.—Top 10 tree species by statewide volume estimates on forest land and timberland, Minnesota, 2014.

Rank	Species	Volume of live trees on forest land (Million ft ³)	Sampling error (%)	Change since 2009 (%)	Volume of sawtimber trees on timberland (Million board feet)	Sampling error (%)	Change since 2009 (%)
1	quaking aspen	3,537.3	2.5	2.1	6,511.9	3.9	3.8
2	red pine	1,274.5	6.6	18.2	4,910.0	7.4	20.9
3	northern white-cedar	1,226.7	5.9	9.7	3,087.3	7.5	6.5
4	paper birch	1,122.3	3.4	-8.8	1,243.0	5.9	0.3
5	bur oak	1,116.0	4.5	9.9	2,275.1	6.4	24.9
6	black ash	1,039.8	4.5	5.2	1,554.5	6.6	19.2
7	American basswood	1,016.9	4.8	6.1	2,710.8	6.2	23.7
8	northern red oak	951.6	5.1	-1.2	2,857.5	6.2	10.6
9	black spruce	946.2	4.7	4.2	910.5	7.7	8.4
10	balsam fir	754.8	3.3	10.0	1,202.2	5.5	4.2
	Other softwoods	2,336.4	2.6	11.4	5,965.2	4.6	9.6
	Other hardwoods	4,168.8	3.7	9.2	6,773.4	4.3	24.7
	All species	19,491.3	1.1	6.4	40,001.4	1.8	13.5

Future Forests of Minnesota

This section focuses on anticipated changes to the forests of Minnesota between 2010 and 2060. The analysis is derived from the Northern Forest Futures (NFF) study (Shifley and Moser, in press). A large component of future forest change will be the result of normal forest growth, aging, natural regeneration, and species succession. In addition, the following external forces will drive forest change: 1) Population increases will result in the conversion of roughly 280,000 acres of forest land to urban land (Nowak and Walton 2005) ; 2) Economic conditions will affect forest products consumption, production, and harvest rates; 3) Invasive species will spread and affect forest change; 4) Changes in population, the economy, energy consumption, and energy production will affect future climate change; and 5) Climate change will affect patterns of forest growth and species succession.

The area of forest land is projected to decline, from 2008 levels, under all three NFF storylines (A1B: higher growth, A2: medium growth, B2: lower growth) (Fig.4).

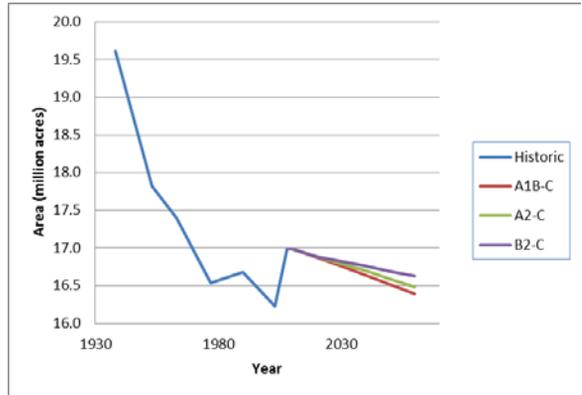


Figure 4.—Projected forest land area (million acres) for Minnesota by storyline 2010-2060.

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Metadata

Information published in this report and in related tables is based on Forest Inventory and Analysis database (FIADB), collected under field guides 3.0 to 6.0 and compiled in the national information management system (NIMS) version 6.0, installed on November 15, 2012. Due to occasional changes to NIMS and FIADB, trend analyses should be made using FIA's online estimation tools, not by comparing published reports or tables. FIA estimates, tabular data, and maps may be generated at <http://fiatools.fs.fed.us>

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