



# Forests of Michigan, 2017

This resource update provides an overview of forest resources in Michigan based on inventories conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station. Estimates are based on field data collected using the FIA annualized sample design and are updated yearly. The annual inventory started in 1999.

For the 2017 inventory, estimates for current variables such as area, volume, and biomass are based on 6,647 plot samples collected from 2011 to 2017. Change variables, such as net growth, removals, and mortality, are based on 6,050 samples collected in 2006 to 2011 and 2011 to 2017.

Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005) and visit the FIA Library at <https://www.fia.fs.fed.us/library/database-documentation/> for definitions and technical details.

## Overview

Currently, Michigan is home to over 20 million acres of forest land (Table 1). Since the 1980 inventory, the estimate of forest land has increased by nearly 2 million acres (Fig. 1). Accompanying this increase, the total number of trees, volume, and biomass also have risen.

Average annual net growth, mortality, and removals have higher sampling errors, which creates uncertainty in associated trends. Despite this uncertainty, the latest inventory shows a notable increase in average annual mortality on forest land at 22.5 percent (Table 1). The statewide mortality increase is primarily driven by a 132-percent increase in ash (*Fraxinus americana*, *F. pennsylvanica*, and *F. nigra*) mortality.

**Table 1.—Michigan forest statistics, 2017 and 2012. Volumes are for trees 5 inches and larger in diameter. Number of trees and biomass are for trees 1 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)	20,340	0.6	20,296	0.6	0.2
Number of live trees (million trees)	14,160	1.4	14,085	1.4	0.5
Aboveground biomass of live trees (thousand oven-dry tons)	874,739	1.0	854,665	1.0	2.3
Net volume of live trees (million ft <sup>3</sup> )	35,300	1.1	34,132	1.1	3.4
Annual net growth live trees (thousand ft <sup>3</sup> /yr)	707,664	2.9	743,299	2.7	-4.8
Annual mortality of live trees (thousand ft <sup>3</sup> /yr)	457,102	3.4	373,256	3.6	22.5
Annual harvest removals of live trees (thousand ft <sup>3</sup> /yr)	394,918	6.3	352,760	6.5	12.0
Annual other removals of live trees (thousand ft <sup>3</sup> /yr)	12,085	31.8	11,293	33.7	7.0
<b>Timberland</b>					
Area (thousand acres)	19,314	0.7	19,272	0.7	0.2
Number of live trees (million trees)	13,423	1.5	13,350	1.5	0.6
Aboveground biomass of live trees (thousand oven-dry tons)	827,432	1.1	808,336	1.1	2.4
Net volume of live trees (million ft <sup>3</sup> )	33,360	1.2	32,251	1.2	3.4
Net volume of growing stock trees (million ft <sup>3</sup> )	30,586	1.2	29,694	1.2	3.0
Annual net growth of growing stock trees (thousand ft <sup>3</sup> /yr)	624,724	2.8	662,031	2.5	-5.6
Annual mortality of growing stock trees (thousand ft <sup>3</sup> /yr)	354,841	3.9	284,141	4.0	24.9
Annual harvest removals of growing stock trees (thousand ft <sup>3</sup> /yr)	348,214	6.4	309,045	6.6	12.7
Annual other removals of growing stock trees (thousand ft <sup>3</sup> /yr)	10,307	32.9	13,118	26.8	-21.4



# Forest Area

Michigan’s current area of forest land is the highest estimate since the 1930s. Timberland accounts for 95 percent of this forest land or 19.3 million acres. Nearly 4 percent of forest land is reserved from timber production and 1 percent is other forest land identified as not being able to meet minimum productivity standards. Michigan’s total area is 37.4 million acres (land and water, excluding Great Lakes).

The Upper Peninsula accounts for only 29 percent of Michigan’s area but has 45 percent of the forests (Fig. 2). The southern Lower Peninsula is the largest region with 14.8 million acres but only accounts for 18 percent of forests in Michigan. The northern Lower Peninsula accounts for 37 percent of Michigan’s forest land.

Maple/beech/birch is the predominant forest-type group (Fig. 3). Sixty-nine percent of it is privately owned and 44 percent of it occurs in the western Upper Peninsula.

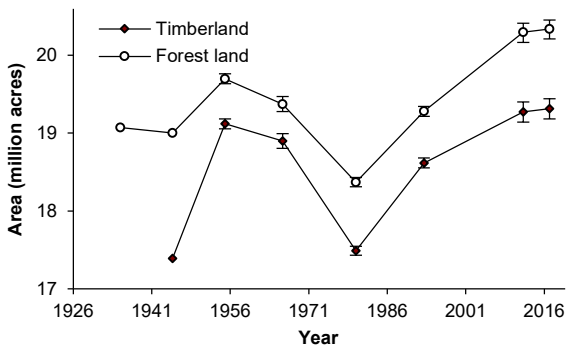


Figure 1.—Forest land and timberland by year, Michigan.

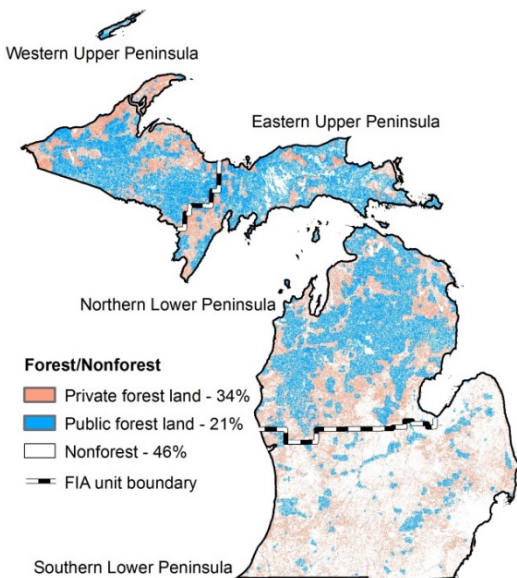


Figure 2.—FIA unit boundaries and area of forest or nonforest with forest identified by major ownership group, Michigan 2017.

Spruce/fir is the most abundant softwood forest-type group and the northern white-cedar forest type accounts for 52 percent of the group. Forty-seven percent of the spruce/fir group occurs in the eastern Upper Peninsula and 54 percent of it is privately owned.

Most of forest land is privately owned by families and individuals, corporations, and other private entities (43.7, 14.6, and 3.6 percent, respectively). The State of Michigan, USDA Forest Service, National Park Service, and other public groups own the remainder (20.8, 13.6, 1.1, and 2.6 percent, respectively).

Michigan’s forests have been maturing as can be seen in the distribution of timberland by stand-size classes (Fig. 4). The acreage of large-diameter stands has been increasing, in contrast to the acreage in small-diameter stands. Small-diameter acreage leveled over the 2012 and 2017 inventories. The acreage of medium-diameter stands has been declining since the 1966 inventory.

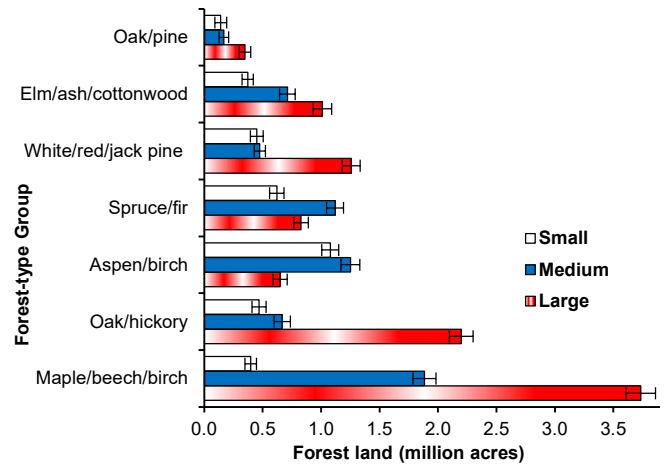


Figure 3.—Forest land by stand-size class (based on tree size) for top seven forest-type groups, Michigan 2017. Large trees are at least 11.0 and 9.0 inches in diameter for hardwoods and softwoods, respectively. Medium trees are at least 5.0 inches in diameter but smaller than large trees. Small trees are less than 5.0 inches in diameter.

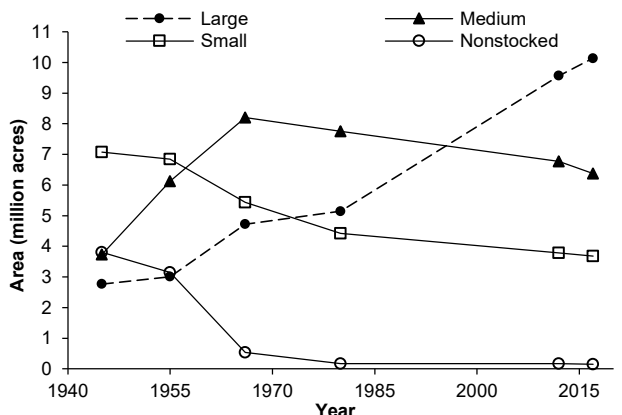


Figure 4.—Timberland by stand-size class and year, Michigan.

## Volume, Biomass, and Trends

Increases in volume, biomass, and number of large-diameter trees have accompanied the increase in area of forest land and large-diameter stands in Michigan.

There are approximately 3,513 million live trees (at least 5-inch diameter) on forest land accounting for approximately 35,300 million ft<sup>3</sup> of volume and 792 million oven-dry tons of aboveground biomass. Estimates for volume and biomass each increased by 3.4 and 2.6 percent, respectively, since the 2012 inventory.

Contributing to this increase, notable gains in volume were observed for balsam fir (13 percent; *Abies balsamea*) and eastern white pine (14 percent; *Pinus strobus*). These gains helped to offset notable losses in volume in green ash (-41 percent) and white ash (-30 percent).

Total net growth has decreased slightly since the 2012 inventory (Table 1). Disregarding net growth attributed by reversions (change from nonforest to forest), net growth for live trees on forest land has not changed substantially from the 2012 to 2017 inventory (665 to 662 million ft<sup>3</sup>). In contrast, reversion growth declined by 41 percent due to an overestimation in the 2012 inventory. Some reversions that occurred in the 1990s to early 2000s were not identified until the 2010 inventory (see Pugh 2013). Mortality has reduced net growth for some species.

Negative net growth estimates indicate that mortality was greater than growth for some species (Table 2). Since the 2012 inventory, ash and American beech (*Fagus grandifolia*) have experienced large increases in mortality at 132 and 77 percent, respectively. The emerald ash borer (EAB; *Agrilus planipennis* Fairmaire) and beech bark disease (*Cryptococcus fagisuga* and *Neonectria*) are the primary agents affecting ash and American beech, respectively. EAB has noticeably increased the statewide mortality estimate inclusive of all species; excluding ash, the statewide mortality estimate remained level since the 2012 inventory.

Affected by an outbreak of spruce budworm (*Choristoneura fumiferana*), the estimate for white spruce (*Picea glauca*) mortality has increased 98 percent since the 2012 inventory.

Balsam fir, a shade-tolerant species, gained in net growth since the 2012 inventory (89 percent). There were also gains in quaking aspen (32 percent; *Populus tremuloides*) and bigtooth aspen (35 percent; *P. grandidentata*), each shade-intolerant species.

Given the variability in estimates of removals, it is difficult to determine if total average annual removals actually differed from the 2012 to 2017 inventory. However, statewide harvest removal estimates increased 22 percent for private land and 38 percent for sugar maple (*Acer saccharum*).

**Table 2.—Number, net volume, aboveground biomass (oven-dry), net growth, mortality, and harvest removals of live trees on forest land, Michigan 2017 (for selected prominent species).**

Species	Trees <sup>a</sup> (million trees)	Net volume <sup>a</sup> (million ft <sup>3</sup> )	Aboveground biomass <sup>b</sup> (thousand tons)	Net growth <sup>a</sup> (thousand ft <sup>3</sup> /yr)	Mortality <sup>a</sup> (thousand ft <sup>3</sup> /yr)	Harvest removals <sup>a</sup> (thousand ft <sup>3</sup> /yr)
Sugar maple	439	5,144	158,591	104,484	18,434	69,961
Red maple	475	4,859	130,664	125,900	23,232	54,829
Northern white-cedar	470	3,006	48,292	46,638	13,306	12,382
Red pine	220	2,484	44,702	69,830	7,136	31,240
Eastern white pine	109	1,867	31,912	64,402	7,675	7,900
Northern red oak	95	1,766	53,915	55,578	3,090	14,536
Quaking aspen	185	1,647	37,200	38,548	43,058	36,801
Bigtooth aspen	121	1,315	28,683	38,947	19,846	14,625
Black cherry	94	1,141	29,054	35,329	9,907	14,992
Eastern hemlock	76	1,128	21,737	22,401	4,186	7,059
Balsam fir	184	727	19,915	19,538	28,424	9,846
White spruce	70	646	11,817	9,697	15,146	10,309
Yellow birch	56	644	18,975	2,171	10,960	5,352
American beech	37	523	15,701	-4,260	16,465	10,284
Green ash	47	393	12,193	-57,411	79,144	4,695
White ash	26	331	10,037	-20,917	33,882	12,009
Black ash	55	292	9,660	-10,464	21,366	655

<sup>a</sup> At least 5-inch diameter trees. <sup>b</sup> At least 1-inch diameter trees.

# Plantations and Red Pine Resources

There are 1.36 million acres of timberland designated as plantations (i.e., clear evidence stand origin from artificial regeneration) in the 2017 inventory. Ninety-six percent of this plantation acreage is in softwood forest types with red pine accounting for 61 percent. Jack pine (15 percent) and Scotch pine (9 percent) types rank second and third, respectively.

Red pine (*Pinus resinosa*) is ranked number one among all species in sawlog production (225 of 746 million board feet) for Michigan (Haugen 2016). In the 2017 inventory, 65 percent of harvested red pine (growing-stock volume) was from plantations.

Fifty to 90 years ago, thousands of acres of softwoods were planted and red pine was the most popular plantation species. These plantations have grown. Since the 1993 inventory on red pine plantations, the number of large red pine has increased 136 percent (see Fig. 3 for stand and tree size classes). Medium and small red pine trees have decreased by 27 and 15 percent, respectively. The rate of planting has been less in the last 50 years and there is concern over plantations and the future red pine resource. Since the 1993 inventory across all forest types, plantation acreage increased approximately 37 percent (987,711 to 1.36 million acres). Red pine plantation acreage increased nearly 34 percent (623,504

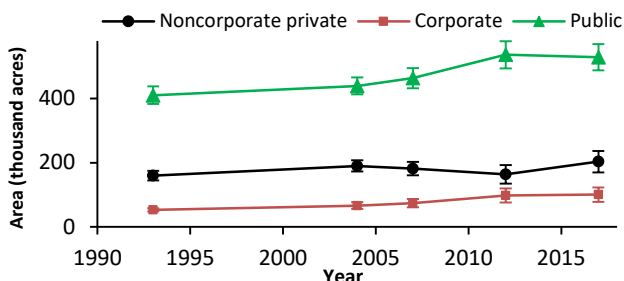


Figure 5.—Timberland area of red pine plantations by ownership class, Michigan.

## References

Bechtold, W.A.; Patterson, P.L., eds. 2005. **The enhanced Forest Inventory and Analysis program: national sampling design and estimation procedures**. Gen. Tech. Rep. SRS-80. Asheville, NC: USDA Forest Service, Southern Research Station. 85 p. <https://doi.org/10.2737/SRS-GTR-80>.

Haugen, D.E. 2016. **Michigan timber industry, 2010**. Resour. Update FS-78. Newtown Square, PA: USDA Forest Service, Northern Research Station. 5 p. <https://doi.org/10.2737/FS-RU-78>.

Pugh, S.A. 2013. **Michigan’s forest resources, 2012**. Res. Note NRS-165. Newtown Square, PA: Newtown Square, PA: USDA Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/NRS-RN165>.

to 832,690 acres; Fig. 5) statewide and by 29 percent on public land. Noncorporate private and corporate acreage estimates rose 27 and 89 percent, respectively.

Public acreage increased in the large stand-size class, decreased in the medium class, and changed little in the small class (Fig. 6). The trend was the same on State of Michigan and Forest Service ownerships (not shown). The trend on private ownership is less precise but estimates in the large and small classes increased while the estimate for the medium class rose and dropped (Fig. 7). This trend on private land is influenced mostly by noncorporate private ownership which has had two to three times more acreage than corporate ownership.

Michigan has experienced a relatively small but significant gain in red pine plantation acreage over the last two and a half decades with an increase in the large stand-size class. This gain has come at the expense of the medium class, while the small class acreage has held steady. These observations are supported by the trend in number of trees by size class. Continued monitoring and more detailed analyses may help resource managers identify appropriate management prescriptions for red pine.

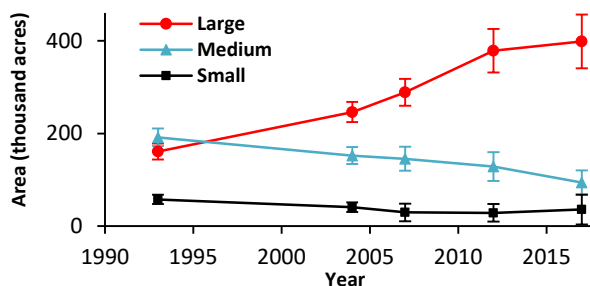


Figure 6.—Timberland area of publicly owned red pine plantations by stand-size class, Michigan.

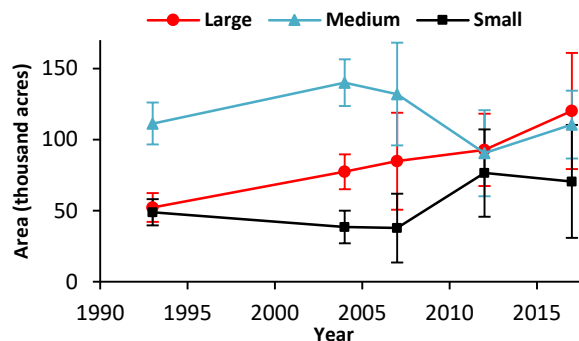


Figure 7.—Timberland area of privately owned red pine plantations by stand-size class, Michigan.

### How to Cite This Publication

Pugh, Scott A. 2018.

#### Forests of Michigan, 2017.

Resource Update FS-153. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. <https://doi.org/10.2737/FS-RU-153>.

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